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Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance With the Disposal Regulations: Certification Decision; Final Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 194

[FRL—6014–9]

RIN 2060–AG85

Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance With the Disposal Regulations: Certification Decision

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: The Environmental Protection Agency (''EPA'') is certifying that the Department of Energy's (''DOE'') Waste Isolation Pilot Plant (''WIPP'') will comply with the radioactive waste disposal regulations set forth at Subparts B and C of 40 CFR Part 191 (Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste). The EPA is required to evaluate whether the WIPP will comply with EPA's standards for the disposal of radioactive waste by the WIPP Land Withdrawal Act (''LWA'') of 1992, as amended. EPA's certification of compliance allows the emplacement of radioactive waste in the WIPP to begin, provided that all other applicable health and safety standards, and other legal requirements, have been met. The certification constitutes final approval under the WIPP LWA for shipment of transuranic waste from specific waste streams from Los Alamos National Laboratory for disposal at the WIPP. However, the certification is subject to four specific conditions, most notably that EPA must approve site-specific waste characterization measures and quality assurance programs before other waste generator sites may ship waste for disposal at the WIPP. The Agency is amending the WIPP compliance criteria (40 CFR Part 194) by adding Appendix A that describes EPA's certification, incorporating the approval processes for waste generator sites to ship waste for disposal at the WIPP, and adding a definition for ''Administrator's authorized representative.'' Finally, EPA is finalizing its decision, also pursuant to the WIPP LWA, that DOE does not need to acquire existing oil and gas leases near the WIPP to comply with the disposal regulations.

EFFECTIVE DATE: This decision is effective June 17, 1998. A petition for review of this final action must be filed no later than July 17, 1998, pursuant to section 18 of the WIPP Land Withdrawal Act of 1992 (Pub. L. 102–579), as amended by the WIPP LWA Amendments (Pub. L. 104–201).

FOR FURTHER INFORMATION CONTACT: Betsy Forinash, Scott Monroe, or Sharon White; telephone number (202) 564–9310; address: Radiation Protection Division, Center for the Waste Isolation Pilot Plant, Mail Code 6602–J, U.S. Environmental Protection Agency, 401 M Street S.W., Washington, DC 20460. For copies of the Compliance Application Review Documents supporting today's action, contact Scott Monroe. The Agency is also publishing a document, accompanying today's action, which responds in detail to significant public comments that were received on the proposed certification decision. This document, entitled ''Response to Comments,'' may be obtained by contacting Sharon White at the above phone number and address. Copies of these documents are also available for review in the Agency's Air Docket A–93–02.

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I. What is the WIPP?

The Waste Isolation Pilot Plant (''WIPP'') is a potential disposal system for radioactive waste. Developed by the Department of Energy (''DOE'' or ''the Department''), the WIPP is located near Carlsbad in southeastern New Mexico. The DOE intends to bury radioactive waste 2150 feet underground in an ancient layer of salt which will eventually ''creep'' and encapsulate waste containers. The WIPP has a total capacity of 6.2 million cubic feet of waste.

Congress authorized the development and construction of the WIPP in 1980 ''for the express purpose of providing a research and development facility to demonstrate the safe disposal of radioactive wastes resulting from the defense activities and programs of the United States.'' [1] The waste which may be emplaced in the WIPP is limited to transuranic (''TRU'') radioactive waste generated by defense activities associated with nuclear weapons; no high-level waste or spent nuclear fuel from commercial power plants may be disposed of at the WIPP. TRU waste is defined as materials containing alpha-emitting radio-isotopes, with half lives greater than twenty years and atomic numbers above 92, in concentrations greater than 100 nano-curies per gram of waste.[2]

Most TRU waste proposed for disposal at the WIPP consists of items that have become contaminated as a result of activities associated with the production of nuclear weapons (or with the clean-up of weapons production facilities), e.g., rags, equipment, tools, protective gear, and organic or inorganic sludges. Some TRU waste is mixed with hazardous chemicals. Some of the waste proposed for disposal at the WIPP is currently stored at Federal facilities across the United States, including locations in Colorado, Idaho, New Mexico, Nevada, Ohio, South Carolina, Tennessee, and Washington. Much of the waste proposed for disposal at the WIPP will be generated in the future.

II. What Is the Purpose of Today's Action?

Before disposal of radioactive waste can begin at the WIPP, the U.S. Environmental Protection Agency (''EPA,'' or ''the Agency'') must certify that the WIPP facility will comply with EPA's radioactive waste disposal regulations (Subparts B and C of 40 CFR Part 191).[3] The purpose of today's action is to issue EPA's certification decision.

With today's action, EPA will add to the Code of Federal Regulations a new Appendix A to 40 CFR Part 194 describing EPA's certification decision and the conditions that apply to the certification. The Agency is adding a new section, § 194.8, to the WIPP compliance criteria (40 CFR Part 194) that describes the processes EPA will use to approve quality assurance and waste characterization programs at waste generator sites. The EPA is also adding a definition of the term ''Administrator's authorized representative'' to the WIPP compliance criteria. Except for these actions, the certification decision does not otherwise amend or affect EPA's radioactive waste disposal regulations or the WIPP compliance criteria.

Today's action also addresses the provision of section 7(b)(2) of the WIPP Land Withdrawal Act which prohibits DOE from emplacing transuranic waste underground for disposal at the WIPP until, inter alia, it acquires specified oil and gas leases, unless EPA determines that such acquisition is not necessary.

III. With Which Regulations Must the WIPP Comply?

The WIPP must comply with EPA's radioactive waste disposal regulations, located at Subparts B and C of 40 CFR Part 191. These regulations limit the amount of radioactive material which may escape from a disposal facility, and protect individuals and ground water resources from dangerous levels of radioactive contamination. In addition, the compliance certification application (''CCA'') and other information submitted by DOE must meet the requirements of the WIPP compliance criteria at 40 CFR Part 194. The compliance criteria implement and interpret the general disposal regulations specifically for the WIPP, and clarify the basis on which EPA's certification decision is made.

IV. What Is the Decision on Whether the WIPP Complies With EPA's Regulations?

A. Certification Decision

The EPA finds that DOE has demonstrated that the WIPP will comply with EPA's radioactive waste disposal regulations at Subparts B and C of 40 CFR Part 191. This decision allows the WIPP to begin accepting transuranic waste for disposal, provided that other applicable environmental regulations have been met and once a 30-day Congressionally-required waiting period has elapsed.[4] EPA's decision is based on a thorough review of information submitted by DOE, independent technical analyses, and public comments. The EPA determined that DOE met all of the applicable requirements of the WIPP compliance criteria at 40 CFR Part 194. However, as discussed below, DOE must meet certain conditions in order to maintain a certification for the WIPP and before shipping waste for disposal at the WIPP.

B. Conditions

As noted above, EPA determined that DOE met all of the applicable requirements of the WIPP compliance criteria. In several instances, however, EPA found that it is necessary for DOE to take additional steps to ensure that the measures actually implemented at the WIPP (and thus the circumstances expected to exist there) are consistent with DOE's compliance certification application (''CCA'') and with the basis for EPA's compliance certification. Regarding several requirements, DOE demonstrated compliance with the applicable compliance criteria for only one category of waste at a single waste generator site. To address these situations, EPA is amending the WIPP compliance criteria, 40 CFR Part 194, and appending four explicit conditions to its certification of compliance for the WIPP.

Condition 1 of the certification relates to the panel closure system, which is intended over the long term to block brine flow between waste panels in the WIPP. In its CCA, DOE presented four options for the design of the panel closure system, but did not specify which one would be constructed at the WIPP. The EPA based its certification decision on DOE's use of the most robust design (referred to in the CCA as ''Option D''). The Agency found the Option D design to be adequate, but also

[1] Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980, Pub. L. 96–164, section 213.

[2] WIPP Land Withdrawal Act, Pub. L. 102–579, section 2(18), as amended by the 1996 WIPP LWA Amendments, Pub. L. 104–201.

[3] WIPP LWA, section 8(d).

[4] WIPP LWA, § 7(b).

determined that the use of a Salado mass concrete—using brine rather than fresh water—would produce concrete seal permeabilities in the repository more consistent with the values used in DOE's performance assessment. Therefore, Condition 1 of EPA's certification requires DOE to implement the Option D panel closure system at the WIPP, with Salado mass concrete replacing fresh water concrete. (For more detail on the panel closure system, refer to the preamble discussion of § 194.14.)

Conditions 2 and 3 of the final rule 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 quality assurance (''QA'') programs to waste characterization activities. At the time of EPA's proposed certification decision, the Los Alamos National Laboratory (''LANL'') was the only site to demonstrate the execution of the required QA programs and the implementation of the required system of controls. Therefore, EPA's certification constitutes final approval under the WIPP LWA for DOE to ship waste for disposal at the WIPP only from the LANL, and only for the retrievably stored (legacy) debris at LANL for which EPA has inspected and approved the applicable system of controls. Before DOE may ship any mixed (hazardous and radioactive) waste from the LANL—even if it is encompassed by the waste streams approved by EPA in this action—DOE must obtain any other regulatory approvals that may be needed, including approval from the State of New Mexico under the Resource Conservation and Recovery Act to dispose of such waste at the WIPP.

As described in the final WIPP certification, before other waste may be shipped for disposal at the WIPP, EPA must separately approve the QA programs for 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 waste characterization systems of controls and QA programs will be conveyed in a letter from EPA to DOE. In response to public comments on these conditions, 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. (For more information on this change, see the preamble section entitled, ''Significant Changes to the Final Rule Made in Response to Public Comments.'' For further discussion of Conditions 2 and 3, refer to the preamble discussions of § 194.22 and § 194.24, respectively.)

Condition 4 of the certification relates to passive institutional controls (''PICs''). The WIPP compliance criteria require DOE to use both records and physical markers to warn future societies about the location and contents of the disposal system, and thus to deter inadvertent intrusion into the WIPP. (§ 194.43) In its application, DOE provided a design for a system of PICs, but stated that many aspects of the design would not be finalized for many years (even up to 100) after closure. The PICs actually constructed and placed in the future must be consistent with the basis for EPA's certification decision. Therefore, Condition 4 of the certification requires DOE to submit a revised schedule showing that markers and other measures will be implemented as soon as possible after closure of the WIPP. The DOE also must provide additional documentation showing that it is feasible to construct markers and place records in archives as described in DOE's certification application. After closure of the WIPP, DOE will not be precluded from implementing additional PICs beyond those described in the application. (See the preamble discussion of § 194.43 for more information on PICs.)

Although not specified in the certification, it is a condition of any certification that DOE must submit periodic reports of any planned or unplanned changes in activities pertaining to the disposal system that differ significantly from the most recent compliance application. (§ 194.4(b)(3)) The DOE must also report any releases of radioactive material from the disposal system. (§ 194.4(b)(3)(iii), (v)) Finally, EPA may request additional information from DOE at any time. (§ 194.4(b)(2)) These reports and information will allow EPA to monitor the performance of the disposal system and evaluate whether the certification must be modified, suspended, or revoked for any reason. (Modifications, suspensions, recertification, and other activities are also addressed in the preamble section entitled, ''EPA's Future Role at the WIPP.'')

C. Land Withdrawal Act Section 4(b)(5)(B) Leases

The EPA finds that DOE does not need to acquire existing oil and gas leases (Numbers NMNM 02953 and 02953C) (referred to as the ''section 4(b)(5)(B) leases'') in the vicinity of the WIPP in order to comply with EPA's final disposal regulations at 40 CFR Part 191, Subparts B and C. The EPA concludes that potential activities at these existing leases would have an insignificant effect on releases of radioactive material from the WIPP disposal system and, thus, that they do not cause the WIPP to violate the disposal regulations.

D. EPA's Future Role at the WIPP (recertification, enforcement of conditions)

The EPA will continue to have a role at the WIPP after this certification becomes effective. As discussed above, DOE must submit periodic reports on any activities or conditions at the WIPP that differ significantly from the information contained in the most recent compliance application. The EPA may also, at any time, request additional information from DOE regarding the WIPP. (§ 194.4) The Agency will review such information as it is received to determine whether the certification must be modified, suspended, or revoked. Such action might be warranted if, for example, significant information contained in the most recent compliance application were no longer to remain true. The certification could be modified to alter the terms or conditions of certification—for example, to add a new condition, if necessary to address new or changed activities at the WIPP. (§ 194.2) The certification could be revoked if it becomes evident in the future that the WIPP cannot or will not comply with the disposal regulations. Either modification or revocation must be conducted by rulemaking, in accordance with the WIPP compliance criteria. (§§ 194.65–66) Suspension may be initiated at the Administrator's discretion, in order to promptly reverse or mitigate a potential threat to public health. For instance, a suspension would take effect if, during emplacement of waste, a release from the WIPP occurred in excess of EPA's containment limits. (See § 194.4(b)(3).)

In addition to reviewing annual reports from DOE regarding activities at the WIPP, EPA periodically will evaluate the WIPP's continued compliance with the WIPP compliance criteria and disposal regulations. As directed by Congress, this ''recertification'' will occur every five

years.[5] For recertification, DOE must submit to EPA for review the information described in the WIPP compliance criteria (although, to the extent that information submitted in previous certification applications remains valid, it can be summarized and referenced rather than resubmitted). (§ 194.14) In accordance with the WIPP compliance criteria, documentation of continued compliance will be made available in EPA's dockets, and the public will be provided at least a 30-day period in which to submit comments. The EPA's decision on recertification will be announced in the **Federal Register**. (§ 194.64)

In the immediate future, the Agency expects to conduct numerous inspections at waste generator sites in order to implement Conditions 2 and 3 of the compliance certification. Notices announcing EPA inspections or audits to evaluate implementation of quality assurance (''QA'') and waste characterization requirements at generator facilities will be published in the **Federal Register**. The public will have the opportunity to submit written comments on the waste characterization and QA program plans submitted by DOE. As noted above, EPA's decisions on whether to approve waste generator QA program plans and waste characterization systems of controls—and thus, to allow shipment of specific waste streams for disposal at the WIPP—will be conveyed by a letter from EPA to DOE. A copy of the letter, as well as any EPA inspection or audit reports, will be placed in EPA's docket. (See the preamble sections entitled ''Dockets'' and ''Where can I get more information about EPA's WIPP activities?'' for more information regarding EPA's rulemaking docket.) The procedures for EPA's approval have been incorporated in the compliance criteria at a new section, § 194.8.

As discussed previously, Condition 1 of the WIPP certification requires DOE to implement the Option D panel closure system at the WIPP, with Salado mass concrete being used in place of fresh water concrete. It will be possible to evaluate the closure system only when waste panels have been filled and are being sealed. At that time, EPA intends to confirm compliance with this condition through inspections under its authority at § 194.21 of the WIPP compliance criteria.

Similarly, EPA will be able to evaluate DOE's compliance with Condition 4 of the certification only when DOE submits a revised schedule and additional documentation regarding the feasibility of implementing passive institutional controls. This documentation must be provided to EPA no later than the final recertification application. Once received, the information will be placed in EPA's docket, and the Agency will evaluate the adequacy of the documentation. If necessary, EPA may initiate a modification to the certification to address DOE's revised schedule; any such modification would be undertaken in accordance with the public participation requirements described in the WIPP compliance criteria, §§ 194.65–66. During the operational period when waste is being emplaced in the WIPP (and before the site has been sealed and decommissioned), EPA will verify that specific actions identified by DOE in the CCA and supplementary information (and in any additional documentation submitted in accordance with Condition 4) are being taken to test and implement passive institutional controls. For example, DOE stated that it will submit a plan for soliciting archives and record centers to accept WIPP information in the fifth recertification application. The Agency can confirm implementation of such measures by examining documentation and by conducting inspections under its authority at § 194.21.

Finally, the WIPP compliance criteria provide EPA the authority to conduct inspections of activities at the WIPP and at all off-site facilities which provide information included in certification applications. (§ 194.21) The Agency expects to conduct periodic inspections, both announced and unannounced, to verify the adequacy of information relevant to certification applications. The Agency may conduct its own laboratory tests, in parallel with those conducted by DOE. The Agency also may inspect any relevant records kept by DOE, including those records required to be generated in accordance with the compliance criteria. For example, EPA intends to conduct ongoing inspections or audits at the WIPP and at waste generator sites to ensure that approved quality assurance programs are being adequately maintained and documented. The EPA plans to place inspection reports in its docket for public examination.

V. What Information Did EPA Examine to Make its Decision?

The EPA made its certification decision by comparing relevant information to the WIPP compliance criteria (40 CFR Part 194) and ensuring that DOE satisfied the specific requirements of the criteria in demonstrating compliance with the disposal regulations. The primary source of information examined by EPA was a compliance certification application (''CCA'') submitted by DOE on October 29, 1996. (Copies of the CCA were placed in EPA's Air Docket A–93–02, Category II–G.) The DOE submitted additional information after that time. On May 22, 1997, EPA announced that DOE's application was deemed to be complete. (62 FR 27996–27998)

However, as contemplated by Congress, EPA's compliance certification decision is based on more than the complete application. The EPA also relied on materials prepared by the Agency or submitted by DOE in response to EPA requests for specific additional information necessary to address technical sufficiency concerns. The Agency also considered public comments on the proposed rule which supported or refuted technical positions. Thus, EPA's certification decision is based on the entire record available to the Agency, which is contained in EPA's Air Docket A–93–02. The record consists of the complete CCA, supplementary information submitted by DOE in response to EPA requests for additional information, technical reports generated by EPA and EPA contractors, EPA audit and inspection reports, and public comments submitted on EPA's proposed certification decision during the public comment period.

In response to public comments regarding the precise materials EPA considered in reaching its certification decision, the Compliance Application Review Documents (''CARDs'') supporting today's decision reference the relevant portion(s) of the October 29, 1996, CCA and any supplementary information that the Agency relied on in reaching a particular compliance decision. (Docket A–93–02, Item V–B–2) All materials which informed EPA's proposed and final decisions have been placed in the WIPP dockets or are otherwise publicly available. A full list of the supporting documentation for EPA's certification decision and the DOE compliance documentation considered by the Agency is located at Docket A–93–02, Item V–B–1. For further information regarding the availability of information EPA examined, see the section entitled ''Dockets'' in this preamble.

[5] WIPP LWA, § 8(f). Congress also directed that this periodic recertification ''shall not be subject to rulemaking or judicial review.''

VI. In Making its Final Decision, how did EPA Incorporate Public Comments on the Proposed Rule?

A. Introduction and the Role of Comments in the Rulemaking Process

Congress directed that EPA's certification decision for the WIPP be conducted by informal (or ''notice-and-comment'') rulemaking pursuant to Section 4 of the Administrative Procedure Act (''APA'').[6] Notice-and-comment rulemaking under the APA requires that regulatory agencies provide notice of a proposed rulemaking, an opportunity for the public to comment on the proposed rule, and a general statement of the basis and purpose of the final rule.[7] The notice of proposed rulemaking required by the APA must ''disclose in detail the thinking that has animated the form of the proposed rule and the data upon which the rule is based.'' (*Portland Cement Ass'n* v. *Ruckelshaus,* 486 F.2d 375, 392–94 (D.C. Cir. 1973)) The public is thus enabled to participate in the process by making informed comments on the Agency's proposal. This provides the Agency the benefit of ''an exchange of views, information, and criticism between interested persons and the agency.'' (Id.)

For the WIPP certification decision, there are two primary mechanisms by which EPA explains the issues that were raised in public comments and the Agency's reactions to them. First, broad or major comments are discussed in the succeeding sections of this preamble. Second, EPA is publishing a document, accompanying today's action and entitled ''Response to Comments,'' which contains the Agency's response to all significant comments received during the comment period on the proposed certification decision. (The EPA also responded to comments received on its advance notice of proposed rulemaking (''ANPR''); for further information on the ANPR, see the preamble section ''Public Involvement Prior to the Proposed Rule.'') The Response to Comments document provides more detailed responses to issues which are addressed in the preamble, and addresses all other significant comments on the proposal. All comments received by EPA, whether written or oral, were given equal consideration in developing the final rule.

[6] WIPP LWA, § 8(d)(2).

[7] 5 U.S.C. 553

B. Significant Changes to the Final Rule Made in Response to Public Comments

Today's action finalizes EPA's proposed decision that the WIPP facility will comply with the disposal regulations and that DOE does not need to acquire existing oil and gas leases in the WIPP Land Withdrawal Area. (For further information, refer to the preamble section entitled, ''What is the decision on whether the WIPP complies with EPA's regulations?'') Beyond these broad determinations, EPA's proposed certification decision also included four conditions related to the panel closure system, quality assurance at waste generator sites, waste characterization measures at waste generator sites, and passive institutional controls. The final rule retains all of these conditions. However, in response to comments submitted on the proposal, the Agency has made clarifying changes to Subpart A of 40 CFR Part 194 to provide a clearer explanation of the process for determining compliance with the conditions related to waste generator sites.

Proposed Conditions 2 and 3 relate to quality assurance (''QA'') programs and waste characterization programs, respectively, at waste generator sites intending to ship waste for disposal at the WIPP. Except for removal of the procedural sections of the proposed conditions from the appendix (as proposed) to Subpart A of 40 CFR Part 194, to provide for a clearer enunciation of the process for determining compliance with the conditions, these conditions are retained with minor clarifications in the final rule. The conditions restrict DOE from shipping waste to the WIPP from any sites other than the Los Alamos National Laboratory until EPA separately approves the QA and waste characterization plans at other waste generator sites. For both QA and waste characterization programs, the proposed approval process included: placement in the docket of site-specific documentation submitted by DOE, publication of a **Federal Register** notice by EPA announcing a scheduled inspection or audit, a period of at least 30 days for the public to comment on information placed in the docket, and the Agency's written decision regarding the approval of these programs in the form of a letter from EPA to DOE. The EPA proposed to approve QA programs on a site-wide basis. However, because the features of waste streams can vary widely and thus can require significantly different characterization techniques, EPA proposed to approve waste characterization measures and controls on the basis of waste streams or, where multiple waste streams may be characterized by the same waste characterization processes and techniques, groups of waste streams.

A number of commenters suggested that in the waste generator site approval process, EPA should delay the public comment period until after completion of an inspection or audit, and should make the Agency's approval decision explicitly subject to judicial review. Other comments questioned the authority for, and the value of, a separate site approval process by EPA.

The EPA finds that it is both necessary and within the Agency's authority to evaluate and approve site-specific QA and waste characterization programs. The compliance criteria expressly provide that any certification of compliance ''may include such conditions as [EPA] finds necessary to support such certification.'' (§ 194.4(a)) Before waste is shipped for disposal at the WIPP, EPA must be confident that the waste will conform to the waste limits and other waste-related assumptions incorporated in DOE's performance assessment—that is, that DOE adheres to the fundamental information and assumptions on the waste on which the certification of compliance is based. Such confidence can be assured only by confirmation that the required QA and waste characterization programs are in place (i.e., established, implemented or executed) at waste generator sites. The EPA believes that an approval process separate from DOE's internal procedures is beneficial because DOE's process is not geared solely to confirming that programs adhere to EPA's compliance criteria, and because DOE's process does not provide for public participation.

Given the great public interest regarding the WIPP, and waste characterization in particular, EPA believes it is important that the public be informed of and have the opportunity to be involved in the site approval process. To that end, EPA's approval process includes docketing information relevant to site-specific approvals, and allowing the public to comment on such information.

The EPA's certification that the WIPP will comply with the 40 CFR Part 191 radioactive waste disposal regulations is based on the Agency's determination that the WIPP will comply with the containment requirements and other requirements of 40 CFR Parts 191 and 194 for the waste inventory described for purposes of the performance assessment. In the CCA, DOE purported to demonstrate that the WIPP would meet the 40 CFR Part 191 release limits

by modeling the WIPP's behavior in its performance assessment. The performance assessment incorporated certain upper and lower limiting values of specified waste components, as required by 40 CFR 194.24(c). The EPA confirmed the results of the performance assessment using the same upper and lower limiting values in the performance assessment verification test (''PAVT''). Those upper and lower limiting values apply to contact-handled, remote-handled, and to-be-generated waste from numerous generator sites. Thus, in today's action, EPA certifies that the WIPP will comply with the 40 CFR Part 191 containment requirements to the extent that emplaced waste falls within the waste envelope limits that were shown by the performance assessment, and confirmed by the PAVT, to be compliant with the 40 CFR Part 191 standards. Proposed Conditions 2 and 3 change neither the performance assessment assumptions nor the terms on which the WIPP is authorized for disposal, but rather ensure that the assumptions on which the compliance certification is based are adhered to in practice.

Based on public comments, EPA also finds it necessary to clarify that the compliance criteria at § 194.22 and § 194.24 were not intended to require that DOE address their requirements—including QA measures, and the use of process knowledge—for all waste streams in the certification application for the initial certification. Clearly, it would be impossible to do so for the to-be-generated waste. It is similarly impossible for DOE to demonstrate fully, in the initial certification application, that the waste emplaced in the disposal system actually conforms to the waste envelope (i.e., upper and lower waste limits) upon which the certification is based, since waste cannot be disposed of at the WIPP before EPA grants an initial certification. Confusion on these issues arose because the compliance criteria at 40 CFR Part 194 apply to information in compliance recertification applications as well as the initial certification application.

The fact that it was not EPA's intent to require DOE to have implemented QA or measurement programs for all waste at every site prior to initial certification is supported by numerous statements made by the Agency at the time the compliance criteria were issued. The EPA had great discretion in setting the waste characterization requirements, since they were part of the general requirements of the WIPP compliance criteria and not derived directly from the disposal regulations. In the Response to Comments for 40 CFR Part 194, EPA emphasized that compliance with the requirements would be confirmed through inspections or audits and would not serve to re-open the certification rulemaking. (Docket A–92–56, Item V–C–1, pp. 6–5, 6–8, and 6–20) The Agency stated that the certification rulemaking would address DOE's analysis of waste characteristics and components and documentation that a system of controls had been established at the WIPP to track the amount of important waste components emplaced in the disposal system. (Docket A–92–56, Item V–C–1, p. 6–9) The certification rulemaking has addressed these issues and found DOE in compliance with the requisite criteria. The EPA believes that the comprehensive waste characterization approach described by DOE in the CCA—including the approach to identification, limitation, and confirmation of waste components important to containment of waste in the disposal system—is an appropriate basis for granting an initial certification. The EPA further believes that confirmation of the QA and system of controls at waste generator sites (i.e., measuring and tracking important waste components) can be reasonably obtained by a process of inspections and audits in accordance with 40 CFR 194.21, 194.22(e), and 194.24(h).

The EPA declines to modify the proposed approval process by delaying the comment period until after the issuance of EPA's inspection or audit report. The EPA does not believe it is prudent to commit to a strict sequence of events that will be adhered to for every approval. In some cases, the Agency may place records of a completed inspection or audit in the docket prior to or during the public comment period. However, in other cases, the Agency believes that the public comment period may better serve members of the public if it allows them to provide comments on DOE's documentation prior to EPA's inspection or audit. In this way, public comments could inform EPA's inspection criteria and process, or provide information on which EPA may take action to follow up in the inspection or audit. Therefore, the Agency does not believe that it is prudent to specify when the comment period may occur in relation to an inspection or audit. Furthermore, EPA declines to make any statement regarding whether the approval decisions are subject to judicial review. Jurisdiction of U.S. Federal Courts is governed by the enactments of the U.S. Congress.

Nevertheless, in response to comments requesting changes or clarifications to EPA's waste generator site and waste stream approval processes, EPA made certain changes to the proposed conditions. In order to clarify EPA's original intent in the compliance criteria regarding approval of site-specific activities, EPA is amending the compliance criteria at 40 CFR Part 194 to include the site-specific approval process. (See 62 FR 58804, 58815) Thus, the procedures for demonstrating compliance with the proposed Conditions 2 and 3 are incorporated in the final rule as a new section at 40 CFR Part 194: § 194.8, ''Approval Process for Waste Shipment from Waste Generator Sites for Disposal at the WIPP.'' Also, in response to comments advocating greater transparency in the approval process, EPA has clarified that scheduled inspections or audits by EPA for the purpose of approving quality assurance programs at waste generator sites will be announced by notice in the **Federal Register** (§ 194.8(a)); this is consistent with EPA's commitment to do so for inspections and audits of waste characterization programs at generator sites (§ 194.8(b)). Providing notice of such inspections will alert the public to upcoming EPA approval activities and allow for more informed public participation. While public notice will be provided for the scheduled initial phase of an inspection or audit, should it prove necessary for EPA to conduct follow-up activities or continuations of inspections and audits, EPA reserves the right to do so without providing additional public notice. Such follow-up activities or continuations of audits or inspections might be necessary to obtain additional information or ensure that corrective actions are being taken to resolve initial findings. In no case will EPA decide whether to approve site-specific quality assurance or waste characterization programs before providing a minimum 30-day public comment period on documentation of the program plans, or before conducting an inspection or audit at the relevant site.

The Agency received some comments related to Conditions 1 and 4 in the proposed rule. EPA's responses to these comments are discussed in the preamble sections related to § 194.14 and § 194.43, respectively. Conditions 1 and 4 were retained without change in the final rule. The response to comments document accompanying today's action provides more detailed responses regarding the certification conditions and all aspects of the final rule.

The EPA received no significant comments on its proposed actions to slightly modify the criteria by revising the authority citation and adding a new definition for Administrator's authorized representative. Therefore, these actions take effect without change from the proposed rule.

VII. How Did EPA Respond to General Comments on Its Proposed Certification Decision?

The EPA received many comments which addressed broad issues related to the proposed certification decision. Many citizens simply expressed their strong support for, or opposition to, opening the WIPP. Some commenters requested that EPA consider certain factors in making its certification decision. These factors include reviews by organizations other than EPA, and the political or economic motivations of interested parties. The EPA's certification decision must be made by comparing the scope and quality of relevant information to the objective criteria of 40 CFR Part 194. Where relevant, the Agency has considered public comments which support or refute technical positions taken by DOE. Emotional pleas and comments on the motives of interested parties are factors that are not relevant to a determination of whether DOE has demonstrated compliance with the disposal regulations and the WIPP compliance criteria, and are therefore outside the scope of this rulemaking.

A number of commenters suggested that EPA should explore alternative methods of waste disposal, such as neutralizing radioactive elements, before proceeding with a certification decision. Others stated that the WIPP should be opened immediately because underground burial of radioactive waste is less hazardous than the current strategy of above-ground storage. Such considerations are all outside the scope of this rulemaking. Congress did not delegate to EPA the authority to abandon or delay the WIPP in favor of other disposal methods. Congress mandated that EPA certify, pursuant to Section 4 of the APA, whether the WIPP will comply with the radioactive waste disposal regulations.[8] Thus, EPA is obligated to determine whether the WIPP complies with the disposal regulations, regardless of the relative risks of underground disposal compared to above-ground storage.

Many members of the public expressed a desire for EPA to oversee other aspects of the WIPP's operation. In particular, the public was concerned with the risks of transporting radioactive materials from waste generator sites to the WIPP. All transportation requirements for the WIPP are established and enforced by regulators other than EPA. (For further discussion on the source and limitations of EPA's authority to regulate the WIPP, see preamble Section X, ''Why and how does EPA regulate the WIPP?'') One commenter stated that EPA should survey electric and magnetic fields at the WIPP. The EPA's disposal regulations apply only to ionizing radiation. They do not apply to non-ionizing radiations such as electric and magnetic fields. These issues are beyond the scope of EPA's authority to regulate waste disposal at the WIPP and are not addressed in the certification rulemaking.

The EPA received a number of comments suggesting that the Agency should have provided more or better opportunities for public participation in its decision making process. Comments suggested, for example, that EPA should have rescheduled public hearings, responded more fully to comments submitted prior to the proposed rule, extended the public comment period, and included the public in all meetings between EPA and DOE. The EPA provided numerous opportunities for public participation in the WIPP certification decision, including two comment periods—one before and one after the proposed decision—of at least 120 days (In fact, EPA accepted comments on its advance notice of proposed rulemaking announcing receipt of DOE's CCA for over 250 days.), two sets of public hearings in New Mexico, **Federal Register** notices, and a number of meetings with various stakeholders. These measures exceed the basic requirements for notice-and-comment rulemaking and are in full compliance with the public participation requirements of both the WIPP compliance criteria and the Administrative Procedure Act. Further discussion on the measures taken by EPA to involve the public can be found in the preamble section entitled, ''How has the public been involved in EPA's WIPP activities?''

Some members of the public expressed doubt that EPA and its contractors possessed the necessary technical skills to evaluate DOE's application or were free from conflicts of interest. Many comments requested that EPA release the names and qualifications of individual contractor employees who provided technical support for EPA's certification rulemaking. The EPA initially denied this request because such information is typically claimed as confidential business information by federal government contractors. (The Trade Secrets Act prohibits EPA from releasing confidential business information, and imposes criminal liability on federal employees for the unauthorized disclosure of such confidential information.[9]) However, in response to the public interest regarding this issue, EPA sought and obtained from its contractors a limited waiver of confidentiality to release the names and qualifications of individual employees who provided technical support related to EPA's certification decision. In January 1998, EPA provided this contractor information to several stakeholders and also placed it in the rulemaking docket. (Docket A–93–02, Items IV–C–13 and IV–C–14) The Agency also sent to stakeholders (and docketed) a description of the measures EPA has taken to ensure that contractors do not have any conflict of interest in providing technical support on the certification rulemaking. While EPA agreed to release the above information to allay public concerns, such information is not relevant to EPA's certification decision. Under notice-and-comment rulemaking, it is the substance and basis for EPA's decision that are at issue.

Finally, several commenters stated that EPA—by initially certifying the WIPP to receive only certain waste from the Los Alamos National Laboratory—is granting a piecemeal certification, and that such an action is illegal under EPA's regulatory authority. The EPA disagrees with the assertion that its actions constitute a phased certification. The EPA's certification is based on the Agency's determination that the WIPP will comply with the disposal regulations for the inventory described in the performance assessment. Conditions 2 and 3 of the certification (related to waste generator sites) change neither the performance assessment assumptions nor the terms on which the WIPP is authorized for disposal, but ensure that DOE adheres to the assumptions on which compliance is based. The EPA believes this approach is consistent with Congressional intent (as reflected in the WIPP LWA) and with the disposal regulations and compliance criteria. For further discussion of comments related to the proposed conditions of certification, refer to the preceding preamble section entitled, ''Significant Changes Made to

[8] WIPP Land Withdrawal Act (''WIPP LWA''), Pub. L. 102–579, as amended by the 1996 WIPP LWA Amendments, Pub. L. 104–201, Section 8(d).

[9] 18 U.S.C. 1905

the Final Rule in Response to Comments.''

VIII. How Did EPA Respond to Major Technical Issues Raised in Comments?

A. Content of Compliance Certification Applications (§ 194.14)

40 CFR Part 194 sets out those elements which the Agency requires to be in a complete compliance application. In general, compliance applications must include information relevant to demonstrating compliance with each of the individual sections of 40 CFR Part 194 to determine if the WIPP will comply with the Agency's radioactive waste disposal regulations at 40 CFR Part 191, Subparts B and C. The Agency published the ''Compliance Application Guidance for the Waste Isolation Pilot Plant: A Companion Guide to 40 CFR Part 194'' (''CAG'') which provided detailed guidance on the submission of a complete compliance application.[10]

Any compliance application must include, at a minimum, basic information about the WIPP site and disposal system design, and must also address all the provisions of the compliance criteria; these requirements are embodied in § 194.14. The documentation required in the compliance criteria is important to enable a rigorous, thorough assessment of whether the WIPP facility will comply with the disposal regulations.

The EPA thoroughly reviewed DOE's compliance certification application (''CCA'') and additional information submitted by DOE, and proposed that DOE complies with each of the requirements of § 194.14, conditioned upon DOE's implementation of the most robust panel closure system design (designated as Option D) with slight modification. The succeeding sections address public comments related to § 194.14. (For more detailed discussions, see Docket A–93–02, Item V–B–2, CARD 14; and Item V–B–3.)

1. Site Characterization and Disposal System Design

The EPA received numerous public comments on issues related to the requirements of §§ 194.14(a) and 194.14.(b), primarily related to the geological features, disposal system design and characteristics of the WIPP. Since the geology and disposal system characteristics are directly related to performance assessment modeling and the containment requirements of 40 CFR Part 191, a discussion of EPA's review of the substantive comments (except for those relating to shaft seals and panel closures) can be found in the Performance Assessment section of this preamble. A discussion of the comments on the engineered features related to long term performance, specifically on the shaft seal design and panel closure system, are discussed below.

a. Shaft Seals. In the CCA, DOE described the seals to be used in each of the four shafts and included the design plans and the material and construction specifications for the seals. (Docket A–93–02, Item II–G–1, CCA Chapter 3.3.1, Chapter 8.1.1, and Appendix SEAL) The purpose of the shaft seal system is to limit fluid flow within the shafts after the WIPP is decommissioned and to ensure that the shafts will not become pathways for radionuclide release. The shaft seal system has 13 elements that fill the shaft with engineered materials possessing high density and low permeability, including concrete, asphalt, clay, compacted salt, cementitious grout, and earthen fill. The compacted salt column component of the system within the Salado is intended to serve as the primary longterm barrier by limiting fluid transport along the shaft during the 10,000 year regulatory period. The EPA proposed that DOE's shaft seal design is adequate because the system can be built and is expected to function as intended. (Docket A–93–02, Item V–B–2, CARD 14, Section 14.E; and Item V–B–3)

Commenters expressed concern that dissolution of the salt column could occur because the overlying Rustler aquifer has karst features and cannot be relied upon to retard the migration of radionuclides. (For more information on karst, refer to the preamble sections on Performance Assessment, Geological Scenarios.) Dissolution of salt (halite) in the WIPP shafts would require a source of water that is not saturated with salt, and a sink, i.e., some location for the water to flow to after it has dissolved the salt in the shafts. Since all of the ground water from the top of the Salado downward is saturated with salt (i.e., it is ''brine''), the unsaturated but highly saline water would probably come down the shaft from the Rustler Formation. In order to reach the salt component of the shaft seal, that water would have to pass through or around 490 feet of concrete, asphalt, and bentonite layers. Then, after flowing through 550 feet of compacted salt column, the saturated water would have to flow through or around another concreteasphalt water stop, another 100 feet of bentonite clay, and the shaft station concrete plug. (Docket A–93–02, Item V–B–2, CARD 14, Section 14.A)

Even if water were to pass through the salt column, only a small fraction of the salt column would be removed. Due to the ongoing inward creep of the Salado Formation, the salt column would still be consolidated after such a dissolution episode. Finally, DOE's PA calculations do not include ''credit'' for bentonite swelling, capture of water by clay, or the adsorption of water into dry halite'all processes that would tend to reduce water predicted to reach the salt column'and the PA results are therefore conservative. Therefore, EPA concludes that dissolution of the salt column is not a concern. (Docket A–93–02, Item V–B–2, CARD 14, Section 14.E; Item V–B–3, Section F.2)

Commenters questioned the ability of the shaft seals to perform as expected because the material and construction of the seals have not been tested. However, EPA found that DOE performed and referenced numerous tests and experiments to establish the material characteristics of importance to containment of waste at the WIPP. The characteristic of primary importance is the material's permeability, the degree to which fluids can travel through the material. The permeability of concrete, asphalt, and bentonite clay are well documented, and DOE performed numerous experiments to demonstrate the applicability of these characteristics to the WIPP's site specific conditions (e.g., high brine concentration). The DOE documented many laboratory and insitu tests of the permeability of compacted crushed salt including a largescale field test to demonstrate the feasibility of implementing such a seal measure. (Docket A–93–02, Item II–G–2, Appendices SEAL, PCS, DEL, and MASS)

The technology planned for constructing the shaft seals has been tested in the real world. The construction equipment and procedures necessary to emplace the seal materials are in large part the same as those used to excavate the WIPP, but used in reverse. Except for salt, the shaft seal component materials are commonly used in construction. Salt has been extensively tested to determine its properties and behavior in the conditions which will exist in the shafts after the WIPP is closed. The EPA finds that the shaft seal design has undergone extensive technical review and testing by DOE that shows it is feasible to construct and is expected to perform as intended. (Docket A–93–02, Item V–B–

[10] Section 194.11 provides that EPA's certification evaluation would not begin until EPA notified DOE of its receipt of a ''complete'' compliance application. This ensures that the full one-year period for EPA's review, as provided by the WIPP LWA, shall be devoted to substantive, meaningful review of the application. (61 FR 5226)

2, CARD 14, Section 14.E; Item V–B–3, Section F.2)

As commenters pointed out, and EPA agrees, many changes may occur in knowledge of construction materials and in construction methods and equipment during the 35 years before the WIPP is expected to be closed. The DOE provided a final design for the shaft seals which could be constructed. However, EPA recognizes the fact that technology may change and expects the shaft seal plans to be periodically reviewed and revised to take full advantage of new knowledge or construction equipment in the future. Acknowledgment of this circumstance does not mean that the existing plans are inadequate, or that major changes in the design are anticipated. Periodic review of the WIPP authorization(s) to operate is required by the various statutes and regulations applicable to the WIPP, including EPA's review of recertification applications every five years, and the State of New Mexico's review of the hazardous waste permit at least every ten years. Shaft seal design changes may be proposed by DOE and perhaps approved by EPA several times before the end of the WIPP disposal operations phase. Significant changes in the designs will be required to go through public noticeandcomment procedures before approval by EPA. (§ 194.65–66)

b. Panel Closure System. Panel closures are needed primarily during active disposal operations at the WIPP and during preparations for final closure of the entire facility. Relative to long-term performance, they can serve to block the flow of brine between panels.

The DOE provided four options for a panel closure system in the CCA, but did not specify which panel closure option would be used at WIPP. The EPA reviewed the four panel closure system options proposed by DOE and considered that the intended purpose of the panel closure system is to prevent the existing disturbed rock zone (''DRZ'') in the panel access drifts (tunnels) from increasing in permeability after panel closure (which could allow greater brine flow). The EPA considers the panel closure system design identified as ''Option D'' to be the most robust panel closure design. (Docket A–93–02, Item II–G–1, CCA Chapter 3 and Appendix PCS; Item V–B–2, CARD 14, Section 14.E; Item V–B–3, Section F.2) The EPA based its evaluation of compliance for the proposed rule on the Option D panel seal design and proposed to establish a certification condition requiring DOE to implement the Option D design. The EPA believes that the proposed design on which compliance was based should be actually implemented at the site. The EPA also proposed to require DOE to use Salado mass concrete (concrete made with Salado salt) for construction of the concrete barrier component of the panel closure. This substitution eliminates the potential for degradation and decomposition of fresh water concrete by infiltration of brine. The EPA determined that implementation of Option D is adequate to achieve the long-term performance modeled in the PA, since DOE shows that the use of a concrete barrier component is capable of providing resistance to inward deformation of the surrounding salt and prohibiting growth of the DRZ from its initial state. (Docket A–93–02, Item V–B–13)

Contrary to public comments, EPA found that the panel closures can be constructed using currently available and widely used technology. Mixing and transportation of concrete, using special measures to prevent segregation of fine and coarse particles (as required in the Panel Closure System construction specifications), and placement in confined spaces by pumping, is used routinely in bridge and building foundations, dams, and in water supply, subway and highway tunnels. The steel forms in which the concrete will be confined are somewhat unusual in shape, but the methods of construction are fairly simple and standardized. The Salado mass concrete mix is specially formulated for use in the WIPP, but it has been extensively tested to determine its properties (e.g., strength and resistance to chloride degradation) as explained in ''Variability in Properties of Salado Mass Concrete.'' (Docket A–93–02, Item II–G–1, Ref. No. 662)

One commenter asked that EPA revise its panel seal design condition so that DOE may reassess the engineering of panel closures when panels are to be closed in the future. The EPA proposed a certification condition (Condition 1) requiring DOE to implement the panel seal design that it designated as Option D in the CCA. The Option D design shall be implemented as described in the CCA, except that DOE is required to use Salado mass concrete rather than fresh water concrete. Nothing in this condition precludes DOE from reassessing the engineering of the panel seals at any time. Should DOE determine at any time that improvements in materials or construction techniques warrant changes to the panel seal design, DOE must inform EPA. If EPA concurs, and determines that such changes constitute a significant departure from the design on which certification is based, the Agency is authorized under § 194.65 to initiate a rulemaking to appropriately modify the certification. The EPA has retained the proposed Condition 1, related to the panel closure system, without change in the final rule. (See also ''Conditions'' and ''Significant Changes to the Final Rule'' sections of this preamble.)

2. Results of Assessments, Input Parameters to Performance Assessments, Assurance Requirements, and Waste Acceptance Criteria

Sections 194.14(c) through (f) require DOE to submit the results of assessments conducted in accordance with 40 CFR Part 194; a description of the input parameters associated with such assessments and the basis for selecting such parameters; documentation of measures taken to meet the assurance requirements of 40 CFR Part 194; and a description of the waste acceptance criteria and actions taken to assure adherence to such criteria. The EPA proposed that DOE complied with §§ 194.14(c) through (f) based on EPA's finding that DOE submitted the information required. The EPA received numerous public comments on the results of assessments, input parameters to the PA, assurance requirements, and the waste acceptance criteria. A discussion of EPA's responses to substantive comments can be found in the corresponding sections of the preamble. Based on these responses, EPA finds that DOE complies with §§ 194.14(c) through (f). For further discussion, refer to CARD 14, Sections 14.C, 14.D, 14.E, 14.F (Docket A–93–02, Item V–B–2) and Sections H.2, I.2, J.2, and K.2 of the technical support document for § 194.14 (Docket A–93–02, Item V–B–3).

3. Background Radiation, Topographic Maps, Past and Current Meteorological Conditions

For the CCA, DOE was required to describe the background radiation in air, soil and water in the vicinity of the disposal system and the procedures employed to determine such radiation (§ 194.14(g)), provide topographic maps of the vicinity of the disposal system (§ 194.14(h)), and describe past and current climatic and meteorological conditions in the vicinity of the disposal system and how these conditions are expected to change over the regulatory time frame (§ 194.14(i)). The EPA proposed that DOE complied with the requirements of §§ 194.14 (g), (h), and (i). The EPA did not receive substantive comments on these issues, except for dissolution related to climate change. A

discussion of EPA's response to the substantive comments on dissolution can be found in the Performance Assessment, Geological Scenarios and Disposal System Characteristics section of this preamble. The EPA finds that DOE complies with §§ 194.14 (g) through (i). For further discussion, refer to Sections 14.K, 14.L, and 14.M of CARD 14 (Docket A–93–02, Item V–B–2) and Sections H.2, L.2, N.2 and N.4 of the technical support document for § 194.14 (Docket A–93–02, Item V–B–3).

4. Other Information Needed for Demonstration of Compliance

The DOE was also required, under § 194.14(j), to provide additional information, analyses, tests, or records determined by the Administrator or the Administrator's authorized representative to be necessary for determining compliance with 40 CFR Part 194. After receipt of the CCA dated October 29, 1996, EPA formally requested additional information from DOE in seven letters dated December 19, 1996, and February 18, March 19, April 17, April 25, June 6, and July 2, 1997. (Docket A–93–02, Items II–I–1, II–I–9, II–I–17, II–I–25, II–I–27, II–I–33, and II–I–37, respectively) The information requested in these letters was necessary for EPA's completeness determination and technical review. EPA staff and contractors also reviewed records maintained by DOE or DOE's contractors (e.g., records kept at the Sandia National Laboratories Records Center in Albuquerque, New Mexico). No additional laboratory or field tests were conducted by DOE at EPA's specific direction; however, DOE did conduct and document laboratory tests after October 29, 1996, in order to present additional data to the Conceptual Model Peer Review Panel. (Docket A–93–02, Item II–A–39)

The EPA proposed that DOE complied with § 194.14(j) because it responded adequately to EPA's formal requests for additional information, analyses, and records. The EPA did not formally request additional information from DOE after publication of the proposed rule. However, in response to comments, EPA did verbally ask DOE and Sandia National Laboratory for information and other assistance in calculations related to the Hartman scenario, drilling into fractured anhydrite, and the CCDFGF code and quasi-static spreadsheet with regard to air drilling. (Docket A–93–02, Items IV–E–24, IV–E–25, IV–E–26, and IV–E–27) In addition, DOE voluntarily submitted information on the proposed rule that was considered as comments.

All documents sent to EPA regarding certification of the WIPP are available in EPA Air Docket A–93–02. Additional information relevant to EPA's certification evaluation that was reviewed by the Agency (e.g., DOE data records packages, quality assurance records, and calculations of actinide solubility for americium, plutonium, thorium and uranium) is also publicly available. Documentation of peer review panel meetings conducted after receipt of the CCA has been placed in the EPA docket. See Docket A–93–02, Item V–B–1 for further information on the location of all documentation reviewed by EPA.

5. Conclusion

The EPA received numerous public comments on the proposed rule regarding § 194.14. EPA has thoroughly reviewed the public comments and addressed all issues raised therein. On the basis of its evaluation of the CCA and supplementary information, and the issues raised in public comments, EPA finds that DOE complies with all subsections of 40 CFR 194.14, with the condition that DOE must fulfill the requirements set forth in Condition 1 of the final rule. For additional information on EPA's evaluation of compliance for § 194.14, see CARD 14. (Docket A–93–02, Item V–B–2)

B. Performance Assessment: Modeling and Containment Requirements (§§ 194.14, 194.23, 194.31 through 194.34)

1. Introduction

The disposal regulations at 40 CFR Part 191 include requirements for containment of radionuclides. The containment requirements at 40 CFR 191.13 specify that releases of radionuclides to the accessible environment must be unlikely to exceed specific limits for 10,000 years after disposal. At the WIPP, the specific release limits are based on the amount of waste in the repository at the time of disposal. (§ 194.31) Assessment of the likelihood that the WIPP will meet these release limits is conducted through the use of a process known as performance assessment (''PA'').

The WIPP PA process culminates in a series of computer simulations that attempts to describe the physical attributes of the disposal system (site characteristics, waste forms and quantities, engineered features) in a manner that captures the behaviors and interactions among its various components. The computer simulations require the use of conceptual models that represent physical attributes of the repository. The conceptual models are then expressed as mathematical relationships, which are solved with iterative numerical models, which are then translated into computer code. (§ 194.23) The results of the simulations are intended to show the potential releases of radioactive materials from the disposal system to the accessible environment over the 10,000-year regulatory time frame.

The PA process must consider both natural and man-made processes and events which have an effect on the disposal system. (§§ 194.32 and 194.33) It must consider all reasonably probable release mechanisms from the disposal system and must be structured and conducted in a way that demonstrates an adequate understanding of the physical conditions in the disposal system. The PA must evaluate potential releases from both human-initiated activities (e.g., via drilling intrusions) and natural processes (e.g., dissolution) that would occur independently of human activities. The DOE must justify the omissions of events and processes that could occur but are not included in the final PA calculations.

The results of the PA are used to demonstrate compliance with the containment requirements in 40 CFR 191.13. The containment requirements are expressed in terms of ''normalized releases.'' The results of the PA are assembled into complementary cumulative distribution functions (''CCDFs'') which indicate the probability of exceeding various levels of normalized releases. (§ 194.34)

As described above, 40 CFR Part 194 contains several specific requirements for the performance assessment of WIPP. It is often difficult to discuss one of the requirements in isolation from the others. For example, several public comments raised concern about the CCA's screening of the fluid injection scenario from the PA and EPA's subsequent analysis. In order for EPA to adequately address the fluid injection issue, the Agency must discuss multiple requirements related to geology and other characteristics specific to the WIPP site (§ 194.14), models and computer codes (§ 194.23), and the screening process for both human-initiated releases and releases by natural processes (§§ 194.32 and 194.33). Because so many of the PA issues have similarly overlapping requirements and are often complex, EPA has chosen to combine the discussions. Therefore, the following discussions are framed in terms of the PA issues raised in comments, rather than according to specific PA requirements of the compliance criteria. The following sections discuss the major PA issues

that were raised during public hearings and the public comment period. For more information on performance assessment and related issues, refer to CARDs 14, 23, 32, and 33. (Docket A–93–02, Item V–B–2)

2. Human Intrusion Scenarios

a. Introduction. Section 194.32 requires DOE to consider, in the PA, both natural and man-made processes and events which can have an effect on the disposal system. Of all the features, events, and processes (''FEPs'') that are considered for the PA calculations, the human-intrusion scenarios related to drilling have been shown to have the most significant impact on the disposal system and its ability to contain waste. (§ 194.33)

In preparing the CCA, DOE initially identified 1,200 potential FEPs, both natural and human-initiated, for the WIPP PA. These FEPs were reduced in number in the final PA calculations. The DOE may eliminate FEPs from consideration in the PA for three reasons:

- Regulatory—FEPs can be omitted based on regulatory requirements. For example, drilling activities that occur outside the Delaware Basin do not have to be considered in the PA, according to §§ 194.33(b)(3)(i) and 194.33(b)(4)(i).
- Probability—FEPs can be omitted because of the low probability that the FEP will occur. For example, DOE determined that the probability of a meteorite landing in the vicinity of the WIPP is so low that it does not need to be considered in the PA. (§ 194.32(d))
- Consequences—FEPS can be omitted because the consequences resulting from the FEP, even if it does occur, are so small. For example, there would be no consequences on the repository or the containment of waste if an archeological excavation took place on the surface in the vicinity of the WIPP. (§ 194.32(a))

The following sections discuss the major public comments on human intrusion scenarios. Generally, public comments related to whether or not the scenario was appropriately screened by DOE and to EPA's subsequent evaluation of this screening. Some comments addressed whether DOE's modeling of events was appropriate. The human intrusion scenarios discussed below are: spallings releases, air drilling, fluid injection, potash mining, and carbon dioxide injection. For more information on human intrusion scenarios, refer to CARDs 32 and 33. (Docket A–93–02, Item V–B–2)

b. Spallings. The DOE's models for the PA included five ways in which radioactive waste could leave the repository and escape to the accessible environment: cuttings,[11] cavings,[12] spallings,[13] direct brine release, and transport of dissolved radionuclides through the anhydrite interbeds (i.e., layers of rock immediately above the repository). The first four of these potential release pathways involve direct releases of radiation to the earth's surface in cases where people drill a borehole while searching for resources.

The DOE's model for computing releases of radiation due to spallings was of particular concern to the Conceptual Models Peer Review Panel which reviewed each of the conceptual models developed for the purposes of the PA. (See Docket A–93–02, Item V–B–2, CARD 23, Section 7.) The peer review panel found the spallings conceptual model inadequate because it did not fully model all potential mechanisms that may cause pressure-driven solid releases to the accessible environment. (Docket A–93–02, Item II–G–12, p. 74) The DOE presented additional experimental evidence and the results of other modeling to the peer review panel and requested that it consider whether the spallings volumes predicted by the original inadequate spallings model were reasonable for use in the PA. (Docket A–93–02, Items II–G–22 and II–G–23) After considering this additional information, the peer review panel concluded that the spallings values in the CCA are reasonable for use in the PA. The panel concluded that, while the spallings model does not accurately represent the future state of the repository, its inaccuracies are conservative and, in fact, may overestimate the actual waste volumes that would be expected to be released by a spallings event. (Docket A–93–02, Item II–G–22, Section 4, p. 18)

The spallings conceptual model relates to the following requirements of § 194.23: documentation of conceptual models used in the PA (§ 194.23(a)(1)); consideration and documentation of alternative conceptual models (§ 194.23(a)(2)); and reasonable representation of future states of the repository in conceptual models (§ 194.23(a)(3)(i)). The EPA proposed that DOE met the requirements of § 194.24(a)(1) and (a)(2), and, for all conceptual models except the spallings conceptual model, § 194.24(a)(3)(i). The EPA did not propose, however, to determine that the spallings model incorporated in the CCA PA ''reasonably represents possible future states of the repository,'' as stated in § 194.24(a)(3)(i). The EPA proposed to accept the spallings model for the purposes of demonstrating compliance with § 194.23(a)(3)(i) on the basis that it has been determined to produce conservative overestimates of potential spallings releases. (62 FR 58807) The Agency now concludes that DOE has met the requirements of § 194.23 in its final rule. (See Docket A–93–02, Item V–B–2, CARD 23, Section 7.4.)

The public commented on four aspects of DOE's spallings modeling and EPA's evaluation of that modeling: adequacy of DOE's spallings modeling, purpose and approach of EPA's spallings modeling, use of DOE's GASOUT code for modeling spallings, and the need to include additional spallings mechanisms.

Some commenters expressed concern that DOE's conceptual model for spallings used in the PA did not adequately represent spallings releases, as stated initially by the Conceptual Model Peer Review Panel. However, others indicated that DOE had worked on the spallings model extensively since the peer review panel's review, and that the spallings model demonstrated that the volume of releases due to spalling would be small.

The EPA agrees that the spallings conceptual model was inadequate to represent possible future states of the repository. In response to the Conceptual Models Peer Review Panel, DOE did substantial additional work, developed a separate mechanistically-based model and provided supporting experimental data. The peer review panel concluded that the spallings model used in the CCA PA calculated release volumes that were reasonable and probably conservative. (Docket A–93–02, Item II–G–22) On the basis of this additional work, EPA concludes that the spallings release volumes calculated by the CCA spallings model are acceptable. Based upon this work, the Agency also agrees with those commenters who stated that spallings would result in only a small volume of waste being released to the accessible environment through spallings.

Commenters asked for clarification of EPA's purpose in producing its spallings evaluation reports for the proposed rule. (Docket A–93–02, Items III–B–10 and III–B–11) They also questioned EPA's technical approach in these reports, particularly the discretization (time and space intervals).

[11] ''Cuttings'' refers to material, including waste, that is cut by a drill bit during drilling and is carried to the surface by the drilling fluid as it is pumped out of the borehole.

[12] ''Cavings'' refers to material that falls from the walls of a borehole as a drill bit drills through. Cavings are carried to the surface by the drilling fluid as it is pumped out of the borehole.

[13] ''Spallings'' refers to releases of solids pushed up and out by gas pressure in the repository during a drilling event.

Discretization is important because if intervals are too large, modeling may not calculate or may incorrectly calculate some important events, and if intervals are too small, modeling will be time-consuming and inefficient.

The EPA prepared its Spallings Evaluation and Supplemental Spallings Evaluation for the proposed rule in order to model simplistically the transport of spallings releases up a borehole during blowout. The spallings model used in the CCA PA did not examine transport; rather, DOE's spallings model took the approach that all waste broken loose and able to move would actually reach the earth's surface. The Agency used an independent model to investigate if DOE's spallings conceptual model would give conservative estimates of spallings releases. The EPA believed this would determine if the calculated spallings releases were potentially acceptable for use in PA, despite the flaws in DOE's model. The EPA undertook these studies early in its own review, and in the Conceptual Models Peer Review Panel's review of the spallings conceptual model, when both the Panel and the Agency were concerned about the results of the model.

After EPA completed its own modeling, DOE performed additional studies using an alternative, mechanistic conceptual model for spallings. (Hansen et al., Spallings Release Position Paper, Docket A–93–02, Item II–G–23) DOE's additional studies showed that its original spallings conceptual model always predicted a greater volume of releases than the mechanistic spallings conceptual model that used a more realistic approach to calculate spallings releases. As a result, both the Conceptual Models Peer Review Panel and EPA concluded that released volumes estimated using the original CCA spallings conceptual model were reasonable and conservative. The EPA found DOE's analysis in the Spallings Release Position Paper to be more conclusive than the Agency's studies in its Spallings Evaluation and Supplemental Spallings Evaluation. DOE's analysis was an improvement over EPA's analysis because it was more thorough, it used much finer discretization (smaller time and space intervals) which allowed more specific predictions, and it predicted both volumes and activity of spallings releases. As described in the proposed rule, EPA examined the Spallings Release Position Paper and concluded that the spallings release volumes calculated by the spallings model used in the PA are conservative and, therefore, acceptable to demonstrate compliance with the waste containment requirements of 40 CFR 191.13. (62 FR 58807) This conclusion is based not on the EPA's spallings reports prepared for the proposed rule, which have been questioned by commenters, but on the additional spallings analysis performed by DOE, presented to the Conceptual Models Peer Review Panel, and found by EPA to demonstrate that the spallings release volumes used in the CCA PA are conservative. (Docket A–93–02, Item III–B–2; Item V–B–2, CARD 23; and Item V–C–1)

Some commenters expressed concern about the stability of Sandia National Laboratory's GASOUT computer code that calculates spallings releases. One individual had used this code to calculate spallings releases due to air drilling, but other commenters stated that it was not appropriate to apply the GASOUT code to the air drilling scenario. (Air drilling refers to the practice of using air or other substances lighter than mud as a drilling fluid.)

The EPA agrees that the GASOUT code may not be stable under some conditions. GASOUT was designed to model blowout of waste during the first few seconds after borehole penetration, where the driller uses mud in the borehole to reduce friction during drilling. The GASOUT code was only intended to be used under specific conditions of waste tensile strength [14] and permeability. (Docket A–93–02, Item II–E–9) Within its range of applicability, GASOUT produces results that are consistent with results obtained by other modeling approaches, such as the quasi-static model and the coupled numerical model. (Docket A–93–02, Item II–G–23) However, if GASOUT is not used as designed, it may well be unstable or may calculate invalid results. In particular, EPA agrees with those commenters stating that it is inappropriate to use GASOUT to analyze the releases of spallings due to air drilling. The programmer of the GASOUT code himself has said that this code was not designed to model drilling using compressible fluids such as air. (Docket A–93–02, Item II–E–9) For further discussion of the GASOUT code, see the discussion of air drilling below in this preamble.

Some commenters stated that DOE had erroneously excluded from the PA the stuck pipe [15] and gas erosion [16] spallings mechanisms, two additional ways by which high gas pressure conditions in the repository could result in releases of solid radioactive waste to the accessible environment. In particular, commenters asserted that DOE had selected an incorrect value for the threshold waste permeability, [17] above which the gas erosion and stuck pipe mechanisms would not occur. They also stated that DOE's assumptions did not take into consideration the presence of magnesium oxide (MgO) backfill, which would affect both waste permeability and tensile strength. These commenters suggested that EPA should do further analysis, should require DOE to do more analysis, or should reject DOE's spallings models and mandate new models. Other commenters countered that stuck pipe and gas erosion would not occur because of the physical and mechanical properties of the waste.

The EPA has analyzed the validity of DOE's decision to exclude stuck pipe and gas erosion mechanisms from the PA. In order for these mechanisms to occur, there must be a combination of high gas pressure, low waste permeability, and low waste strength. First, the gas pressure in the repository must be sufficiently high to move waste to and up the borehole. Low waste permeability is necessary to maintain the high pressure during the drilling event. Finally, low waste tensile strength is necessary to allow the waste to break off and move toward the borehole. The DOE has fabricated simulated samples of waste that have corroded or degraded and have generated gas, as is expected to occur in the WIPP once waste is emplaced, and has measured the porosity [18] of these samples. Waste porosity and gas pressure are related. This is because a greater porosity means a greater volume of spaces that gas can fill. By the ideal gas law, when the same number of gas molecules fill a larger volume, they will have a lower gas pressure. The waste porosity also affects waste permeability,

[14] Tensile strength is resistance to being pulled apart.

[15] ''Stuck pipe'' means a situation where high gas pressures in the repository would break off radioactive waste and press it against a drill string hard enough to stop or greatly reduce drilling. In order to continue drilling, a drill operator would raise and lower the drill string and, in the process, could transport waste to the surface.

[16] ''Gas erosion'' means a situation where radioactive waste breaks off slowly due to high gas pressures in the repository, enters drilling mud surrounding the drill, and is transported to the earth's surface in the mud.

[17] ''Waste permeability'' is the degree to which fluid can move through the waste.

[18] ''Porosity'' is the fraction of space present that is open and can store gases or liquids, as opposed to space filled by solid matter.

since more open space in waste means more space where a liquid or gas can penetrate. Based upon DOE's measurements of the porosity of surrogate waste samples, EPA found that it is extremely unlikely that the required conditions of high gas pressure and low waste permeability will exist in the WIPP. The high pressure necessary to support gas erosion or stuck pipe mechanisms would expand the WIPP waste, creating a higher porosity (and higher permeability). Thus, for the characteristics of the WIPP waste, the permeability would not become low enough (less than 10^{-16} square meters) to create a gas erosion or stuck pipe event. (Docket A–93–02, Item V–B–2, CARD 23, Section 7.4) If the permeability is not low enough for gas erosion or stuck pipe, releases may still occur, but the release mechanism will be a short-lived blowout (spallings) rather than gas erosion or stuck pipe. Therefore, EPA concludes that DOE correctly modeled only the ''blowout'' process in its spallings model and appropriately excluded stuck pipe and gas erosion.

c. Air Drilling. Shortly before publication of the proposed certification decision, and after EPA's cutoff date for addressing ANPR comments, EPA received a comment containing a technical report stating that DOE should have included the human intrusion scenario of air drilling in the PA, rather than screening it out. (Docket A–93–02, Item IV–D–01) Normally, oil drillers will use mud in the borehole to reduce friction and to carry away solids that break free as the drill bit bores into the ground. However, in some cases, drillers might instead use air, mist, foam, dust, aerated mud or light weight solid additives as the fluid in the borehole. Public comments noted that the air drilling[19] scenario was not included by DOE in the CCA, and raised the following issues:

- Air drilling technology is currently successfully used in the Delaware Basin.
- Air drilling is thought to be a viable drilling technology under the hydrological and geological conditions at the WIPP site.
- Air drilling could result in releases of radionuclides that are substantially greater than those considered by DOE in the CCA.

In response to these concerns, EPA prepared a study on air drilling and its likely impact on the WIPP (Docket A–93–02, Item IV–A–1), placed it in the docket, and allowed for a public comment period of 30 days. (63 FR 3863; January 27, 1998) The EPA's study examined the frequency of air drilling near the WIPP, the likelihood that drillers would use air drilling under the conditions at the WIPP, and the potential volume of radioactive waste that could be released using air drilling. In the report, the Agency concluded that air drilling is not a common practice in the Delaware Basin, and that air drilling through the Salado, the geologic salt stratum where the WIPP is located, is not presently used in the Delaware Basin near the WIPP. Because the use of air as a drilling fluid is not current practice in the Delaware Basin, EPA found that DOE is not required to include air drilling in the PA. (§ 194.33(c)(1)) Nevertheless, the Agency also modeled potential releases of radioactive waste during air drilling, and found that any releases would be within the range calculated in the CCA PA for mud-based drilling.

The EPA received a number of comments on its air drilling report. Some members of the public stated that air drilling is a proven technology and the frequency of its use by the oil and gas industry is increasing. They suggested that air drilling techniques are not currently being used more widely because of the limited knowledge of new developments and the industry's resistance to changing methods. The commenters implied that if these obstacles are overcome, air drilling will occur widely in the future. One commenter recommended that the Agency require DOE to consider air drilling using a frequency of 30% of all wells, based upon a projected estimate from DOE of the use of air drilling in the entire U.S. in the year 2005. In contrast, other commenters stated that air drilling would be less economic than mud drilling if the driller encountered any interruption in the air drilling process.

The Agency recognizes that air drilling is a proven technology for extraction of oil and gas under appropriate conditions. However, EPA believes that it is inappropriate to use speculative projections of future practices in the oil and gas industry across the U.S. in the PA or to guess that a practice will be used more in the future because some drillers may currently misunderstand the technology. The EPA's compliance criteria require DOE to assume that future drilling practices and technology will remain consistent with practices in the Delaware Basin at the time a compliance application is prepared. (§ 194.33(c)(1)) The EPA included this requirement in the compliance criteria to prevent endless speculation about future practices, and to model situations that are representative of the Delaware Basin, rather than a wider area that is not representative of conditions at the WIPP site. (61 FR 5234; Docket A–92–56, V–C–1, p. 12–12) The Agency chose to use current drilling practices for resources exploited in the present and past as a stand-in for potential future resource drilling practices. (61 FR 5233) The specific frequency suggested by the commenter is arbitrary because it applies to the entire U.S. rather than the Delaware Basin and because the commenter provides no reason for selecting an estimated frequency of air drilling in 2005 rather than in some other year. The DOE must abide by the requirement of § 194.33(c)(1) to assume that future drilling practices remain consistent with practices in the Delaware Basin at the time the CCA was prepared (1996). Thus, the pertinent issues are whether air drilling constitutes current practice in the Delaware Basin and, if so, how it could affect potential releases from the WIPP.

Some commenters said that air drilling is already occurring in the Delaware Basin, and thus, should be considered in the PA. One commenter noted that EPA should look at the frequency of air drilling in the Texas portion of the Delaware Basin, as well as in the New Mexico portion of the Delaware Basin, consistent with § 194.33(c)(1). Commenters also raised a concern that EPA's examination of well files might underestimate the occurrence of air drilling because information on the drilling fluid used is not always clear in the records. Another commenter suggested that air drilling could be left out of the PA only if it has a probability of less than one chance in ten thousand, under § 194.32(d).

The EPA agrees that the frequency of air drilling needs to be examined in the entire Delaware Basin. In response to these public comments, EPA supplemented the analysis in its initial air drilling report by conducting a random sample of wells drilled in the New Mexico and Texas portions of the Delaware Basin and has determined the frequency of air drilling in the entire Delaware Basin. (The initial report is located at Docket A–93–02, Item IV–A–1; the supplemented report is located at Docket A–93–02, Item V–B–29.) The Agency found that air drilling is not used more frequently in the Delaware Basin as a whole than in the New Mexico portion of the Basin. At the 95% statistical confidence level, EPA found that, at most, only 1.65% of all wells in the Delaware Basin may have been drilled with air. In those records examined, none of the wells were

[19] In this discussion, the term ''air drilling'' refers to all forms of drilling using drilling substances lighter than mud.

drilled through the salt-bearing geologic formation, as would be required to penetrate the WIPP. This additional information confirms the Agency's conclusion (as stated initially in Docket A–93–02, Item IV–A–1) that air drilling is not a current practice in the Delaware Basin.

The EPA agrees that the well drilling records examined in its random sample may not by themselves be conclusive about whether air drilling was used at specific wells. As an independent confirmation of the extent of air drilling in the Delaware Basin (and near the WIPP specifically), EPA also interviewed knowledgeable industry contacts, many of whom were experienced in air drilling. These individuals independently confirmed that air drilling is rarely practiced in the Delaware Basin and that it is virtually nonexistent in the vicinity of WIPP. (Docket A–93–02, Item V–B–29) The DOE also found similar results in an exhaustive analysis of 3,349 wells in the Delaware Basin. (Docket A–93–02, IV–G–7) These independent sources of information further verify EPA's conclusion that air drilling is not a current practice in the Delaware Basin. In particular, air drilling through the salt section (where the waste is present) is not consistent with current drilling practices in the Delaware Basin.

The EPA disagrees that the frequency of air drilling must be less than one in ten thousand wells in order for DOE to leave it out of the PA. Section 194.33(c)(1) requires DOE to look at ''drilling practices at the time a compliance application is prepared.'' This requirement refers to typical industry practices in the Delaware Basin at the time a compliance application is prepared. (See 61 FR 5230; Docket A–92–56, Item V–C–1, p. 12–18; Docket A–93–02, Item II–B–29, p. 50.) It was not intended to apply to experimental procedures, emergency procedures, or conjectured future practices. The Agency finds it unrealistic to consider a specific deep drilling method to be current practice or typical of drilling in the Delaware Basin when it is used for only a small percentage of all wells in the Basin. As indicated in § 194.32, deep drilling and shallow drilling are events to be considered in the PA. The Agency believes that DOE has correctly implemented the requirements of § 194.32(d) by including the general technique of deep drilling as a scenario in the PA, rather than separately analyzing the probability of each potential kind of deep drilling.

One commenter stated that air drilling is a viable technique under the conditions in the vicinity of the WIPP site. This commenter said that drilling with air may even become the method of choice in the WIPP area, since a driller will prefer to use a technology such as air drilling, which avoids loss of circulation. Another commenter expressed concern about the conclusions of EPA's Analysis of Air Drilling at WIPP (Docket A–93–02, Item IV–A–1) that water inflow upon drilling would prevent air drilling near the WIPP and that air drilling is not an economically feasible drilling method near the WIPP. This commenter also stated that EPA's estimates of the water flow rate that can be tolerated during air drilling were too low.

The EPA examined a report from a commenter that found that water inflows from the Culebra would not prevent air drilling at the WIPP site. The report based this premise on the transmissivity in some parts of the WIPP site. However, EPA disagrees that the transmissivity threshold mentioned in the report would provide sufficient reason to conclude that air drilling was currently practical in that area. The range of transmissivities at the WIPP site shows that air drilling is definitely not feasible in some parts of the site, and is unsuitable in other portions of the site. The EPA also found that the possibility of excessive water inflow was only one of the reasons mentioned by industry contacts as to why air drilling was not used in the vicinity of WIPP. Other reasons, cited in EPA's Air Drilling Report, include sections of unconsolidated rock above the salt section and the potential for hitting brine pockets in the Castile Formation. (Docket A–93–02, Item V–B–29) Because of the reasons industry contacts gave for not conducting air drilling near the WIPP, the Agency disagrees that air drilling would ever become a preferred method of drilling at the WIPP site.

Commenters were concerned that there might be greater releases of waste with air drilling than with mud drilling. This is because air and foam are less dense than mud, so it would take less pressure inside the repository to push waste toward the surface as solid waste (spallings) or as waste dissolved in brine (direct brine release). One individual calculated spallings releases due to air drilling using DOE's GASOUT computer code, and found that releases due to air drilling were several orders of magnitude higher than the releases computed in the CCA PA. (Docket A–93–02, Item II–D–120) Other commenters countered that the GASOUT code was not designed to model spallings using air drilling, and therefore, that the GASOUT code could not be applied in this situation.

Although EPA concluded that there was no need to include air drilling in the PA, the Agency conducted its own modeling of spallings due to air drilling to respond to public concerns. (Docket A–93–02, Item V–B–29, Section 6 and Appendix A) The EPA used the quasi-static model developed by DOE as a mechanistic model of spallings, an approach that provides greater modeling flexibility than with the GASOUT code. The quasi-static model tends to overestimate releases of radioactive waste because it predicts the total volume of waste that is available for transport. The total volume available for transport would not all be released in actuality because pressurized gas would not be able to lift large, heavy particles up to the earth's surface. Studies have shown that the quasi-static model generally predicts larger spalled volumes than the model incorporated in the GASOUT code. (Docket A–93–02, Item II–G–23, Table 3–3) For air drilling conditions, EPA estimated volumes of releases to be within the range of spallings values predicted by the CCA and used in the PAVT evaluation.

The EPA also examined the effects of air drilling on the combined, complementary cumulative distribution functions (''CCDFs'') used to show graphically whether the WIPP meets EPA's containment requirements for radioactive waste. (Docket A–93–02, Item V–B–29, Section 6) The EPA found that the CCDFs produced by DOE were not significantly different from those produced in the PAVT. In fact, releases from the WIPP were still below the containment requirements of § 191.13 by more than an order of magnitude when air drilling is included as a scenario.

The EPA determines that DOE does not need to include air drilling in the PA because it is not current practice in the Delaware Basin. Further analyses, conducted by EPA solely to allay the public's concerns on this issue, showed that spallings releases calculated in the CCA and the PAVT encompass the potential impacts of air drilling (were it to occur) on compliance with the containment requirements.

See CARD 32 for further discussion of the screening of features, events, and processes. (Docket A–93–02, Item V–B–2)

d. Fluid Injection Commenters stated that DOE should not have screened out the human intrusion scenario of fluid injection [20] from the final PA

[20] The fluid injection discussed here refers to either (1) brine disposal from oil activities, (2) maintenance of pressure in existing oil production,

Continued

calculations. Brine could be injected into existing boreholes, enter the repository, become contaminated and flow to various release points. In § 194.32(c), EPA's compliance criteria specifically require DOE to analyze the effects of boreholes or leases that may be used for fluid injection activities near the disposal system soon after disposal.

The fluid injection scenario has been of particular concern to the public because of events that occurred in the Rhodes-Yates oil field, about 40 miles east of WIPP but outside the Delaware Basin in a different geologic setting. An oil well operator, Mr. Hartman encountered a brine blowout in an oil development well while drilling in the Salado Formation in the Rhodes-Yates Field. In subsequent litigation, the court found that the source of the brine flow was injection water from a long-term waterflood borehole located more than a mile away. A fluid injection scenario causing the movement of fluid under high pressure is referred to as ''the Hartman Scenario'' after this case.

The DOE initially screened out this activity from the PA because the Department's modeling of fluid injection indicated that it would result in brine inflow values within the range calculated in the CCA PA where there is no human intrusion. (Docket A–93–02, Item II–A–32) Both EPA and public commenters on the Advance Notice of Proposed Rulemaking did not believe that DOE had performed sufficient analyses to rule out the potential effects of fluid injection related to oil production on the disposal system. Therefore, the Agency required DOE to model fluid injection using more conservative geologic assumptions about the ability of Salado anhydrite to transmit fluid. (Docket A–93–02, Item II–I–17) This more conservative modeling showed that fluid injection would have little impact on the results of the PA. (Docket A–93–02, Item II–I–36) Based on this modeling and other information submitted by DOE on the frequency of fluid injection well failures, EPA proposed that DOE's screening was sufficient and realistic. (62 FR 58806, 58822) Thus, EPA concluded that fluid injection could be screened out of the final PA calculations based on low consequences to the disposal system.

The EPA performed its own independent review of fluid injection, which showed that the injection analysis must include the nature of anhydrites, duration of injection activities, and presence of leaking boreholes. (Docket A–93–02, Item V–B–22) As part of its analysis, the Agency performed additional modeling of the injection well scenario. The EPA concluded that, although scenarios can be constructed that move fluid to the repository via injection, the probability of such an occurrence, given the necessary combination of natural and human-induced events, is very low.

Several commenters stated that either EPA or DOE needed to model the Hartman Scenario. One commenter stated that it should be proven that DOE's BRAGFLO [21] code can reproduce what is believed to have happened in the Hartman case. Some members of the public also referred to modeling performed by Bredehoeft and by Bredehoeft and Gerstle which found that the Hartman scenario could cause releases in excess of the disposal regulations (Docket A–93–02, Item II–D–116 Attachment (b)); these commenters stated that neither EPA nor DOE had satisfactorily modeled the Hartman Scenario.

The EPA examined Bredehoeft and Gerstle's modeling of fluid injection at the WIPP and finds their assumptions highly unrealistic. In particular, the report assumes that all brine is directly injected into one anhydrite interbed in the Salado Formation. The anhydrite interbeds in the Salado are only a few feet thick. Therefore, a driller would need to plan specifically to deliberately inject brine into the anhydrite interbeds to have such a situation occur at the WIPP. Also, well operators using fluid injection for oil or gas recovery would be attempting to inject brine into formations where petroleum and gas reserves are found, which are thousands of feet below the Salado. If flooding due to fluid injection occurred accidentally in the vicinity of the WIPP, the flow of fluid would not be limited to the narrow band of one anhydrite interbed in the Salado. Also, Bredehoeft and Gerstle's report assumes that fractures in the anhydrite will extend for three or more kilometers and will remain open. This would require extremely high pressures to be generated by the brine injection process. The EPA agrees that under very unrealistic conditions, modeling can show fluid movement toward the WIPP under an injection scenario. However, when using more realistic but still conservative assumptions in the modeling, fluid movement sufficient to mobilize radioactive waste in the disposal system does not occur.

In response to public comments, the Agency tried to reproduce several of the results obtained with Bredehoeft's model using DOE's BRAGFLO model. In two cases, EPA's modeling produced flows similar to those in the March 1997 Bredehoeft report. (Docket A–93–02, Item II–D–116) However, because the Agency's study looked at flows in multiple locations and Bredehoeft's study does not specify the location of its predicted flows, the results are not directly comparable. The EPA also attempted to replicate Bredehoeft's modeling of high pressure conditions that would be mostly likely to cause a catastrophic event. However, the Agency found that critical aspects of Bredehoeft's work are not documented sufficiently to make meaningful comparisons using the BRAGFLO computer code. In particular, the grid spacing used in the model predictions were unclear. This information is necessary in order to recreate Bredehoeft's simulation. Also, EPA was unable to determine whether the length to which fractures grow are based on completely opened or partially opened fractures. The Agency contacted the primary author of the paper in order to obtain additional critical information. However, the author was not certain how they had treated these aspects of modeling and had no further documentation. (Docket A–93–02, Item IV–E–23) Because of insufficient documentation of vital aspects of modeling, the Agency could not replicate Bredehoeft's results. In addition, due to lack of proper documentation it was not clear to EPA that Bredehoeft's modeling represented the Hartman Scenario. Therefore, EPA finds that lack of agreement between the Bredehoeft model and BRAGFLO does not indicate that DOE's modeling is inadequate. (Docket A–93–02, Item V–B–22)

Several commenters had concerns about EPA's Fluid Injection Analysis, including its conclusions that the geology and the current well construction practices near the WIPP are extremely different from the geology and well construction practices that occurred in the Hartman case. In contrast, other commenters stated that fluid injection is unlikely to occur near WIPP and current well construction practices in the area will prevent injection well leakage. Some commented that EPA's probability estimates for the chain of events that could lead to a blowout caused by fluid injection were overly optimistic and that the probability estimate ignores

or (3) water flooding to increase oil recovery. In the Delaware Basin, the fluid would most likely be brine.

[21] BRAGFLO predicts gas generation rates, brine and gas flow, and fracturing within the anhydrite marker beds in order to calculate the future of the repository.

experience with severe water flows in New Mexico.

The EPA concluded that current well construction practice makes it unlikely that there could be a well failure of the nature of the ''Hartman scenario'' that occurred in the Rhodes-Yates field outside the Delaware Basin. This is because regulatory requirements for drilling are much more rigorous near the WIPP than was the case at the Rhodes-Yates field at the time of the Hartman case. Also, the Agency reiterates that there are significant differences in the geology near the WIPP and in the Rhodes-Yates field where the Hartman case occurred, that should not be ignored. The vertical distance between the formation where brine would be injected for disposal and the formation where the repository is located is greater than the vertical distance that fluid is believed to have traveled in the Hartman case. This distance, and effects of friction, would make it more difficult for fluids to travel vertically upward at the WIPP than in the Hartman case. Interbeds near the WIPP site are more numerous and are likely to be thinner than in the Hartman case, thereby reducing the likelihood of flow between the repository and the WIPP boundary. The Agency concludes that the geology in the WIPP area will play an active role in reducing fluid movement, or in an extreme case, preventing a massive well blowout. (Docket A–93–02, Item V–B–22)

While EPA accepted DOE's argument that the fluid injection scenario can be screened out of the PA on the basis of low consequence, DOE presented supplemental information that also indicated that the probability of a catastrophic well failure would be low. The EPA's Fluid Injection Analysis for the proposed rule also examined the chain of events necessary to cause catastrophic failure for a well. The EPA estimated that the probability of this chain of events occurring for a given well in the vicinity of the WIPP was low'within the range of one in 56,889 to one in 667 million. (Docket A–93–02, Item III–B–22) These estimates of probability were intended to illustrate in this hypothetical failure scenario the chain of events that must all occur for an injection well to impact the WIPP. The commenters objected to the lowest probability estimate, but did not state which probabilities or assumptions in the chain of events that they believed EPA had incorrectly selected. The EPA notes that this estimate of low probability was only one of many reasons cited in the technical support document for EPA's proposed determination that fluid injection could be screened from the PA. (Docket A–93–02, Item III–B–22) After considering geologic information, well history and age, construction standards, and operating practices, the Agency concludes that reported water flows in the Salado Formation in other areas of New Mexico are not representative of conditions in the vicinity of the WIPP. (Docket A–93–02, Item V–B–22) Even if an injection event takes place, the predicted low consequence is sufficient reason to remove it from consideration in the PA.

One commenter stated that EPA should require DOE to revise its PA model to include the Hartman Scenario and perform another PA. In contrast, another commenter stated that fluid injection events will not impact repository performance, even with conservative assumptions, so fluid injection can be excluded from the PA. The Agency finds that:

- Commenters' modeling of fluid injection that predicted potential releases exceeding EPA standards was based upon unrealistic assumptions that would maximize releases.
- The EPA tried to replicate scenarios similar to the Hartman case using DOE's BRAGFLO model. Some results were similar in magnitude to modeling results presented by commenters, but not directly comparable.
- Modeling by DOE predicts that fluid injection will cause low flows that will not significantly impact the results of PA.
- Well construction procedures near the WIPP have changed due to regulatory requirements; therefore, it is unreasonable to assume that the same well procedures from the Hartman case will occur near the WIPP.
- There are significant geological differences between the WIPP site and the Rhodes-Yates field in the Hartman case.

For all of these reasons, EPA concludes that it is not necessary to repeat the PA using the scenario of fluid injection. (Docket A–93–02, Item V–B–22; Also, see Docket A–93–02, Item V–B–2, CARDs 23 and 32 for further discussion of fluid injection.)

A related issue raised by commenters was DOE's modeling of fractures in the anhydrite interbeds directly above the WIPP. Such fractures could allow injected brine to enter the repository, to dissolve waste, and to release radioactivity outside the WIPP. Commenters stated that DOE's model for anhydrite fracturing was inadequate to describe observed changes at the WIPP and was not based on sufficient experimental data. Some commenters stated that DOE's model significantly understates the length of fractures compared to another modeling technique, Linear Elastic Fracture Mechanics (''LEFM''). Shorter fractures would mean that contaminated brine does not travel as easily, which lessens releases.

The Agency disagrees that DOE's modeling of anhydrite fracturing is inadequate. The independent Conceptual Models Peer Review Panel found that the ''type of fracture propagation and dilation used in the conceptual model has been substantiated by in situ tests.'' The Panel also found that the conceptual model was adequate. (Docket A–93–02, Item II–G–1, Appendix PEER.1) The EPA finds that the mathematical ''porosity model'' used in the CCA PA adequately implements the conceptual model for anhydrite fracturing. This mathematical model used a combination of field test data at lower pressures and the theory of continuum mechanics at higher pressures.

Some features of LEFM are not appropriate for representing the anhydrite interbeds. LEFM predicts that a single, long fracture hundreds of feet long will be created in a homogeneous medium. The Agency finds that this approach is inappropriate for the anhydrite interbeds in the Salado at the WIPP, which already contain numerous small fractures. (Docket A–93–02, Item IV–G–34, Attachment 5; Item V–C–1, Section 194.23) Field tests found that fractures branched into a series of fractures following preexisting fractures or weaknesses near the injection hole, rather than producing a single, long-distance fracture. In the case of fluid injection, these fractures would store fluid, which would slow down and shorten further fractures. The pre-existing fractures will produce a fracture front, such as that modeled by BRAGFLO, rather than a single fracture radius, as modeled by an LEFM. Two studies cited by commenters as support for use of LEFM in fact question the applicability of LEFM to WIPP anhydrites and recommend that DOE consider alternative conceptual models. (e.g., Docket A–93–02, Item IV–G–38) The EPA concludes that BRAGFLO is more appropriate to use for WIPP than a pure linear elastic fracture mechanics model because there are pre-existing fractures in the anhydrite layers that must be accounted for in the conceptual model. The EPA finds that the conceptual model based on a single fracture is fundamentally flawed for application in WIPP anhydrites. The Agency also finds that the model incorporated in the PA is appropriate,

and that further modeling with revised computer codes is not necessary.

e. Potash Mining. Public comments raised concerns about DOE's estimates of the potash reserves in the vicinity of the WIPP and DOE's evaluation of the solution mining scenario. The primary effects that mining could have on the repository are opening existing fractures in the geologic formations above the WIPP and increasing hydraulic conductivity as a result of subsidence. These effects could change the flow and path of ground water through the Culebra dolomite.

Several commenters stated that DOE underestimated the amount of potash in the vicinity of the WIPP and therefore underestimated the impact that extracting the additional potash would have on the performance of the repository. In the CCA, DOE provided estimates of the mineable potash reserves both outside and within the WIPP Land Withdrawal Area. The compliance criteria require DOE to consider excavation mining of only those mineral resources which are extracted in the Delaware Basin. (§ 194.32(b)) Therefore, potash resources of a type or quality that are currently not mineable for either technological or economic reasons need not be addressed in DOE's analysis. The EPA determined, through an independent analysis, that the CCA appropriately represents the extent of currently mined resources, in accordance with the criteria. The EPA also determined that DOE appropriately considered the impact that such resources and excavation mining could have on the performance of the repository. (Docket A–93–02, Item V–B–2, CARD 32)

Additional comments were received on DOE's screening of solution mining from the PA. The DOE determined that solution mining of potash is not occurring in the vicinity of the WIPP and can be omitted from the PA based on the regulatory requirement that only currently occurring (or near-future) practices be considered in the PA. (§ 194.32(c)) The EPA agrees with DOE that solution mining is not a current practice and can be omitted from the PA on regulatory grounds.

The DOE submitted supplemental information which related to the potential effects of solution mining for potash. (Docket A–93–02, Item II–I–31) The DOE concluded that the impacts of solution mining for potash would be the same as those for room and pillar mining, and that the potential subsidence-induced hydraulic effects in the Culebra would be similar to those for typical mining practices. Some comments disputed this conclusion, stating that the effects of solution mining on the repository would be substantially different than those from conventional mining and could cause the WIPP to exceed the containment requirements. After examining these comments, EPA concluded that the scenarios set forth in the comments were not realistic and that the commenter's conclusion was based on an extreme example of subsidence from solution mining. The EPA disagrees with the comments and concludes that subsidence in the vicinity of the WIPP would not vary significantly with solution mining compared to conventional mining.

The EPA concludes that solution mining for potash is appropriately omitted from the PA because it is not a current practice, and therefore, is not an activity expected to occur prior to or soon after disposal. As added assurance, the Agency also finds that even if solution mining of potash were to occur in the vicinity of the WIPP, the potential effects of such mining are consistent with those from conventional techniques and are therefore already accounted for in the PA. (Docket A–93–02, Item V–C–1, Section 8)

f. Carbon Dioxide Injection. Public comments raised concerns that carbon dioxide (CO_2) injection is a current drilling practice in the Delaware Basin that DOE inappropriately omitted from the PA calculations. Carbon dioxide flooding is the injection of CO_2 into an oil reservoir to improve recovery. CO_2 injection is typically used in tertiary recovery processes after the economic limits for waterflooding have been reached. When CO_2 is injected and mixing occurs, the viscosity of the crude oil in the reservoir is reduced. The CO_2 increases the bulk and relative permeability of the oil, and increases reservoir pressure so that the resulting mixture flows more readily toward the production wells. When CO_2 begins to appear at the producing well, it is typically recovered, cleaned of impurities, pressurized and re-injected.

The use of CO_2 flooding for enhanced oil recovery in west Texas and southern New Mexico began in 1972. In this area, most CO_2 injection activity is located on the Central Basin Platform and on the Northwest Shelf. A limited number of CO_2 flooding projects have occurred in the Texas portion of the Delaware Basin. Economy of scale, oil prices, proximity to CO_2 supply and reservoir heterogeneity are several of the controlling factors that strongly influence whether this technique is applied at a given well. (Docket A–93–02, Item V–C–1, Section 8)

In the CCA (Appendix SCR), DOE determined that CO_2 injection is not a current drilling practice in the Delaware Basin and therefore omitted it from consideration in the PA. For the proposed rule, EPA concurred with DOE that CO_2 injection was not a current practice. However, as a result of the public comments, EPA reviewed the issue and determined that CO_2 injection does occur in the Texas portion of the Delaware Basin. In responding to comments, EPA found no evidence of CO_2 injection practices in the New Mexico portion of the Delaware Basin. (Docket A–93–02, Item V–C–1, Section 8) All CO_2 injection projects found in New Mexico occurred outside the Delaware Basin. The EPA found that CO_2 injection has only limited potential for use around WIPP because of site-specific concerns related to reservoir size, proximity to existing pipelines and reservoir heterogeneity. However, because EPA confirmed that CO_2 injection is practiced in the Delaware Basin, EPA conducted an analysis of the consequences that CO_2 injection could have on the PA calculations.

In order to investigate the potential effect of CO_2 injection should it occur in the future, EPA conducted some bounding calculations. (Docket A–93–02, Item V–C–1, Section 8) Using numerous conservative assumptions, EPA estimated the rate of CO_2 flow through a hypothetical wellbore annulus into an anhydrite interbed at the depth of the WIPP repository. For example, grout in the wellbore annulus is expected to degrade only along portions of the wellbore; however, EPA assumed that such degradation would occur along the entire wellbore, thus providing a continuous pathway for CO_2 migration. Other conservative assumptions included a long time frame for injection, constant CO_2 pressures at the point of injection and at the intersection of the interbed with the borehole, and a high permeability in the interbed. The EPA's calculations also assumed that CO_2 would be injected into the Delaware Mountain Group below WIPP and readily migrate to Marker Bed 139, through which CO_2 is assumed to flow toward the repository. These assumptions increase the potential effect of the gas injection and therefore increase the predicted radionuclide releases that are calculated for the performance of the WIPP repository.

These simple but conservative calculations for a hypothetical CO_2 flood indicate that, even if it were to occur, CO_2 injection does not pose a threat to WIPP. For the very conservative assumptions specified in

this study, even for long periods of time, there is little potential for injected CO_2 to ever reach the repository. In summary, DOE determined that CO_2 injection was not a current drilling practice in the Delaware Basin and therefore screened it from the PA based on regulatory requirements. Based on public comments, EPA identified limited CO_2 injection activities in the Delaware Basin. The EPA conducted an analysis of the effects of CO_2 injection on the repository and found that CO_2 injection can be omitted from the PA because of the minimal consequences that would occur as a result of CO_2 injection.

g. Other Drilling Issues. A few public comments raised concerns about other human intrusion related scenarios. For example, some comments disagreed with the drilling rates that were set forth in the CCA. Other comments contended that natural gas storage exists in the Delaware Basin and should be considered in the PA.

Several public comments stated that the CCA did not provide drilling rates that are consistent with the extensive drilling throughout the area. The EPA required DOE to include the effects of drilling into a WIPP waste panel in the PA. The DOE was required to separately examine the rate of shallow and deep drilling. Shallow drilling is defined in § 194.2 as drilling events that do not reach a depth of 2,150 feet below the surface and therefore do not reach the depth of the WIPP repository. Deep drilling is defined in § 194.2 as drilling events that reach or exceed the depth of 2,150 feet and therefore reach or exceed the depth of the repository. Both types of drilling events include exploratory and developmental wells. (See Docket A–93–02, Item V–B–2, CARD 33 for further discussion of drilling rates.)

The EPA accepted DOE's finding that shallow drilling would not be of consequence to repository performance and was therefore not included in the PA. (Docket A–93–02, Item V–B–2, CARD 32, Section 32.G) The future rate of deep drilling was considered in DOE's PA. The deep drilling rate set forth in the CCA for the Delaware Basin is 46.775 boreholes per square kilometer per 10,000 years.

Several commenters suggested that DOE should use other, higher deep drilling rates in the PA. Comments stated that these higher rates, based on drilling over limited areas near the WIPP or on time periods shorter than 100 years (such as the last year or the last 50 years), would be more consistent with current drilling rates. The EPA's criteria require that the deep drilling rate be based on drilling in the Delaware Basin over the 100-year period immediately prior to the time that the compliance application is prepared. (§ 194.33(b)(3)) Although the drilling rate dictated by EPA's requirements may be lower than the current drilling rate, the use of a 100-year drilling rate more adequately reflects the actual drilling that may be expected to take place over the long term. (See Response to Comments for 40 CFR Part 194, Docket A–92–56, Item V–C–1, p. 12–11.) The future rate of deep drilling in the PA was set equal to the average rate at which that type of drilling has occurred in the Delaware Basin during the 100-year period immediately prior to the time that the compliance application was prepared. Commenters did not suggest that DOE had failed to include known drilling events or had calculated the rate inconsistently with EPA's requirements. Therefore, EPA finds that the approach taken by DOE meets the regulatory requirements set forth in § 194.33(b). (Docket A–93–02, Item V–B–2, CARD 33)

Natural gas storage facilities, in underground cavities, are known to exist in the Salado Formation outside the Delaware Basin. However, neither EPA nor DOE is aware of any natural gas storage in the Salado Formation of the Delaware Basin. Because there is no known gas storage in the Delaware Basin, DOE is permitted to omit it from the PA according to the requirements of § 194.32(c).

In addition to determining that there is no known gas storage in the Delaware Basin, EPA conducted an analysis of the effects that this activity would have on the repository. The EPA's analysis, presented in the response to comments, shows that natural gas storage would not affect the ability of the WIPP repository to successfully isolate waste because the migration potential of the gas would be minimal.

3. Geological Scenarios and Disposal System Characteristics

a. Introduction. 40 CFR 194.14(a) requires DOE to describe the natural and engineered features that may affect the performance of the disposal system. Among the features specifically required to be described are potential pathways for transport of waste to the accessible environment. This information is crucial to the conceptual models and computer modeling that is done to determine compliance with the containment requirements and the individual and ground-water protection requirements. In addition to a general understanding of the site, EPA required specific information on hydrologic characteristics with emphasis on brine pockets, anhydrite interbeds, and potential pathways for transport of waste. The EPA also required DOE to project how geophysical, hydrogeologic and geochemical conditions of the disposal system would change due to the presence of waste. Geology also relates to criteria at §§ 194.32 and 194.23, which require DOE to model processes which may affect the disposal system, and to use models that reasonably represent possible future states of the disposal system.

The EPA examined the CCA and the supplemental information provided by DOE and proposed to find that it contained an adequate description of the WIPP geology, geophysics, hydrogeology, hydrology and geochemistry of the WIPP disposal system and its vicinity, and how these conditions change over time. (62 FR 58798–58800) Several commenters suggested that the WIPP site geology and disposal system characteristics have been incorrectly assessed or inaccurately modeled. Commenters expressed concern with the WIPP site regarding Rustler recharge; dissolution, including karst; presence of brine in the Salado; use of two dimensional modeling with the BRAGFLO computer code instead of modeling the disposal system using a three-dimensional representation (2D/3D BRAGFLO), earthquakes, and the gas generation conceptual model. The EPA's response to these comments is discussed below.

b. WIPP Geology Overview. The WIPP is located in the Delaware Basin of New Mexico and Texas and is approximately 26 miles southeast of Carlsbad, New Mexico. This area of New Mexico is currently arid, but potential future precipitation increases were accounted for in the PA. The Delaware Basin contains thick sedimentary deposits (over 15,000 feet, or 4572 meters, thick) that overlay metamorphic and igneous rock (1.1 to 1.5 billion years old). The WIPP repository is a mine constructed approximately 2,150 feet (655 meters) below ground surface in the Permian age (6200–250 million years old) Salado Formation, which is composed primarily of salt (halite).

The DOE considered the primary geologic units of concern to be (from below the repository to the surface): (1) the Castile Formation (''Castile''), consisting of anhydrite and halite with pressurized brine pockets found locally throughout the vicinity of the WIPP site; (2) the Salado Formation (''Salado''), consisting primarily of halite with some anhydrite interbeds and accessory minerals and approximately 2,000 feet (600 meters) thick; (3) the Rustler Formation (''Rustler''), containing salt,

anhydrite, clastics, and carbonates (primarily dolomite), with the Culebra dolomite member of the Rustler as the unit of most interest; and (4) the Dewey Lake Red Beds Formation (''Dewey Lake''), consisting of sandstone, siltstone and silty claystone. The geologic formations below these were included in the screening of features, events, and processes, but were not included in the PA calculations because they did not affect the performance of the disposal system. See CARD 32, Sections 32.A and 32.F, for a detailed discussion of screening of features, events, and processes. (Docket A–93–02, Item V–B–2)

c. Rustler Recharge. Numerous comments on the proposed rule were related to whether the Rustler Formation, primarily the Culebra dolomite member, would be recharged; that is, whether water will infiltrate through the soil and underlying rock and into the Culebra. Commenters linked high infiltration to the potential dissolution of the Culebra and other members of the Rustler, concluding that karst has been formed and contributes to ground water flow. Commenters claimed that the presence of karst features would render DOE's ground water flow models invalid. Site characterization data and DOE's ground water modeling indicate that infiltration is very low and limited, if any, dissolution is ongoing, contrary to commenters statements.

The DOE indicated that the units above the Salado (i.e., the Rustler, the Dewey Lake and the Santa Rosa) are classified as a single hydrostratigraphic unit (i.e., equivalent to a geologic unit but for ground water flow) for conceptual and computer modeling. The Rustler is of particular importance for WIPP because it contains the most transmissive units above the repository (i.e., has the highest potential rate of ground water flow). In particular, the Culebra dolomite member of the Rustler Formation is considered to be the primary ground water pathway for radionuclides because it has the fastest ground water flow in the Rustler Formation. The Culebra dolomite is conceptualized as a confined aquifer in which the water flowing in the Culebra is distinct from rock units above or below it and interacts very slowly with other rock units. 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. (Docket A–93–02, Item V–B–2, CARD 14, Sections 14.B.4 and 14.B.5) The DOE stated that the Culebra member conceptually acts as a ''drain'' for the units around it, but that it takes up to thousands of years for the Culebra to respond to changes in the environment. DOE's modeling indicates that the Culebra ground water is still responding to changes in precipitation from the latest ice age. DOE's explanation for the ground water flow in the units above the Salado is embodied in the ground water basin model which was introduced in Chapter 2 of the CCA. The EPA did not consider treatment of this issue in the CCA to be adequate and requested additional information. (Docket A–93–02, Item II–I–17) The DOE provided additional information in response to this request. (Docket A–93–02, Item II–I–31)

The ground water basin model, which simulates recharge passing slowly through the overlying strata before reaching the portion of the Culebra within the boundaries of the WIPP site recognizes the possibility of localized infiltration. (Docket A–93–02, Item V–B–2, CARD 23) The DOE included ground water recharge in its ground water basin modeling for the Culebra Member of the Rustler formation. The DOE also acknowledged the water-bearing capabilities of the Dewey Lake and considered this possibility in the PA evaluations. The DOE assumed that the water table would rise in response to increased recharge caused by up to twice the current site precipitation.

Essentially, DOE's conceptual model of flow in the Culebra assumes that the Culebra is a confined aquifer in which the flow slowly changes directions over time, depending on climatic conditions. The ground water basin model also accounts for the current ground water chemistry. Current geochemical conditions are the result of past climatic regimes and ground water responses to those changes; because the ground water chemistry is still adjusting to the current conditions, it does not reflect the current ground water flow direction in the Culebra. This new interpretation allows for limited but very slow vertical infiltration to the Culebra through overlying beds, although the primary source of ground water will be lateral flow from the north of the site. The EPA reviewed DOE's conceptualization of ground water flow and recharge, and believes that it provides a realistic representation of site conditions because it plausibly accounts for the inconsistencies in the current ground water flow directions and the geochemistry. The EPA examined this treatment of recharge in the PA modeling and determined it to be an appropriate approach that reasonably bounds and accounts for the impact of potential future recharge. (See Docket A–93–02, Item V–B–2, CARD 14, Sections 14.B.4 and 14.B.5; CARD 23, Section 2.4; and CARD 32, Section 32.F.4 for detailed discussions of hydrogeology.)

Commenters also stated that DOE's estimate of the age of ground water is based on an unreliable methodology and that the stable isotopic compositions of most samples of ground water from the Rustler Formation were found to be similar to the composition of other, verifiably young, ground water in the area. The age of the ground water is important because the ground water basin model is based on the assumption that the Rustler water is ''fossil'' water, having been recharged under climatic conditions significantly different from the present. Because the isotopic data can be interpreted differently, EPA examined the entire spectrum of data that could be used to assess infiltration rates, including DOE's ground water basin model, Carbon-14 data, and tritium data. Based on these data, EPA concluded that the ground water basin model provides a plausible description of ground water conditions in the Culebra. The EPA also points out that recent Carbon-14 data indicate that a minimum age of 13,000 years is appropriate for Culebra waters. Further, different geochemical zones in the WIPP are explained by differences in regional recharge and long residence time. (Docket A–93–02, Item II–I–31) The EPA examined all data pertaining to ground water flow in the Rustler, and believes the DOE's total conceptualization adequately described system behavior for the purposes of the PA.

d. Dissolution. In the CCA, DOE indicated that the major geologic process in the vicinity of the WIPP is dissolution. The DOE proposed that three principal dissolution mechanisms may occur in the Delaware Basin: lateral, deep and shallow. (Docket A–93–02, Item V–B–2, CARD 14, section 14.B.4) Deep dissolution refers to that at the base of or within the salt section along the Bell Canyon Castile Formation; lateral dissolution occurs within the geological units above the Salado (progressing eastward from Nash Draw); and shallow dissolution, including the development of karst and dissolution of fracture fill in Salado marker beds and the Rustler, would occur from surface-down infiltration of undersaturated water. Lateral, strata-bound dissolution can occur without shallow dissolution from above.

To the west, the slight dip in the beds has exposed the Salado to near-surface dissolution processes; however, DOE estimated that the dissolution front will not reach the WIPP site for hundreds of

thousands of years. Near-surface dissolution of evaporitic rocks (e.g., gypsum) has created karst topography west of the WIPP site, but DOE contended that karst processes do not appear to have affected the rocks within the WIPP site itself. The DOE indicated that while deep dissolution has occurred in the Delaware Basin, the process of deep dissolution would not occur at such a rate near the WIPP that it would impact the waste containment capabilities of the WIPP during the regulatory time period. The DOE concluded that the potential for significant fluid migration to occur through most of these pathways is low. However, DOE also concluded that fluid migration could occur within the Rustler and Salado anhydrite marker beds and included this possibility in PA calculations. In the proposed rule, EPA concluded that deep, lateral, and shallow dissolution (including karst features and breccia pipes) will not serve as significant potential radionuclide pathways and that the potential for significant fracture-fill dissolution during the regulatory time period is low. (Docket A–93–02, Item V–B–2, CARD 14, Section 14.B.5; Item V–B–3, Section B.3.t)

Comments on the proposed rule stated that shallow dissolution and karst features occur at WIPP and will affect its containment capabilities. The EPA does not agree with DOE's assertion that the distribution of salt in the Rustler is solely a depositional feature because Rustler transmissivity (which is related to fracture occurrence in the Rustler) corresponds somewhat to the occurrence of salt in the Rustler. This implies that some post-Rustler dissolution has occurred which impacts the fracturing in Rustler rocks. However, the evidence observed by EPA indicate many Rustler features were formed millions of years ago (e.g., the breccia zone in the exhaust shaft, or at WIPP–18, where anhydrite/clay-rich strata may be halite dissolution residues). Other Rustler features (e.g., salt distribution in the Rustler) could have occurred sometime after the Rustler was deposited, but there is no evidence to indicate that ongoing dissolution of soluble material in the Rustler or at the Rustler-Salado contact will modify the existing transmissivity to the extent that the results of PA will be affected. (Docket A–93–02, Item V–B–2, CARD 14, Section 14.B.5)

The EPA concurs that the presence of fractures and related fracture fill that could be attributed to dissolution or precipitation could significantly impact ground water transport in the Rustler. The DOE modeled the presence of fractures using a dual porosity model, and has accounted for permeability variability by developing transmissivity fields based upon measured field data which reflect the varying transmissivity values. This dual porosity conceptual model recognizes that fluid may flow through both the rock matrix and fractures at the site. The use of dual porosity assumes ground water flows through fractures, but allows solutes to diffuse into the matrix. The EPA concludes that while fractures are present in Rustler Formation units and slow vertical infiltration does occur, there is no evidence that indicates fractures are conduits for immediate dissolution of Rustler or Salado salts, or that pervasive infiltration and subsequent dissolution of the Salado Formation or Rustler is a rapid, ongoing occurrence at the WIPP site. Further, ground water quality differences between the more permeable units of the Rustler Formation support relative hydrologic isolation (i.e., the water in the Magenta member interacts very little with the water in the Culebra member), or at least they support very slow vertical infiltration that has not allowed for extensive geochemical mixing of ground waters in these units.

Many commenters suggested that WIPP cannot contain radionuclides because WIPP is in a region of karst (topography created by the dissolution of rock). Karst terrain typically exhibits cavernous flow, blind streams, and potential for channel development that would enhance fluid and contaminant migration. Numerous geologic investigations have been conducted in the vicinity and across the WIPP site to assess the occurrence of dissolution (karst) and the presence of dissolution-related features. The EPA reviewed information and comments submitted by DOE, stakeholders, and other members of the public regarding the occurrence and development of karst at the WIPP. (Docket A–93–02, Item V–B–2, CARD 14, section 14.B.5) The EPA acknowledges that karst terrain is present in the vicinity of the WIPP site boundary near the surface. Near-surface dissolution of evaporitic rocks (e.g., gypsum) have created karst topography west of the WIPP site. Nash Draw, which (at its closest to WIPP) is approximately one mile west of the WIPP site, is attributed to shallow dissolution and contains karst features. (Docket A–93–02, Item V–B–3, Section B.3.t) The EPA also recognizes the potential importance of karst development on fluid migration.

The EPA agrees that karst features occur in the WIPP area but concluded that karst features are not pervasive over the disposal system itself. The EPA examined hydrogeologic data (e.g., transmissivity and tracer tests) from DOE's wells at and near the WIPP site and found no evidence of cavernous ground water flow typical of karst terrain at the WIPP site. Similarly, a field investigation conducted by EPA during the summer of 1990 to assess the occurrence of karst features showed no evidence of significant karst features, such as large channels, dolines, sinkholes, or collapsed breccias (other than those at, for example, at WIPP–33 and Nash Draw) in the immediate WIPP vicinity. (55 FR 47714) Available data suggest that dissolution-related features occur in the immediate WIPP area (e.g., WIPP–33 west of the WIPP site), but these features are not pervasive and are not associated with any identified preferential ground water flow paths or anomalies at the WIPP site. (Docket A–93–02, Item V–B–2, CARD 14, Section 14.B.5) Therefore, the groundwater modeling in the PA is adequate.

Several commenters stated that poor Rustler Formation core recovery at WIPP indicates the presence of karst. The commenters state that fragmented core samples containing dissolution residues are a clear indication of unconsolidated or cavernous zones capable of transmitting water with little resistance. However, core recovery is related to rock strength, and does not necessarily have an association with local hydrologic conditions. In the case of WIPP, cores that were attempted through fractured material, including the Culebra, exhibited poor recoveries. The EPA agrees that fractured Rustler is ′present at test well H–3. However, EPA does not believe that the presence of fractured material in the Rustler indicates that karst processes are active. In fact, the development of fractures can occur for various reasons unrelated to dissolution (e.g., removal of overlying rock due to erosion). The DOE recognized the presence of fractures within the Culebra, and included this dual porosity system in the PA modeling. In addition, core loss is a common occurrence in the drilling of all kinds of rocks, sometimes associated with fracture and other causes related to drilling technology, as well as the occurrence of soft or incompetent rock. The EPA concludes that to interpret all zones of lost core as zones of karst is inappropriate, as other rock features contribute to core loss which have nothing to do with cavernous porosity.

The EPA reviewed information pertinent to the potential development of karst in the WIPP area and believes that the near continuous presence of the more than half-million year old

Mescalero Caliche over the WIPP site is a critical indicator that recharge from the ground surface to the bedrock hydrologic regime has not been sufficient to dissolve the caliche at the site. If active dissolution of the evaporites in the subsurface were occurring in the WIPP area, it would be expected that collapse features would be evident in the Mescalero above the area where the dissolution is, or has occurred. As noted above, EPA has found no evidence of direct precipitation-related flow increases typical of karst terrain, and no field evidence of large channels or other karst features. The relative pervasiveness of the Mescalero Caliche over a long period of time is also an indication that there has been an arid climate and very low recharge conditions over a long period of time at the WIPP site. This, combined with DOE's near-future precipitation assumptions, led EPA to conclude that karst feature development will neither be pervasive nor impact the containment capabilities of the WIPP during the 10,000 year regulatory period. (Docket A–93–02, Item V–B–2, CARD 14, Section 14.B.5; Item V–B–3, Section 3.B.t)

The EPA concludes that dissolution has occurred in the WIPP area outside of the WIPP site, as evidenced by karst features like Nash Draw. It is possible that dissolution has occurred at the WIPP site sometime in the distant past (i.e., millions of years ago for strata-bound features) associated with a geologic setting other than that currently present at WIPP; however dissolution in the Culebra is not an ongoing process at the WIPP site. Thus EPA finds that DOE's modeling (which assumes no karst within the WIPP site boundary) is consistent with existing borehole data and other geologic information.

e. Presence of Brine in the Salado. Numerous commenters stated the Salado Formation will be wet and that brine is weeping into the repository at a slow but significant rate, leading to a wet repository which will corrode the waste containers. This, the commenters stated, would invalidate the basic premises of the WIPP that dry salt beds would creep and encapsulate the waste canisters.

The EPA agrees that brine will enter the repository from the Salado Formation via anhydrite marker beds. The EPA also notes that the presence of brine within the Salado is a key element of the PA modeling; brine inflow is assumed to occur and the impact of brine inflow on gas generation is assessed. Brine is necessary for both of the processes that may cause gas generation: either drum corrosion or microbial respiration. If there is no inflow of brine into the repository, neither corrosion of iron drums nor survival of microbes would occur, so gas generation would not occur. Therefore, although the commenters correctly noted that initial WIPP studies did assume the salt to be ''dry,'' the presence of interstitial brine has long been recognized and is accounted for in the PA. (Docket A–93–02, Item V–B–2, CARD 14, Section 14.E.5; Item V–B–3, Section F.2)

In the CCA discussion of the gas generation conceptual model, DOE indicates that brine is expected to be present in the repository due to a natural inflow of brine. Corrosion of the waste containers, generation of gases resulting from waste corrosion and microbial degradation, and the effects of these processes on the disposal system components have been addressed in the DOE PA and the EPA-mandated PAVT. (Docket A–93–02, Item V–B–2, CARD 14, Section 14.D; Item V–B–2, CARD 23, Section 2.4; Item V–B–3, Section E.2) The DOE also considered that additional brine could be introduced to the waste area if a drilling event passed through the waste and subsequently hit a brine pocket. The presence of a pressurized brine pocket beneath WIPP was addressed in the PA under the Human Intrusion Scenarios whereby the reservoir is penetrated by a borehole and brine is subsequently released into and mixed with the waste and eventually discharged either into the Culebra or at the ground surface. The EPA concludes that DOE adequately considered the presence of brine in PA modeling because it included the possibility of encountering a brine pocket in its intrusion scenarios, and because the potential effects of brine on corrosion rates and gas generation were incorporated in PA models. For more information on brine pocket parameter values, see the subsequent discussion of Parameter Values in the Performance Assessment sections of this preamble.

f. Gas Generation Model. Some chemical reactions could occur in the WIPP because metal containers holding waste may corrode and waste made from organic materials such as rubber may decompose if water is available and if other conditions are conducive to such decomposition. The corrosion reaction would create hydrogen gas (H2). The decomposition of organic waste would create carbon dioxide ($_2$) and methane (CH_4). These gases would build up in the repository after it is sealed, increasing pressure inside the waste rooms.

The DOE developed a gas generation conceptual model to describe this situation. The Department's gas generation conceptual model incorporates the following basic premises:

- Gas is generated primarily by metal corrosion and microbial processes;
- Gas generation is closely linked to other processes;
- Gas generation from microbial processes will not always occur;
- High gas pressures in the repository can cause the Salado anhydrite interbeds to fracture; and
- High gas pressure is necessary before spalling and direct brine releases can begin.

The DOE performed experiments on gas generation rates for the 1992 PA and updated these experiments more recently. (Telander, M.R. and R.E. Westerman, 1997. ''Hydrogen Generation by Metal Corrosion in Simulated Waste Isolation Pilot Plant Environments,'' SAND96–2538; see Docket A–93–02, Item V–B–1.) The gas generation rates are important in The PA because build-up of high gas pressures increases the chance for releases if a drill bores into the repository.

During the public comment period, commenters questioned the gas generation rates used in the gas generation conceptual model. One commenter stated that calculated corrosion rates were too low because they are based upon long-term tests that show lower rates than short-term tests, they assume a high pH, and they include a minimum rate of zero, perhaps by assuming that salt crystallization will prevent corrosion. The commenter also stated that corrosion rates used in the model should account for the fact that direct contact with salt and backfill increases the rate. The commenter further stated that DOE seemed to use the observed data to set the upper limit of a distribution of corrosion rates, rather than the midpoint of such a distribution, which would systematically understate the corrosion rate because most values would be less than the values taken from DOE's observed data. Finally, the commenter stated that aluminum corrosion is as significant as corrosion of steel, and that it is likely to take place in the repository because CO_2 and iron will be present and will enhance aluminum corrosion.

The EPA examined DOE's studies on gas generation rates. The EPA disagrees that the assumptions of long-term rates, pH, and minimum corrosion rate are not well-founded. Since the results of the corrosion testing are used to develop a long-term hydrogen gas generation rate for the repository that applies over

hundreds of years, it is appropriate that DOE developed the rate based on hydrogen generation over a longer time (12 to 24 months) rather than for a shorter time. Data indicate that during the first few months of the test, the corrosion reaction had not yet stabilized at equilibrium, producing more hydrogen gas than would have been expected at equilibrium for the amount of iron present. (Docket A–93–02, Item II–G–1, CCA Reference #622) Therefore, the higher rate of gas generation observed in the short-term is unlikely to represent what happens in the repository over hundreds of years.

The DOE's assumption of high pH (about 10) is consistent with data on the use of magnesium oxide (MgO) backfill. Because DOE has committed to using MgO backfill in the repository in the CCA, EPA finds it reasonable to assume this pH in the repository. (See the preamble section ''Engineered Barriers'' for further discussion of MgO backfill.) Furthermore, even if the MgO were not fully effective and the pH were to drop from near 10 to between 7 and 8, the enhanced corrosion rate expected at that lower pH is already reflected in the probability distribution for the corrosion rate parameter. DOE's experimental data show that MgO backfill will function as assumed in the CCA. Therefore, EPA concludes that DOE considered the issue of pH and realistically incorporated it into the model.

The DOE took its minimum corrosion rate of zero from studies on steel corrosion rates when the steel is in a humid environment and also when steel is submerged in brine. The DOE found that virtually no corrosion occurred and no hydrogen gas was generated under humid conditions. Also, the studies show that the steel has an extremely low corrosion rate when it is submerged in brine at the higher pH expected in the WIPP. Some DOE studies also found that salt films may prevent corrosion, as the commenter mentioned. (Docket A–93–02, Item II–G–1, CCA Appendix MASS, Attachment MASS 8–2) Based on all these studies, EPA concludes that DOE's minimum corrosion rate is supported and appropriate.

The DOE assumed that the corrosion rates of steel submerged in brine were uniformly distributed from zero to 0.5 micrometers per year. The EPA believes that the bases for the parameter assumptions are adequately documented and the use of the particular parameter distribution is consistent with demonstrating the concept of reasonable expectation for the H_2 gas generation rates used in the CCA. However, EPA was concerned that the maximum corrosion rate value selected by DOE did not fully reflect other uncertainties. These uncertainties included the accelerated corrosion of steel in reactions with other materials such as backfill and aluminum. Data from DOE tests indicated that corrosion rates might be twice as high as those used in the PA. (Docket A–93–02, Item V–B–14) Thus, in the PAVT, EPA required DOE to double the maximum corrosion rate to assure that these other uncertainties were more fully reflected. (Docket A–93–02, Item II–G–28) (Doubling the corrosion rate would be expected to cause the gas generation rate to rise but not necessarily double, since other factors such as microbial degradation also influence gas generation.) This and other changes made in the PAVT showed that the repository remained in compliance with the standards.

The commenter correctly notes that the corrosion data from DOE's studies were used to set the upper limit of a uniform distribution of corrosion, rather than a mid-point. (Telander, M.R. and R.E. Westerman, 1997. See Docket A–93–02, Item V–B–1.) However, EPA does not agree that this practice would systematically understate the corrosion rate under the conditions expected to occur in the repository. The experimental rate was obtained under pH conditions substantially lower than those expected in the repository (i.e., 7.4 to 8.4 versus 9.2 to 9.9). The corrosion rate is expected to be at least an order of magnitude lower at the higher pH than at the pH expected in the repository in the presence of MgO. (Docket A–93–02, Item V–B–14) Therefore, the higher corrosion values (i.e., those based on the study) represent extreme conditions, rather than those expected in the repository, and the parameter range would account for all values that are likely to occur. In addition, as noted above, EPA required that the maximum corrosion rate be doubled in the PAVT to account for uncertainties in this parameter. The Agency believes that this addresses the concerns raised by the commenter.

The commenter notes that CO_2 and iron will enhance the corrosion of aluminum. Although EPA agrees this is true, the Agency believes it does not affect the results of the PA. Carbon dioxide reacts with MgO, so CO_2 will not be available to reduce the brine pH and to enhance corrosion. Second, accelerated corrosion of aluminum is not a significant factor in the WIPP's performance, since brine will be consumed in corrosion reactions and will lead to smaller direct brine releases. (This is also discussed in the following preamble section concerning two dimensional modeling of brine and gas flow.) The results of DOE's modeling show that iron is consistently left over after reacting with all available brine. (Docket A–93–02, Item II–G–7, Fig. 2.2.9) Based upon data on these reactions, the Agency concludes that enhanced corrosion of aluminum due to CO_2 and iron will not increase releases of radioactivity because brine will not be left over to go to the surface as direct brine releases. (Docket A–93–02, Item V–C–1)

g. Two-Dimensional Modeling of Brine and Gas Flow. The DOE modeled the flow of brine and gases within the repository in the BRAGFLO computer code. The DOE simplified this model by representing the repository as a space in two dimensions rather than in three dimensions, as it is in reality. The Department made this simplification in order to speed up computer calculations significantly. The DOE performed a screening analysis titled S1: Verification of 2D-Radial Flaring Using 3D Geometry to see if the two-dimensional BRAGFLO model would predict similar results to a three-dimensional model. (WPO #30840) In Appendix MASS, Attachment 4–1 of the CCA, DOE explained that the results of the screening analysis showed that a three-dimensional model would not give significantly different results from the two-dimensional model used in the PA. The EPA examined DOE's documentation to determine if the CCA complied with EPA's requirements for documentation of conceptual models and consideration of alternative conceptual models under §§ 194.23(a)(1) and (a)(2). The EPA reviewed the screening analysis and concluded in the proposal that DOE sufficiently documented its rationale and approach behind using a two-dimensional model for brine and gas flow in the repository. (62 FR 58808)

One commenter stated that DOE's screening analysis suggested that the two-dimensional (''2D'') BRAGFLO model might underestimate releases of radionuclides to the surface under higher gas pressures. The commenter stated that several three-dimensional (''3D'') BRAGFLO simulations of the repository should be performed using parameter values from the CCA PA. The recommended analysis would include calculations of direct brine releases (releases of brine contaminated with radioactive waste) and spallings (releases of solid waste pushed out of the repository under high pressure), and an assessment of how much brine would be consumed by chemical reactions. Another commenter stated that the screening analysis had been

misinterpreted because details of the assumptions used in the original screening analysis had not been considered. This commenter also stated that results of additional analysis submitted by DOE as comments showed that the two-dimensional BRAGFLO code used in the CCA PA results in a conservative estimate of the releases when compared to results from a three-dimensional code.

The EPA examined the screening analysis mentioned by the commenters. The Agency found that the divergence between the results of the two-dimensional and three-dimensional versions of BRAGFLO occurred only at very high (lithostatic [22]) pressures that would occur seldom if ever in the repository. (Docket A–93–02, Item V–C–1, Section 5) For simulations at the gas generation rates used in the CCA PA, the two-dimensional BRAGFLO code predicted greater brine inflows than the three-dimensional code. (Greater brine inflows could potentially lead to greater direct brine releases.)

The EPA also considered how much brine would be consumed in chemical reactions. One of DOE's studies showed that brine is consumed by corroding steel barrels and leaves behind at least 20 percent of the original steel at the end of 10,000 years for 99 percent of the sets of simulated conditions tested in the CCA PA. (Docket A–93–02, Item II–G–7, p. 2–12) Based on this study, EPA concluded that even if the 3D model predicted additional brine inflow (beyond that predicted in the current 2D model), this brine will simply be consumed in chemical reactions (i.e., corrosion of metal drums), and will not go to the surface as direct brine releases. In addition, the Agency looked at results of additional simulations that DOE conducted to compare BRAGFLO 2D and 3D results. (Docket A–93–02, Item IV–G–34, Attachment 1 and February 25, 1998, memorandum) DOE's results show that the use of a two dimensional representation does not result in an underestimate of direct brine release during human intrusion. In all cases investigated, the two dimensional simulations consistently predict either the same or higher repository pressures and brine saturations than their corresponding three-dimensional simulations, leading to larger releases. The Agency, therefore, concludes that the two-dimensional BRAGFLO code results in conservative estimates of releases from the repository compared to results from a three-dimensional model.

[22] Lithostatic pressure is the pressure exerted by overlying rock layers.

In addition, EPA found that DOE sufficiently documented its development of conceptual models and scenarios, including alternative conceptual models considered, in the CCA and additional documentation submitted to the Agency. Therefore, EPA finds DOE in compliance with the requirements of §§ 194.23(a)(1) and (a)(2) with respect to modeling of brine and gas flow.

h. Earthquakes. Several public comments raised concerns about the effect that earthquakes could have on the repository and the containment of waste. Several commenters refer to a recent (January 4, 1998) earthquake in New Mexico, over 100 miles from the WIPP site, as an indication of the weakness of the WIPP site for disposal purposes.

In the CCA, DOE examined seismicity as part of its features, events, and processes, analyses, and concluded earthquakes could be excluded from the PA calculations based on low consequences. This conclusion is drawn from a wealth of knowledge about the seismic activity and processes in the region, but is based primarily on the fact that the intensity of ground shaking (the primary cause of destruction from an earthquake) is significantly less underground than at the surface. In addition, the ductile nature of a salt deposit makes it deform differently than typical hard rocks, so the displacement due to rupture (if any) will be less. The EPA reviewed DOE's earthquake (seismic) scenario in the Technical Support Document for 194.14: Content of Compliance Application, Section IV.B.4.f. (Docket A–93–02, Item V–B–3) The EPA concurs with DOE's analysis, that the probability of a release of radionuclides from the repository due to the opening of fracture pathways caused by an earthquake is very small.

Many years of seismological monitoring, microseismal studies and geologic study demonstrate that there are no probable sources of large earthquakes at or near the WIPP site. (Docket A–93–02, Item II–G–1, Chapter 2.6) The only sources of significant earthquakes in the region lie far to the west of the site along the Rio Grande rift or to the south along major plate tectonic features in Mexico, although measurable earthquakes have occurred closer to the WIPP. (Docket A–93–02, Item II–G–1, Chapter 2 and Appendix SCR) Micro-earthquakes (magnitude 3.0 or smaller on the Richter scale), most of which are too small to be felt, or small, shallow teleseismal ground motion related to distant earthquakes are the only seismicity expected at the WIPP site during the very short period that the repository will persist as an underground opening. The EPA notes that the site of the January 4, 1998, earthquake is located in the Rio Grande Rift—over 100 miles east of WIPP—and seismic activity in that area, including the January 4, 1998 earthquake, was too small to have an impact at WIPP. Therefore, EPA finds that the effects of earthquakes need not be considered in performance assessments. (See Docket A–93–02, Item V–B–2, CARD 32, Section G)

i. Conclusion. The EPA finds that DOE adequately assessed the site characteristics for the purposes of the PA and use in comparison with EPA's radioactive waste disposal standards and WIPP compliance criteria. The results of EPA's review of the CCA and additional information provided by DOE is provided in CARDs 14, 23, 32 and 33. (Docket A–93–02, Item V–B–2)

4. Parameter Values

a. Introduction. Parameters are numerical values or ranges of numerical values used in the PA 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 parameter values are well-established physical constants, such as the Universal Gas Constant or atomic masses of radionuclides. Parameters also can be physical, chemical or geologic characteristics that DOE established by experimentation. The DOE has also assigned parameters to aspects of human intrusion scenarios, such as the diameter of a drill bit used to drill a borehole that might penetrate the repository.

Section 194.23(c)(4) requires detailed descriptions of data collection procedures, data reduction and analysis, and code input parameter development. Section 194.14(d) requires DOE to describe the input parameters to the PA and to discuss the basis for their selection. Section 194.14(a) requires DOE to describe the characteristics of the WIPP site, including the natural and engineered features that may affect the performance of the disposal system, which is part of the process of parameter development.

The Agency reviewed the CCA, parameter documentation, and record packages for approximately 1,600 parameters used as input values to the CCA PA calculations. The EPA further reviewed parameters record packages and documentation in detail for 465 parameters important to performance of the disposal system. The Agency selected parameters to review in depth based on the following criteria:

- Parameters that were likely to contribute significantly to releases or seemed to be poorly justified;
- Parameters that control various functions of the CCA PA computer codes that were likely to be important to calculations of releases and important to compliance with the containment requirements of § 191.13; and
- Other parameters EPA used to evaluate the overall quality of Sandia National Laboratory's (''SNL'') documentation traceability.

After its initial review, EPA found that DOE had a great deal of documentation available in the SNL Records Center supporting most of the parameters used in the CCA PA. However, EPA had some concerns about the completeness of the list of CCA PA parameters in the CCA and the SNL Records Center, the description and justification to support the development of some code input parameters, and the traceability of data reduction and analysis of parameter-related records. The Agency did not agree with the technical justification of some parameter values and probability distributions.

The Agency later required DOE to perform additional calculations in a Performance Assessment Verification Test (''PAVT'') in order to verify that the cumulative impact of all required and other corrections to input parameters, conceptual models, and computer codes used in the PA was not significant enough to necessitate a new PA. The EPA directed DOE to incorporate modified values or distributions for twenty-four parameters in the PAVT. (Docket A–93–02, Item II–I–27) The PAVT showed that the calculated releases may increase by up to three times from those in the original CCA PA, but that the WIPP is still an order of magnitude below the containment requirements in § 191.13. The DOE satisfied EPA's concerns about the parameters by incorporating EPA's changes to the parameter values and parameter distributions in the PAVT.

During the public comment period on the proposed rule, members of the public expressed concern about a few specific parameters used in the PAVT: distribution coefficients (K_d), the permeability of borehole plugs, the characteristics of a potential brine pocket, and the solubility of different actinide ions in brine. Commenters stated these particular parameters could have an especially great impact on releases, and therefore, on the results of the PA.

b. Distribution Coefficient (K_d). As the primary radionuclide pathway during an intrusion, the Culebra was the subject of many public comments, especially related to distribution coefficients [23] (K_d values). In DOE's conceptual model the Culebra is characterized as a fractured dolomite that has dual-porosity and acts to physically retard movement of contaminants. In a dual-porosity rock unit, ground water is believed to flow through the fractures, but water and contaminants can access the pore space within the rock matrix away from the fractures. Movement of water and contaminants into the pore space slows (retards) their respective forward movement. This physical retardation is necessary in order to have chemical retardation. In the process of chemical retardation, contaminants diffuse from the fractures into the pore space where they can adsorb onto the rock mass. This adsorption is described by distribution coefficients, or K_d values.

The CCA indicated that there were no contributions to total releases from the ground water pathway. (Docket A–93–02, Item II–G–1, Chapter 2) This was due to the limited amount of contaminated brine predicted to reach the Culebra and the fact that radionuclides adsorbed into the Culebra dolomite did not move with the ground water flow. That is, the movement of the radionuclides were retarded with respect to the ground water flow. The estimate of the extent of the retardation (i.e., the K_d value) was based on laboratory tests using crushed rocks and small columns of rock. (CCA, Docket A–93–02, Item II–G–1, Chapter 6)

The EPA reviewed DOE's K_d values in detail. (Docket A–93–02, Item V–B–4) Based upon the review of DOE's data, methodologies, and conclusions, EPA proposed that the K_d ranges suggested by DOE were sufficient for the PA. (62 FR 58799) The EPA also concluded that the laboratory tests were conducted appropriately and that the K_d values DOE derived from this testing are reasonable, given the experimental evidence, and sufficient for PA purposes. (Docket A–93–02, Item V–B–2, CARD 14, Section 14.B.5)

Commenters stated that DOE's experiments did not produce K_d values that are representative of conditions in the Culebra. The DOE data on actinide K_d values are derived directly from the results of a number of experiments (e.g., crushed rock, column tests) conducted with brine solutions that are representative of brines in the disposal system. The DOE used samples of the Culebra Dolomite and brine solutions that are considered to be representative of the field situation. These data were supplemented by experiments with other natural dolomites and column experiments, in which the effects of a field-realistic solid to solution ratio could be investigated. The laboratory-derived K_d values are expected to overestimate the mobilities of the actinides, making them reflective of upper bounds for predicting the maximum possible rates of actinide migration in the PA calculations. Therefore, it is reasonable to expect that the range of actinide K_d values obtained from the DOE experiments are inclusive of any scale-effects that might produce a different average K_d value than the experimental average in either the greater or lesser directions. Docket A–93–02, Item V–B–4, Section 4.4 presents EPA's analysis of field K_d testing.

The DOE's experimental results show that each of the actinides tested is adsorbed to the rock matrix to varying extents; hence, they will not migrate as fast as the overall rate of horizontal water flow (i.e., the actinides will be attenuated). These results are consistent with general theories of the adsorptive behavior of cationic solutes under alkaline pH conditions.

The EPA reviewed DOE's actinide K_d values and concluded that the population of K_d values determined in DOE experiments was not well-represented by a uniform distribution. The Agency recommended that a loguniform distribution be used in the PA calculations. In the PAVT, loguniform distributions for the actinide K_d values were used. (WPO# 47258; Docket No A–93–02, Item II–G–39) The results of PAVT still resulted in compliance with regulatory release limits. Therefore, EPA determined that the CCA PA was adequate for the purpose of determining compliance. (Docket A–93–02, Item V–B–4)

The DOE also performed bounding calculations using the minimum K_d values necessary to achieve compliance with EPA limits. The bounding estimates were obtained for plutonium (^{239}Pu) and americium (^{241}Am), which are critical actinides with respect to releases to the accessible environment. Results of DOE's bounding assumptions (whereby all other factors are set to the least favorable value) indicate that a K_d of 3 milliliter per gram (ml/g) is sufficient for compliance for ^{239}Pu and

[23] Dissolved waste migrating out of the disposal site would migrate as atoms with a positive electrical charge, or cations; these could be cation species such as Pu^{+4} or U^{+6}. When liquid such as brine carries the cations through sediment or rock, some of the cations become attached to the surface of these solids. Therefore, the cations travel more slowly than the liquid as a whole. The rate of advance of the cation as the liquid migrates can be described with a number called a retardation factor. Distribution coefficients, or K_d's, are used in calculating the retardation factor.

^{241}Am. Estimates based on typical CCA sample sets indicate that K_d values greater than 1 ml/g are sufficient for compliance. (A higher K_d value indicates greater retardation—or less movement—of radionuclides.) The K_d ranges determined from DOE column experiments, conducted since submission of the CCA, for ^{239}Pu and ^{241}Am are typically greater than 100 ml/g, thus inferring that K_d values used in the PA are more than sufficient to ensure compliance with EPA limits with respect to accessible environment release through the Culebra. For these reasons, the actinide K_d values developed by DOE are considered to be adequate for representing actinide mobilities in the PA calculations. (Docket A–93–02, Item V–B–2, CARD 14, Section 14.G.5)

The EPA reviewed and responded to the public comments on K_d values and finds the K_d values used in the PA are sufficient. Refer to EPA Technical Support Document for Section 194.14: Assessment of K_d Values Used in the CCA for EPA's detailed review. (Docket A–93–02, Item V–B–4)

c. Actinide Solubility. Actinide solubilities are used in the computer codes to calculate the actinide concentrations released from the repository. They are important because as radionuclides dissolve in brine, they are more easily released from the disposal system through direct brine release mechanisms. Commenters questioned the analysis of certain chemical conditions in the disposal system relating to backfill, ligands, uncertainty, and oxidation state analogy.

An important factor influencing actinide solubility is the magnesium oxide (MgO) backfill DOE proposed to emplace in the WIPP. The DOE indicated that MgO backfill emplaced with transuranic waste would mitigate the solubility-enhancing effects of carbon dioxide from waste degradation. The DOE proposed to emplace a large amount of MgO in and around waste drums in order to provide an additional factor of safety and thus account for uncertainties in the geochemical conditions that would affect CO_2 generation and MgO reactions.

Commenters stated that DOE has not shown the predicted MgO chemical processes will take place. The DOE provided documentation in the CCA and supplementary information that MgO can effectively reduce actinide solubility in the disposal system. While the conceptual model peer review panel initially rejected DOE's conceptualization of the Chemical Conditions Model, DOE provided additional information on MgO processes and the peer review panel later concluded that MgO processes will indeed take place as initially postulated by DOE. The EPA concluded that DOE's qualitative justification was sufficient to show that the emplacement of MgO backfill in the repository will help prevent or substantially delay the movement of radionuclides toward the accessible environment by helping to maintain alkaline conditions in the repository, which in turn favors lower actinide solubilities. Furthermore, DOE's bounding of pH levels to a narrow range greatly reduces the uncertainty associated with pH and actinide solubility in the PA. Refer to CARD 24, Section 24.B.6, and CARD 44 for further discussion of the effects of MgO. (Docket A–93–02, Item V–B–2)

The EPA received numerous comments regarding DOE's lack of a sensitivity analysis on the effects of organic ligands and that organic ligands other than ethylene diaminetetraacetic acid (''EDTA'') should have been considered. Organic ligands are important since they can increase more mobile fractions, i.e., can make more radionuclides available for transport. Organic chemicals are expected to be part of the waste, especially because many were used in the separation of actinides during chemical processing of nuclear materials. DOE's bounding calculations and incorporation of uncertainty ranges to represent actinide concentrations in the PA calculations indicate that organic ligands will have only a minor effect on the solubilities of actinide solids under the expected repository conditions. The EPA found, through independent calculations, that there is no substantive information that could be gained by conducting a sensitivity analysis on the effects of organic ligands or conducting the calculations with citrate rather than EDTA, since EDTA provides a conservative assessment of the effects of ligands on solubility of actinide solids. (Docket A–93–02, Item V–B–2, CARD 24, Section 24.E.5) The EPA agrees with the conclusions of the Waste Characterization Independent Review Panel ''that under the conditions of MgO backfill, chelating agents (e.g., organic ligands) will have a negligible effect on repository performance. The Panel notes that, even at the basic pH in the repository, the availability of transition metals may be enhanced due to the formation of soluble halo complexes, making an even stronger case that base metals control ligand chemistry.''

Commenters also expressed concern about the solubility uncertainty range used in the PA computer codes. The DOE determined that the available experimental data for the oxidation state +IV actinides (i.e., plutonium, uranium, and neptunium) were insufficient for making such comparisons. However, the experimental procedures for determining the solubilities of +IV actinide solids are not substantially different from those used to determine the solubilities of +III and +V actinide solids. Therefore, EPA concluded that the uncertainties determined for the +III and +V actinide solids would be inclusive of those that would be obtained for +IV actinide solids, which are based on experimental measurements of thorium oxide. This expectation is based on the fact that DOE used the outermost limits of the differences between model results and experimental results for all data examined to define the breadth of the uncertainty limits. This procedure greatly expands the size of the uncertainty bounds beyond what might be calculated from statistical treatment of the distribution of the differences. (Docket A–93–02, Item V–B–2, CARD 24, Section 24.B.6; and Item V–B–17) The EPA therefore finds that the uncertainty bounds on actinide solubility are adequate for use in the PA.

Finally, commenters raised issues regarding the limitations of the oxidation state analogy in the Actinide Source Term Dissolved Species Model. In short, the actinide oxidation analogy means that actinides of the same oxidation state tend to have similar chemical properties under similar conditions. The oxidation state analogy is based on standard inorganic chemistry principles. This generalization can be made because chemical reactions involving ionic species are related primarily to the charge densities of the reacting species. Actinides with the same oxidation state have the same core electronic structure; hence they have similar ionic radii and charge densities, which in turn leads to analogous chemical behavior in solubility and aqueous speciation reactions. In addition to the theoretical basis, DOE conducted experimental studies that confirmed the validity of the oxidation state analogy, and subsequently employed it in its representation of the solubilities of actinides. The EPA finds that the actinide oxidation state is adequate for use in the PA. (Docket A–93–02, Item V–B–2, CARD 24, Section 2.B.6)

For details regarding chemical reactions of MgO, see CARD 24 (Waste Characterization) and CARD 44 (Engineered Barriers). For further

information regarding the PA modeling of solubility and chemical conditions in the repository, see CARD 23 (Models and Computer Codes). CARDs can be found in Docket A–93–02, Item V–B–2.

d. Brine Pockets. The Castile Formation lies underneath the Salado Formation, where the WIPP is located. This stratum contains pockets of brine under pressure. One of the parameters in the PA that commenters believed to be important is the probability that a driller will hit a brine pocket in the Castile. The CCA PA models the possibility that a drill bit could penetrate a brine pocket in the Castile Formation, allowing brine to rise up the borehole and into the repository. The brine could then dissolve radioactive waste and could carry it to the earth's surface if another driller bored a hole into the repository. This could increase the amount of radioactive waste reaching the accessible environment.

Some commenters expressed concern that brine from brine pockets in the Castile Formation could travel up to the level of the repository, or even to the earth's surface. The EPA believes that this is not a problem unless the repository is disturbed by human intrusion. Because it is difficult for water to travel in the Salado and Castile formations (i.e., they have low permeability), there is no natural connection between a Castile brine pocket and the waste panel area under undisturbed conditions. These brines are also either saturated or nearly saturated with soluble minerals such as salt (halite), and thus, the brine in pockets will not dissolve the surrounding material. (Docket A–93–02, Item II–G–1, CCA Chapter 2, Table 2–5) However, in the case of a deep drilling intrusion that goes through a waste panel and into the Castile, it is possible that the driller will intercept brine in the Castile and create a pathway for Castile brine to flow into the repository and interact with the waste. The probability of human intrusion through the WIPP repository to an underlying Castile brine pocket is a key component of the PA.

The 1992 draft PA considered the probability of a driller hitting a brine pocket under the waste area with a range of 25 percent to 62 percent, based on geophysical work that suggested brine may be present. (Docket A–93–02, Item II–G–1, Reference #563) In the CCA PA, DOE assigned a probability of hitting a brine pocket of 8 percent, based upon a geostatistical analysis of oil and gas wells in the vicinity of WIPP. The Agency believed that the assigned probability was low, based upon data from one particular DOE study using the Time Domain Electromagnetic (''TDEM'') method. In addition, EPA found there was considerable uncertainty in this parameter. Therefore, in the PAVT the Agency required DOE to change the constant value of this parameter to a uniform probability distribution from 1 percent to 60 percent, based upon data in the TDEM study. (Docket A–93–02, Item II–I–27)

Many commenters questioned the use of a uniform distribution from 1 percent to 60 percent as the range for the probability of hitting a brine pocket that EPA specified be used in the PAVT. Some believed that EPA should require DOE to examine a probability of 100 percent for hitting a brine pocket, based upon data from DOE's WIPP–12 borehole, which suggested that a large reservoir of brine might lie in the Castile Formation under the WIPP Land Withdrawal Area. Others recommended that EPA require DOE to repeat the PA assuming a constant probability of 60 percent.

The EPA carefully evaluated the potential occurrence of brine pockets below the WIPP. The EPA agrees that there is significant uncertainty concerning the existence of a brine pocket beneath the repository. For this reason, EPA required DOE to reevaluate the probability of hitting a brine pocket in the PAVT using a probability distribution rather than a constant value.

The EPA also considered the possibility that the brine pocket indicated by WIPP–12 data may underlie 100 percent of the repository. Based on reservoir volume and thickness data from WIPP–12, commenters found that a cylindrically-shaped reservoir could underlie the entire repository. However, EPA considers this unlikely because brine in the Castile does not reside in homogeneous and well-defined reservoirs. Instead, it is believed to reside in vertical or subvertical fracture systems, which may be extensive and contain significant volumes of brine. (Docket A–93–02, Item II–G–1, Appendix MASS, Attachment 18–6) Although EPA agrees that part of the WIPP–12 reservoir may underlie part of the repository, the time-domain electromagnetic (''TDEM'') survey data do not support speculation of a 100% probability of an encounter. (Docket A–93–02, Item II–G–1, Chapter 2.2.1.2.2, Item V–B–3, section IV; Item V–B–14, Sections 4.1, 4.4, and 4.5) In addition, as pointed out by one of the commenters recommending a probability of 60 percent, some boreholes adjacent to brine-producing boreholes near the WIPP site are known to be dry. In view of the lack of support from the TDEM data and the other concerns expressed above, EPA concludes that available data do not support a 100 percent probability of hitting a brine pocket.

The EPA established its 1 percent to 60 percent range of probability for hitting a brine pocket based upon data from the TDEM survey. The Agency examined the data and found that the probability distributions for encountering brine under the WIPP varied widely, depending on whether or not one assumed that brine pockets exist below the bottom of the Anhydrite III layer near the top of the Castile Formation. Using the base of the anhydrite layer as the cutoff, EPA's simulations showed that the fraction of the excavated area of the repository underlain by brine varies from 1 to 6 percent of the excavated area. Using the base of the Castile as the cutoff, the fraction of the excavated area of the repository underlain by brine would range from about 35 to 58 percent. According to the 1992 WIPP PA, Castile Formation brines are generally found in the uppermost anhydrite layer (usually Anhydrite III), rather than all the way through the Castile. (Docket A–92–03, Item II–G–1, CCA Reference #563, Vol. 3, p. 5–4) If brine is confined to the upper (Anhydrite III) layer, which is the more probable case based on geologic information, the maximum fraction of the repository area underlain by brine is 6 percent. However, in order to examine the possible effects of the more conservative case, EPA chose to assume an equal probability that a driller would hit a brine pocket in either the upper Anhydrite III layer or the base of the Castile. Therefore, EPA used a probability range in the PAVT with a low value of 1 percent based on the upper anhydrite layer and the high value of 60 percent derived by rounding up the highest value from the TDEM survey. The EPA believes that existing information supports the range used in the PAVT as valid, and probably conservative, values for the probability of hitting a brine pocket.

The Agency also notes that a sensitivity analysis of the PA parameters submitted in comments showed that the final results of the PA were not significantly affected by increasing the probability of hitting a brine pocket. Even when the Castile brine encounter probability was increased to 100 percent'the highest possible probability'there was no significant difference between the resulting mean CCDF and the mean CCDF in the CCA, which was based upon a brine encounter probability of 8 percent.

(Docket A–93–02, Item IV–G–43) The EPA believes that 100 percent is an unrealistically high probability. The results of this study confirm that examining such a probability in more detail would provide little added information about the performance of the WIPP.

Commenters stated that the range of the compressibility of rock surrounding a Castile brine pocket used in the CCA PA was too wide. They also believed that the brine pocket volume values used in the PA were too small. Castile rock compressibility is one of several parameters that affects the volume of brine pockets in the Castile. This is important because a drill bit would be more likely to hit a large brine pocket than a small one.

The EPA agrees with commenters that DOE's parameters for rock compressibility in the Castile and representation of brine pocket size/volume in the CCA PA were not consistent with available information. The EPA also believes that the parameters of the Castile brine pockets are highly uncertain. In order to capture this uncertainty, the Agency believed it would be appropriate to sample from a range of parameter values, rather than to use a single estimate, as DOE did in the CCA PA. In the PAVT, EPA required DOE to use a range of possible brine pocket volumes. (WPO#41887. See Docket A–93–02, Item V–B–1. See also Docket A–93–02, Item V–B–14.) Changing the rock compressibility of the Castile and the Castile porosity effectively modified the sampled brine pocket volume to include, more representatively, the possibility of larger brine pocket volumes like those expected based on data from the WIPP–12 borehole. The EPA found that modification of these parameters in the PAVT did not result in releases that exceed EPA's containment standards. Based on these results, EPA has concluded that the CCA PA was adequate for the purpose of demonstrating compliance.

e. Permeability of Borehole Plugs. In the PA modeling, DOE assumed that people drilling for resources would follow standard practice and plug the boreholes left behind. As long as these borehole plugs remain intact, the pressure of gases generated from the waste will build up inside the repository. The more permeable the borehole plugs are, the more gas will be capable of escaping from the repository. This would reduce pressure in the repository and therefore would reduce the potential for releases of radioactivity through spallings or direct brine release from a future drilling event. In the CCA PA, DOE modeled a situation in which borehole plugs between the Castile and Bell Canyon Formations would remain impermeable, and most borehole plugs closer to the earth's surface would disintegrate after two hundred years and would become more permeable.

One commenter stated that the CCA does not model the gas buildup which would result from impermeable plugs. The EPA does not agree that the CCA does not model gas buildup. In the CCA PA and PAVT, gas pressure is allowed to build up in the undisturbed repository. Pressure would be released if a borehole is drilled into the repository. In some of the PA simulations, pressure builds up again, although not to undisturbed levels, after it is released during a borehole intrusion. (Docket A–93–02, Item II–G–7, Figure 3.3.1) However, EPA was concerned about DOE's assumption that a relatively small number of borehole plugs would have low permeability. In the CCA PA, DOE assumed that 98 percent of the boreholes would be plugged with either two or three plugs, where the top plug would degrade and become more permeable, and 2 percent of the boreholes were plugged with a single low permeability plug. The EPA was concerned that an assumption that only 2 percent of the boreholes had low permeability might not be conservative. Therefore, EPA required that the permeability range for borehole plugs in the PAVT be broadened to include lower values (at which gas will not escape at a significant rate). This parameter change ensured that the PAVT would more frequently incorporate low borehole permeability and gas pressure buildup for more simulations than in the CCA PA, providing a more conservative result.

Other commenters expressed concern that the borehole plug permeabilities used in the CCA PA and the PAVT were too high, and might underestimate releases of radioactive material from the WIPP. One commenter pointed out that EPA retained the permeability used by DOE as a high value and then added a range of permeabilities extending to lower values after the Agency rejected DOE's initial value as too high.

In the PAVT, EPA required that two changes be made regarding the permeability of the borehole plugs. First, the Agency required that the permeability of the intact plugs during the first two hundred years of the plug lifetime be treated as a variable or probability distribution rather than as a fixed parameter, with a range bounded by values found in the literature. The range of values included borehole plug permeabilities both higher and lower than the constant permeability used in the CCA. In addition, EPA required DOE to use a range of permeability values to represent the permeability of borehole plugs that have started to degrade. The upper end of the new range was the same permeability as that used in the CCA, but the lower end of the range was reduced by three orders of magnitude and the median was reduced by an order of magnitude. The Agency believed that the upper end of the range chosen by DOE, based upon the permeability of silty sand, was reasonable because an abandoned borehole plug could degrade to this type of debris over long periods of time. Since the permeability of the actual borehole fill material at some time well into the future is unknowable, the Agency believes that the use of data based on natural materials is a reasonable approach. However, the Agency was not satisfied with the rationale for the lower end of the range originally chosen by DOE. The EPA believes that there is some probability that the concrete borehole plugs will not degrade as assumed in the CCA PA. Consequently, in the PAVT, EPA set the lower end of the range at a permeability value consistent with intact concrete.

One commenter stated that DOE had not sufficiently accounted for uncertainty in the lifetime of a borehole plug before it degrades. (A borehole plug with a longer lifetime would take longer to become more permeable and would allow more gas to build up in the repository.) This commenter stated that DOE should perform additional calculations to investigate how borehole plug lifetimes could influence repository conditions and compliance with the containment requirements.

The EPA also initially had concerns that uncertainty about the lifetime of borehole plugs had not been sufficiently represented in the CCA PA. In order to reflect this uncertainty, the Agency required DOE to use a probability distribution of borehole plug permeabilities for intact plugs during the first two hundred years of their lifetime in the PAVT, rather than a constant value. The sampled range of permeabilities includes values representing the permeability of both intact (newer) plugs and disintegrating (older) plugs. Therefore, EPA believes that this change made in the PAVT adequately addresses the effects of uncertainty in borehole plug life.

5. Other Performance Assessment Issues

The EPA used many methods to analyze specific scenarios or characteristics that DOE included in the PA. Commenters had concerns about

these methods, since the soundness of EPA's conclusions would depend upon the soundness of the methods used to reach those conclusions. Commenters disagreed with aspects of a few types of analyses in particular: sensitivity analysis, and the PA verification test (''PAVT''). Sensitivity analysis is a computer modeling technique that examines whether results of computer modeling will change significantly if a particular parameter value is changed. The EPA's approach to sensitivity analysis is documented in EPA's Technical Support Document for Section 194.23: Sensitivity Analysis. (Docket A–93–02, V–B–13) The PAVT was a set of 300 simulations of additional performance assessment calculations required by EPA. The PAVT implemented DOE's PA modeling using the same sampling methods as the CCA PA, but incorporating parameter values that were selected by EPA. Because some commenters disagreed with DOE's approach to the PA and EPA's approach to its analysis, they recommended that the Agency require DOE to repeat the PA using different scenarios or characteristics of the WIPP and its surroundings; these issues are discussed in preceding sections of this preamble related to the PA.

a. Sensitivity Analysis. Computer modelers perform a sensitivity analysis for a parameter in a model to find out if results of modeling are sensitive to (significantly affected by) that parameter. If the results of modeling are not sensitive to the parameter, then the exact value of the parameter is not important to the results of modeling.

The compliance criteria require DOE to document the development of input parameters for the PA under §§ 194.14(d), 194.23(c)(4), and 194.34(b). As part of its parameter development, DOE conducted a sensitivity analysis of parameters used in the CCA PA. (Docket A–93–02, Item II–G–1, Appendix SA, Volume XVI) The EPA reviewed this and supplementary information that documents DOE sensitivity analysis of the parameters sampled in the PA. (Docket A–93–02, Item II–G–7) As the Agency continued in its review of the CCA and supporting documentation, EPA found that there were three categories of parameters not fully documented in the CCA documents or in the Sandia National Laboratory WIPP Records Center. These categories were: (1) parameters lacking supporting evidence; (2) parameters having data records that support values other than those selected by DOE; and (3) parameters that are not explicitly supported by the relevant data or information. The EPA expressed concern about 58 parameters of the 465 parameters that EPA reviewed in detail. (Docket A–93–02, Item II–I–17) For these 58 parameters, EPA evaluated whether changing the parameter values would have a significant impact on the results of computer modeling, primarily through the use of a sensitivity analysis. (Docket A–93–02, Item V–B–13) (Distribution coefficients, or Kd values, were examined in separate calculations and analyses conducted by EPA. (Docket A–93–02, Items V–B–4, V–B–7, and V–B–8)) In its sensitivity analysis, the Agency examined changes in output from the PA models' major submodels that calculate releases and solubility of actinides: BRAGFLO [24], BRAGFLO—DBR [25], CUTTINGS—S [26], SOURCE TERM [27], and CCDFGF [28]. The EPA found that 27 of the 58 parameters have a significant impact on the results of modeling and that 31 of the 58 parameters did not have a significant impact. Some of these parameters (both significant and insignificant to results) were subsequently determined to be adequately supported based on additional documentation provided by DOE or Sandia National Laboratory. (Docket A–93–02, Items II–I–25 and II–I–27) For parameters that might have an impact on the results of the PA and were found not to be adequately supported, EPA required DOE to perform a Performance Assessment Verification Test with revisions to the significant parameters.

Commenters stated that they had concerns about the submodel approach used in EPA's sensitivity analysis. One commenter stated that EPA had not justified this approach, beyond stating that it was ''a more sensitive method'' than examining the final results of the complete PA model. Another commenter stated that EPA had not shown that the submodel approach for testing sensitivity related in any particular way to the compliance demonstration with the containment requirements. This commenter also stated that EPA had not explained or justified why the analysis used the average of changes in the outputs of the submodels, and that averaging output changes might disguise the significance of a parameter value change if some outputs change in direct response and others change inversely.

The DOE's PA model uses almost 1600 parameters. Even an important parameter may change the final results of the PA by a relatively small percentage because so many parameters contribute to the final results. The different submodels contain far fewer parameters than the complete PA. Therefore, a change in any one parameter will cause a greater percentage change in the output from a submodel than in the final result of the entire PA modeling. It is for this reason that EPA chose to use submodels. This approach provided intermediate results that would be a more sensitive measure of reactions of a model to changes in input parameters than the resultant complementary cumulative distribution functions (''CCDFs'') used to determine compliance.

The submodel outputs that EPA analyzed for sensitivity included the outputs most closely linked with radionuclide release and the ability of the WIPP to meet EPA's containment requirements. Examples of submodel outputs are gas pressure in the repository; cumulative brine release into the Culebra dolomite; cumulative cavings release and cumulative spallings release to the earth's surface; and brine flow into the anhydrite interbeds away from the repository. If a parameter changes the submodel outputs significantly, it may have a significant impact on the final results of the PA; however, if a parameter does not change the submodel output significantly, then it cannot change the final results of the PA significantly. In addition, EPA notes that the nature of the testing—which included three model runs at low, average, and high parameter values—means that it is not practical to develop mean CCDFs. It would be necessary to run all of the PA codes for each parameter change a hundred times to create a single CCDF. Therefore, except for those parameters included in the CCDFGF code, it would have been extremely cumbersome and time-consuming to perform a sensitivity analysis on the final results of the PA.

The Agency disagrees that averaging the submodel outputs disguises the significance of a parameter value change

[24] BRAGFLO predicts gas generation rates, brine and gas flow, and fracturing within the anhydrite marker beds in order to predict the future state of the repository.

[25] BRAGFLO—DBR calculates the amount of waste that dissolves in brine and travels in the contaminated brine as a direct brine release.

[26] CUTTINGS—S predicts the volume of solid waste released from the repository because of human intrusion drilling. This includes releases from cavings (material that falls from the walls as a drill bit drills through), cuttings (material that is actually cut by a drill bit during drilling, including any waste), and spallings (releases of solids pushed up and out by gas pressure in the repository).

[27] SOURCE TERM calculates actinide solubilities within the repository. The solubility values are then used in the NUTS and PANEL codes to calculate the actinide concentrations in brine released from the repository.

[28] CCDFGF calculates the complementary, cumulative distribution functions (''CCDFs'') used to show compliance with EPA's containment requirements.

if some outputs change in direct response and others change inversely. The EPA used absolute values [29] of the percent changes in computing the average percent changes. If two parameters had inverse relationships, those relationships would not cancel each other out because the final results would be an average of the absolute values. Averaging of the percent changes in the key submodel outputs was a significant step only for the parameters in the BRAGFLO code, where average changes to output were developed based on 11 model outputs. The EPA averaged the results of these eleven outputs in order to give equal weight to each in determining the sensitivity of BRAGFLO parameters.

Several members of the public commented that most of the sensitivity analyses varied only one parameter, rather than varying several parameters at a time, which potentially could show a significant combined result. The EPA varied single parameters in most of the analyses to identify those parameters that were most important to the PA results. One of the problems with varying multiple parameters simultaneously is that it is difficult to determine which parameter (or parameters) led to the observed result. Analysis of groups of parameters requires the Agency to find that the entire group of parameters is sensitive or not sensitive. In addition, if some parameters in a group increase releases while others reduce releases, a group analysis may not detect actual sensitivity for individual parameters. This is because the sensitivity analysis typically looks at low, high, and average values for all parameters in the group simultaneously. Without examining the sensitivity of individual parameters, the analyst would not always know enough about the parameters to be able to predict the most extreme situation with the greatest consequences of releases. The ability to determine the significance of individual parameters is important because this allows one to improve the model's predictive capability by focusing resources on those parameters that are most sensitive and have the greatest impact on results. It is true that EPA did not perform a separate sensitivity analysis run on groups of parameters that it determined were insensitive through individual parameter tests. The Agency believes that this is not necessary because the cumulative calculated sensitivity of these insensitive parameters is so small compared to the sensitive parameters. For example, the sum of the percent changes for all 33 insensitive parameters in BRAGFLO together was 47 percent (ranging from 0 percent to 10 percent each), while the percent change for the individual sensitive parameters ranged from 101 percent to 103,611 percent each. (Docket A–93–02, Item V–B–13, Table 3.1–1) Therefore, EPA concluded that those parameters it found insensitive through analysis of individual parameters will not have a significant effect on results of the PA and do not need to be re-analyzed in groups.

In addition to performing its own sensitivity analysis on parameters, the Agency required DOE to complete a comprehensive recalculation of the entire PA in the Performance Assessment Verification Test (''PAVT''). The purpose of the PAVT was to perform a complete evaluation of the synergistic effects of changing important and questionable parameters on the outcome of the PA calculations. The results of the PAVT indicate that the calculated releases would increase when changes are made to the sensitive parameters identified by the Agency, but the revised results of the PA with these more conservative parameter values would still be an order of magnitude less than the containment requirements of 40 CFR 191.13.

A commenter stated that EPA's sensitivity analysis did not vary conceptual models. The Agency agrees that this is true. The objective of EPA's sensitivity analysis was to determine the importance of selected individual parameters and groups of parameters to the PA results. The purpose of a sensitivity analysis on conceptual models would be to determine if model results would change significantly using different assumptions or using alternative conceptual models. The EPA examined the conceptual models and alternatives, under §§ 194.23(a)(1) and (a)(2). As a result of this review, EPA required DOE to conduct a sensitivity analysis on Culebra transmissivity and to examine the assumption that the Culebra acts as a fully confined system as it pertains to hydrogeochemistry of the Culebra. (Docket A–93–02, Item II–I–17) The EPA found that the sensitivity analysis results supported DOE's treatment of Culebra transmissivity and treatment of the Culebra as a confined system because of the minimal impact on results when changing assumptions. (Docket A–93–02, Item II–I–31) In addition, the Conceptual Models Peer Review Panel reviewed the conceptual models, as required by §§ 194.27 and 194.23(a)(3)(v). The Agency finds that it is not necessary to perform further sensitivity analysis on conceptual models because both the Agency's and the Panel's reviews accomplished the purpose of evaluating the impact of using different assumptions or using alternative conceptual models. These reviews found all the conceptual models except the spallings model to be adequate for use in the PA, and concluded that the spallings values used in the CCA PA are reasonable for use in the PA. (Docket A–93–02, Item V–B–2, CARD 23, Section 7)

The EPA determined that DOE 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 quality assurance activities. The DOE also documented the probability distribution of these parameters, as required by § 194.34(b). The Agency analyzed parameter values used in the CCA, including DOE's documentation of the values and EPA's sensitivity analysis. The EPA also required DOE to change these parameter values in the PAVT and found that the WIPP is still an order of magnitude below the containment requirements in § 191.13. (For further discussion of values for several specific parameters, refer to the preceding preamble discussion, ''Parameter values.'' See also Docket A–93–02, Item V–B–2, CARD 23, Sections 8 and 9.) Therefore, the Agency determines that the CCA complies with §§ 194.14(d), 194.23(c)(4) and 194.34(b).

b. Performance Assessment Verification Test. The containment requirements at § 191.13 indicate that a disposal system is to be tested through a PA that predicts the likelihood of occurrence of all significant processes and events that may disturb the disposal system and affect its performance, and that predicts the ability of the disposal system to contain radionuclides. Section 191.13 requires that a disposal system be designed so that there is reasonable expectation that cumulative releases (1) have a probability of less than one in ten (0.1) of exceeding the calculated release limits, and (2) have no more than a one in one thousand (0.001) chance of exceeding ten times the calculated release limits.

In the process of reviewing the CCA, the Agency found problems with some computer codes and with documentation of parameter

[29] Absolute value is the magnitude of a number, without a positive or negative sign. For example, positive three and negative three both have an absolute value of three.

development. Commenters also voiced concerns about some parameters used in the CCA PA during the public comment period for the Advanced Notice of Proposed Rulemaking. The Conceptual Models Peer Review Panel initially found that one of the conceptual models used for the PA, the spallings conceptual model, was not adequate. The DOE itself found some problems with some of its codes, particularly concerning code stability. Because of these many concerns, the Agency required DOE to perform additional calculations in a Performance Assessment Verification Test (''PAVT'') in order to verify that the cumulative impact of all changes to input parameters, conceptual models, and computer codes used in the PA was not significant enough to necessitate a new PA. (PAVT, Docket A–93–02, Items II–G–26 and II–G–28) The PAVT used modified parameter values and ranges, selected by EPA, in DOE's PA model. Many of these parameter values were suggested by public comments. The PAVT results showed releases that were higher, on average, than DOE's original calculations in the CCA. However, the PAVT results were still well within the EPA release limits stated in 40 CFR 191.13.

During the public comment period on EPA's proposed certification decision for the WIPP, commenters raised several issues about the PAVT and about the PA in general. Some commenters stated that the PAVT incorporated extremely conservative ranges for 24 critical parameters, and that the PA in general was done in a conservative fashion. Other commenters stated that specific parameter values needed to be changed in order to make more conservative assumptions. In particular, the public mentioned parameters for actinide solubility, distribution coefficients (K_d), the probability of hitting a brine pocket, and the permeability of borehole plugs. (These parameters are discussed above.) Commenters also said that DOE needed to investigate possible human intrusion scenarios more thoroughly. Among the human intrusion scenarios commenters identified for further study were air drilling, fluid injection, CO_2 injection, and potash mining. Members of the public commented that DOE had incorrectly assessed geology of the WIPP site and the future state of the waste to go into the WIPP. They stated concerns about the potential for dissolution, for the recharge of ground water in the Rustler Formation with contaminated brine, for earthquakes, and for water entering the Salado layer and the modeling of gas generation and flow of brine and gas in the repository. Many commenters stated that the Agency should require DOE to run another PA using different assumptions about these topics.

The EPA initially had many of the same concerns as those mentioned by the public, particularly concerning parameters and human intrusion scenarios. As discussed in the above preamble sections on the PA, EPA questioned the values and distributions of many values of the parameters. The Agency even required DOE to revise some parameter values for the PAVT. The EPA also asked DOE to investigate fluid injection further. After receiving public comments, the Agency did independent work on the possible impacts of fluid injection and air drilling, as well as analysis of the likelihood of air drilling and CO_2 injection in the Delaware Basin. (Docket A–93–02, Item V–C–1, Sections 5 and 8) After reviewing the information available, the Agency concludes that DOE's PA incorporates the appropriate human intrusion scenarios and geologic and disposal system characteristics. The PAVT and additional analyses of intrusion scenarios by both DOE and EPA have adequately addressed concerns raised by commenters.

Based upon results of the CCA PA (as confirmed by the PAVT), EPA finds that the WIPP complies with the containment requirements by a comfortable margin, even when using more conservative parameter values that were changed significantly from those in the CCA PA. This modeling shows that the WIPP will contain waste safely under realistic scenarios, and even in many extreme cases. The EPA found that the scenarios and parameter changes suggested by commenters either had already been adequately addressed by DOE, were inappropriate for the Delaware Basin, would impact neither releases nor the results of the PA sufficiently to justify further analysis, or were not realistic. Therefore, the Agency concludes that no further PA is required to determine if the WIPP is safe or to make its certification decision.

Many comments were based on a philosophy that DOE should use an unrealistically conservative approach to the PA. For example, a commenter stated that air drilling should be incorporated in the PA at the most conservative rate predicted by DOE in the near future for the entire U.S., even if air drilling is not currently a standard practice in the Delaware Basin. Another commenter suggested using the most conservative value from the PAVT for the probability of hitting a brine pocket, even after the commenter's own sensitivity analysis showed that this parameter did not have a significant impact on WIPP compliance at still higher values. A different commenter stated that DOE and EPA should analyze actinide solubilities as if DOE were not adding MgO to reduce those solubilities, even though the Department has committed to adding MgO. The Agency found all of these suggestions to be inappropriate, either because they were unrealistic or because they required additional analysis when the change had already been demonstrated to have little or no impact on the PA results. The Agency believes that the PA should be a reasonable assessment with some conservative assumptions built in, rather than an assessment comprised entirely of unrealistic assumptions and worst-case scenarios. The disposal regulations at 40 CFR Part 191 require the PA to show there is a reasonable expectation that cumulative releases will meet the containment requirements. This philosophy is reflected elsewhere in EPA's requirements, such as in the requirement for the mean CCDF to comply with the containment requirement, rather than for every CCDF to comply. If unrealistically conservative assumptions were used in the PA, then results of the PA would not reflect reality and would not be a reasonable measure of the WIPP's capability to contain waste.

6. Conclusions

Section 194.23 sets forth specific requirements for the models and computer codes used to calculate the results of performance assessments (''PA'') and compliance assessments. In order for these calculations to be reliable, DOE must properly design and implement the computer codes used in the PA. To that end, § 194.23 requires DOE to provide documentation and descriptions of the PA models, progressing from conceptual models through development to mathematical and numerical models, and finally to their implementation in computer codes.

The CCA and supporting documents contain a complete and accurate description of each of the conceptual models used and the scenario construction methods used. The scenario construction descriptions include sufficient detail to understand the basis for selecting some scenarios and rejecting others and are adequate for use in the CCA PA calculations. Based on information provided in the CCA, together with supplementary information provided by DOE in response to specific EPA requests, EPA

concluded that DOE provided an adequate and complete description of alternative conceptual models seriously considered but not used in the CCA. The information on peer review in the CCA and in supplementary information demonstrates that all conceptual models have undergone peer review consistent with the requirements of § 194.27. Related issues discussed above in today's preamble include spallings, fluid injection, air drilling, CO_2 injection, and the gas generation conceptual model. The Agency determines that the DOE has demonstrated compliance with the requirements of §§ 194.23 (a)(1), (a)(2) and (a)(3)(v).

The Conceptual Models Peer Review Panel found all the conceptual models to reasonably represent possible future states of the repository and to be adequate for use in the PA except the spallings conceptual model. However, as discussed above in this preamble, additional modeling conducted by DOE, and additional data presented by DOE, provide a substantial basis for EPA to conclude that the results of the spallings model are adequate and useful for the purpose for which conceptual models are intended, i.e., to aid in the determination of whether the WIPP will comply with the disposal regulations during the regulatory time period. Public comments received on this issue are discussed above in the preamble section on spallings. Because the spallings model produces reasonable and conservative results, and because the Peer Review Panel found that all other conceptual models reasonably represent possible future states of the repository, EPA finds DOE in compliance with § 194.23(a)(3)(i).

Based on information contained in the CCA and supporting documentation for each code, EPA concludes that the mathematical models used to describe the conceptual models incorporate equations and boundary conditions which reasonably represent the mathematical formulation of the conceptual models. Some of the specific issues related to this criterion are in the section of the preamble entitled, ''Two-dimensional modeling of brine and gas flow.'' Based on the CCA and supplementary information provided by DOE, the Agency determines that DOE provided sufficient technical information to document the numerical models used in the CCA. Based on verification testing, EPA also determined that the computer codes accurately implement the numerical models and that the computer codes are free of coding errors and produce stable solutions. The DOE resolved coding error problems and stability problems identified in numerical models by completing code revisions and supplementary testing requested by the Agency. Therefore, the Agency concludes that DOE has demonstrated compliance with §§ 194.23(a)(3) (ii), (iii) and (iv).

Based on EPA audits and CCA review, EPA found that code documentation meets the quality assurance requirements of ASME NQA–2a–1990 addenda, part 2.7, to ASME NQA–2–1989 edition. Thus, the Agency finds that DOE complies with § 194.23(b).

Based on DOE's documentation for each code and supplementary information requested by EPA, the Agency found that DOE provided adequate documentation so that individuals knowledgeable in the subject matter have sufficient information to judge whether the codes are formulated on a sound theoretical foundation, and whether the code has been used properly in the PA. The EPA 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. The 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. The EPA finds that DOE did not use any software requiring licenses. Therefore, EPA determines that DOE has complied with the requirements of §§ 194.23(c) (1),(2),(3) and (5).

The EPA determined 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. The 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. Public comments regarding parameters are discussed above in the preamble in the section titled ''Parameter Values.'' The Agency finds that DOE has demonstrated compliance with the requirements of § 194.23(c) (4) and (6).

Because DOE provided EPA with ready access to the necessary tools to permit EPA to perform independent simulations using computer software and hardware employed in the CCA, EPA finds DOE in compliance with § 194.23(d).

Section 194.31 of the compliance criteria requires DOE to calculate release limits for radionuclides in the WIPP in accordance with 40 CFR Part 191, Appendix A. Release limits are to be calculated using the activity, in curies, from radioactive waste that will exist in the WIPP at the time of disposal. The CCA PA and the PAVT were calculated using release limits calculated according to Appendix A of 40 CFR Part 191 using DOE's projected inventory of waste radioactivity at the time of disposal. Therefore, EPA concludes that DOE has met the requirements of § 194.31.

Section 194.32 requires DOE to consider, in the PA, both natural and man-made processes and events which can have an effect on the disposal system. The EPA expected DOE to consider all features, events and processes (''FEPs'') that may have an effect on the disposal system, including both natural and human-initiated processes. The Department is not required to consider FEPs that have less than one change in 10,000 of occurring over 10,000 years.

The EPA concluded that the initial FEP list assembled by DOE was sufficiently comprehensive, in accordance with §§ 194.32(a) and (e)(1). Based on quantitative and qualitative assessments provided in the CCA and supporting documents, EPA concluded that DOE appropriately rejected those FEPs that exhibit low probability of occurrence during the regulatory period,

in accordance with § 194.32(d). In addition, EPA found DOE's inclusion of various scenarios in the PA to be reasonable and justified, and meets the requirement of § 194.32(e)(2). The DOE provided documentation and justification for eliminating those FEPs that were not included in the PA. In some cases (e.g., fluid injection, CO_2 injection, potash mining and dissolution), the CCA did not initially provide adequate justification or convincing arguments to eliminate FEPs from consideration in the PA. However, DOE provided supplemental information and analyses, which EPA determined was sufficient to demonstrate compliance with § 194.32(e)(3).

The EPA verified, through review of the CCA and supporting documents, that DOE included, in the PA, appropriate changes in the hydraulic conductivity values for the areas affected by mining. The area considered to be mined for potash in the controlled area is consistent with the requirement of § 194.32(b), that the mined area be based on mineral deposits of those resources currently extracted from the Delaware Basin. Thus, EPA finds that DOE complies with § 194.32(b).

In accordance with § 194.32(c), DOE considered the possibility of fluid injection, identified oil and gas exploration and exploitation, and water and potash exploration as the only near future human-initiated activities that need to be considered in the PA. The EPA's review of the CCA and supporting documents referenced in the CCA with respect to § 194.32(c), indicated that DOE adequately analyzed the possible effects of current and future potential activities on the disposal system. In response to concerns expressed by EPA and stakeholders, DOE conducted additional analyses and submitted follow-up information. In addition, EPA has performed its own analysis of fluid injection. Public comments concerning human intrusion FEPs are discussed in the preamble sections above titled, ''Fluid injection,'' ''Potash mining,'' and ''CO_2 injection.'' The collected information provided by DOE was adequate. Therefore, EPA concludes that DOE's analysis meets the requirements of § 194.32(c).

Section 194.33 requires DOE to make specific assumptions about future deep and shallow drilling in the Delaware Basin. The EPA found that the documentation in the CCA demonstrated that DOE thoroughly considered deep and shallow drilling activities and rates within the Delaware Basin in accordance with § 194.33 (a) and (b). The EPA found that DOE appropriately screened out shallow drilling from consideration in the PA. The EPA also found that DOE appropriately incorporated the assumptions and calculations for drilling into the PA as stipulated in §§ 194.33 (b) and (c). In accordance with § 194.33(c), DOE evaluated the consequences of drilling events assuming that drilling practices and technology remain consistent with practices in the Delaware Basin at the time the certification application was prepared. Public comments concerning this issue are discussed in the preamble section above titled, ''Air drilling.'' The EPA determined that the PA models did not incorporate the effects of techniques used for resource recovery, as allowed by § 194.33(d). The EPA further concludes that the drilling information in the CCA is consistent with available data. Therefore, the Agency finds DOE in compliance with the requirements of § 194.33.

Section 194.34 of the compliance criteria provides specific requirements for presenting the results of the PA for the WIPP. Section 194.34 requires DOE to use complementary cumulative distribution functions (''CCDFs'') to express the results of the PA. The Department also must document the development of probability distributions, and the computational techniques used for drawing random samples from these probability distributions, for any uncertain parameters used in the PA. The PA must include a statistically sufficient number of CCDFs. The CCA must display the full range of CCDFs generated. Finally, the CCA must demonstrate that the mean of the population of CCDFs meets the containment requirements of § 191.13 with at least a 95 percent level of statistical confidence.

The CCA presented the results of the PA in the form of CCDFs. The PA used Latin Hypercube Sampling to sample values randomly from probability distributions of uncertain parameters. Parameter values and their distributions were documented in the CCA and in Sandia National Laboratory's Records Center. The CCA presented the full range of the 300 CCDFs generated in the PA, as well as mean CCDF curves. The CCDFs showed that the mean CCDF curve met the containment requirements of § 191.13. Less than one percent of CCDF curves in the CCA PA exceeded one times the release limit, and no CCDF curves exceeded ten times the release limit. Based on these results, DOE concluded that the WIPP met EPA's requirements.

The EPA also examined the results of the PAVT in light of the requirements of § 194.34. The PAVT presented the results of the PA in CCDFs, and presented the complement of 300 CCDFs. DOE's documentation and EPA's separate analysis demonstrated that 300 CCDFs are sufficient, statistically speaking. The PAVT used the same random sampling technique of Latin Hypercube Sampling that the PA model used for the CCA PA. The DOE used parameter values assigned by EPA, as well as other parameter values and their distributions documented earlier for the CCA PA. The mean CCDF curve for the PAVT showed that releases were roughly three times those calculated in the CCA PA, but releases still met the containment requirements of § 191.13 by more than an order of magnitude at the required statistical confidence level. Less than ten percent of CCDF curves in the PAVT exceeded one times the release limit, and no CCDF curves exceeded ten times the release limit. The PAVT confirmed that the CCA PA was adequate for determining compliance. Therefore, EPA concludes that the CCA PA meets EPA's containment requirements and that DOE complies with the requirements of § 194.34.

C. General Requirements

1. Quality Assurance (§ 194.22)

Section 194.22 establishes quality assurance (''QA'') requirements for the WIPP. QA is a process for enhancing the reliability of technical data and analyses underlying DOE's CCA. Section 194.22 requires DOE to (a) establish and execute a QA program for all items and activities important to the containment of waste in the disposal system, (b) qualify data that were collected prior to implementation of the required QA program, (c) assess data for their quality characteristics, to the extent practicable, (d) demonstrate how data are qualified for their use, and (e) allow verification of the above measures through EPA inspections/audits. The DOE's QA program must adhere to specific Nuclear Quality Assurance (''NQA'') standards issued by the American Society of Mechanical Engineers (''ASME'').

The EPA assessed compliance with the QA requirements in two ways. First, EPA reviewed general QA information submitted by DOE in the CCA and reference documents. The EPA's second level of review consisted of visits to the WIPP site, as well as WIPP-related facilities, to perform independent audits and inspections to verify DOE's compliance with the QA requirements. The proper establishment and execution of a QA program is verified strictly by way of inspections and audits.

Therefore, EPA conducted audits to verify the proper execution of the QA program at DOE's Carlsbad Area Office (''CAO''), Sandia National Laboratories (''SNL''), and Westinghouse's Waste Isolation Division (''WID'') at the WIPP facility. The EPA auditors observed WIPP QA activities, interviewed WIPP personnel, and reviewed voluminous records required by the NQA standards, but not required to be submitted as part of the CCA.

Section 194.22(a)(1) requires DOE to adhere to a QA program that implements the requirements of the following: (1) ASME NQA–1–1989 edition; (2) ASME NQA–2a–1990 addenda, part 2.7, to ASME NQA–2–1989 edition; and (3) ASME NQA–3–1989 edition (excluding Section 2.1 (b) and (c), and Section 17.1). The EPA verified that DOE established these requirements in the Quality Assurance Program Document (''QAPD'') contained in the CCA. The QAPD is the documented QA program plan for the WIPP project, as a whole, to comply with the NQA requirements. The QAPD is implemented by DOE's CAO, which has the authority to audit all other organizations associated with waste disposal at the WIPP (such as WID, SNL and waste generator sites) to ensure that their lower-tier QA programs establish and implement the applicable requirements of the QAPD. The EPA audited DOE's QA program at CAO and determined that DOE properly adhered to a QA program that implements the NQA standards. Therefore, EPA finds DOE in compliance with § 194.22(a)(1).

Section 194.22(a)(2) requires DOE to include information in the CCA that demonstrates that the requisite QA program has been ''established and executed'' for a number of specific activities. Section 194.22(a)(2)(i) requires DOE to include information which demonstrates that the QA program has been established and executed for waste characterization activities and assumptions. In the CCA, DOE provided the QAPD, which is DOE's central QA document program plan that then must be incorporated into site-specific QA program plans. The DOE generator sites will prepare site certification Quality Assurance Plans (''QAPs'') that, together with Quality Assurance Project Plans (''QAPjPs''), will constitute site-specific QA program plans.[30] The EPA finds that the QAPD, as it applies to waste characterization, is in conformance with the NQA requirements and that DOE's QA organization can properly perform audits to internally check the QA programs of the waste generator sites. However, as discussed below, the Agency will verify the establishment and execution of site-specific QA programs.

The compliance criteria require that QA programs be established and executed specifically with respect to the use of process knowledge and a system of controls for waste characterization. (§§ 194.22(a)(2)(i) and 194.24(c)(3) through (5)) To accomplish this, waste generator site-specific QA programs and plans must be individually examined and approved by EPA to ensure adequate QA programs are in place before EPA allows individual waste generator sites to transport waste for disposal at the WIPP. Since waste characterization activities have not begun for most TRU waste generator sites and storage facilities, EPA has not yet evaluated the compliance of many site-specific QA plans and programs.

To date, one WIPP waste generator site, Los Alamos National Laboratory (''LANL''), has been approved by EPA to have established an adequate QA program plan and to have properly executed its QA program in accordance with the plan. Prior to approval of LANL's site-specific QA program, EPA conducted an audit of DOE's overall WIPP QA program and approved its capability to perform audits in accordance with the requirements of NQA–1. The EPA then inspected three DOE audits of LANL's QA program. Based on the results of the inspections, the EPA inspectors determined that the QA program had been properly executed at LANL.[31] Therefore, EPA finds that the requirements of § 194.22(a)(2)(i) have been met for waste characterization activities at LANL.

With respect to other waste generator sites, EPA will verify compliance with § 194.22(a)(2)(i) conditioned on separate, subsequent approvals from EPA that site-specific QA programs for waste characterization activities and assumptions have been established and executed in accordance with applicable NQA requirements at each waste generator site.

As waste generator facilities establish QA programs after LANL, EPA will assess their compliance with NQA requirements. The approval process for site-specific QA programs includes a **Federal Register** notice, public comment period, and on-site EPA audits or inspections to evaluate implementation. For further information on EPA's approval process, see Condition 2 and § 194.8. For further discussion of waste characterization programs and approval of the processes used to characterize waste streams from generator sites, see the discussion of § 194.24 below in this preamble.

Section 194.22(a)(2)(ii) requires DOE to include information which demonstrates that the QA program has been established and executed for environmental monitoring, monitoring of performance of the disposal system and sampling and analysis activities. Westinghouse's WID was responsible for establishing this requirement under the WID QAPD described in the CCA. The EPA conducted an audit of the WID and found that the requisite QA program had been established and executed for environmental monitoring, sampling and analysis activities. The EPA also finds that Chapter 5 of the CCA and referenced documents contain a satisfactory description of compliance with this section. Therefore, EPA finds the WIPP in compliance with § 194.22(a)(2)(ii).

Section 194.22(a)(2)(iii) requires DOE to include information which demonstrates that the QA program has been established and executed for field measurements of geologic factors, ground water, meteorologic, and topographic characteristics. WID is responsible for conducting field measurements of geologic factors, ground water, meteorologic and topographic characteristics. The EPA conducted an audit of the WID QA program and found it to be properly established and executed in accordance with the applicable NQA requirements. The EPA also finds that Chapter 5 of the CCA and referenced documents contain a satisfactory description of compliance with this section. Therefore, EPA finds DOE in compliance with § 194.22(a)(2)(iii).

[30] NQA–1 (Element II–2) requires that organizations responsible for activities affecting quality (in the case of the WIPP, affecting the containment of waste in the disposal system) must have documented QA programs in accordance with the applicable NQA requirements. The documentation for such programs is commonly referred to as a ''quality assurance program plan,'' or ''QAPP.'' For WIPP waste generator sites, the role of the QAPP is fulfilled by documents with other titles, such as the QAP and the QAPjP. The ''TRU QAPP'' referenced by DOE in the CCA is not a QAPP as described by the NQA standards; rather, it is a technical document that describes the quality control requirements and performance standards for characterization of TRU waste coming to the WIPP facility. The TRU QAPP is addressed more specifically in the preamble discussion of § 194.24, Waste Characterization.

[31] The terms ''audits'' and ''inspections'' are not synonymous. At waste generator sites, EPA may either conduct its own audits or inspect audits conducted by DOE. (The DOE–CAO conducts audits to evaluate waste characterization programs at waste generator sites.) The difference is that for an inspection, EPA's role is to review DOE's QA checks, and not actually conduct all of the checks itself.

Section 194.22(a)(2)(iv) requires DOE to include information to demonstrate that the QA program has been established and executed for computations, computer codes, models and methods used to demonstrate compliance with the disposal regulations. SNL and WID are responsible for computations and software items. The EPA reviewed information in the CCA and conducted audits of both SNL and WID QA programs. The Agency found that computer codes were documented in a manner that complies with the applicable NQA requirements, and that software QA procedures were implemented in accordance with ASME NQA–2a, part 2.7. The EPA also finds that Chapter 5 of the CCA and referenced documents contain a satisfactory description of compliance with this section. The EPA therefore finds that DOE complies with § 194.22(a)(2)(iv).

Section 194.22(a)(2)(v) requires DOE to include information which demonstrates that the QA program has been established and executed for procedures for implementation of expert judgment elicitation. CAO and CAO's Technical Assistance Contractor were responsible for developing the procedures for the expert elicitation that was conducted (after the publication of the CCA). The EPA found that the requirements of this regulation were met by the development and implementation of CAO Team Procedure 10.6 (Revision 0), CAO Team Plan for Expert Panel Elicitation (Revision 2), and CAO Technical Assistance Contractor Experimental Programs Desktop Instruction No.1 (Revision 1). The EPA finds DOE in compliance with § 194.22(a)(2)(v). The process of expert judgment elicitation is discussed in further detail in the section of this preamble related to § 194.26 of the compliance criteria.

Section 194.22(a)(2)(vi) requires DOE to include information which demonstrates that the QA program has been established and executed for design of the disposal system and actions taken to ensure compliance with the design specifications. Most of the WIPP's design was conducted before the EPA required a QA program. Design work for the repository sealing system was conducted under the SNL QA program. The QA procedures established and implemented by SNL and WID address the requirements of the NQA standards; design verification was accomplished by a combination of NQA–1 Supplement 3S–1 methods. The EPA audits of SNL and WID showed that the QA programs are properly established and executed. The EPA also finds that Chapter 5 of the CCA and referenced documents contain an adequate description of compliance with this section. Therefore, EPA finds DOE in compliance with § 194.22(a)(2)(vi).

Section 194.22(a)(2)(vii) requires DOE to include information which demonstrates that the QA program has been established and executed for the collection of data and information used to support compliance applications. SNL was responsible for this activity. SNL adequately addressed these requirements by implementing numerous QA procedures to ensure the quality of data and information collected in support of the WIPP. The EPA's audit of SNL concluded that the QA program is properly established and executed. Therefore, EPA finds DOE in compliance with § 194.22(a)(2)(vii).

Section 194.22(a)(2)(viii) requires DOE to include information which demonstrates that the QA program has been established for any other item or activity not listed above that is important to the containment of waste in the disposal system. The DOE has not identified any other item or activity important to waste isolation in the disposal system that require QA controls to be applied as described in the CAO QAPD. To date, the EPA has also not identified any other items or activities which require controls. The EPA audits determined that the QA organizations of CAO, WID, and SNL have sufficient authority, access to work areas, and organizational freedom to identify other items and activities affecting the quality of waste isolation. Therefore, EPA finds DOE in compliance with § 194.22(a)(2)(viii).

Section 194.22(b) requires DOE to include information which demonstrates that data and information collected prior to the implementation of the QA program required by § 194.22(a)(1) 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; corroborating data; confirmatory testing; or a QA program that is equivalent in effect to § 194.22(a)(1) ASME documents.

The EPA conducted two audits that traced new and existing data to their qualifying sources. The two audits found that equivalent QA programs and peer review had been properly applied to qualify existing data used in the PA. The EPA also concluded that the use of existing data from peer-reviewed technical journals was appropriate, since the level of such reviews was equivalent to NUREG–1297 peer reviews conducted by DOE. Therefore, EPA finds DOE in compliance with § 194.22(b). Furthermore, the Agency is approving the use of any one of the following three methods for qualification of existing data: (1) peer review, conducted in a manner that is compatible with NUREG–1297; (2) a QA 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); or (3) use of data from a peer-reviewed technical journal.

Sections 194.22(c)(1) through (5) require DOE to provide information which describes how all data used to support the compliance application have been assessed, to the extent practicable, for specific data quality characteristics (''DQCs''). In the CCA, DOE stated that in most cases it was not practicable to document DQCs for performance assessments, but asserted that the intent of DQCs was fulfilled by other QA programs and quality control measures.

The Agency agrees with DOE that it is not appropriate to apply DQCs retroactively to all of the parameters and existing data used in the PA, but believes that they can and should be applied to measured data (i.e., field monitoring and laboratory experiments) as they are developed and used. The EPA found that, because DOE deemed it impractical to apply DQCs in some instances, the CCA and supplementary information did not systematically or adequately address DOE's consideration of DQCs for measured data related to the PA. Therefore, EPA reviewed parameter records to determine whether DOE could in fact show that various data quality characteristics had been considered for measured data. The Agency reviewed additional materials, primarily data record packages at the SNL records center, to independently determine whether DQCs had been assessed for data used in the PA. The EPA found that for recent data (five to ten years old), DOE's experimental program plans in the data record packages generally addressed data quality in measured data, including accuracy, precision, representativeness, completeness, and comparability during measurement and collection.

For older existing data, EPA found less documentation of assessment of DQCs. However, laboratory notebooks'which provide first-hand documentation of measurement procedures and results'supporting data

record packages provided some information related to the quality of measurements (e.g., how well DOE's measured values compared with values found in peer-reviewed publications). Many existing data were also subject to peer review in order to qualify them for use in the CCA; EPA concluded that the peer review panels considered the use of DQCs in determining that such data were adequate. The EPA also agreed with DOE's argument in supplementary information that for most of the existing data, collection under a program equivalent to the NQA standards in § 194.22(a)(1) provided adequate evidence that the quality of data had been evaluated and controlled. Finally, EPA concurred with DOE's conclusion that the uncertainties in measured data reflected in DQCs have a small effect on compliance certainty, compared to other uncertainties in the PA (such as extrapolation of processes over 10,000 years).

The EPA found that data quality received considerable attention from peer reviewers and Independent Review Teams assembled by DOE, and was subject to NQA requirements as specified in the Quality Assurance Program Document (''QAPD''). Section § 194.22(a) requires DOE to implement NQA–3–1989 in its quality assurance program. NQA–3–1989 states, ''Planning shall establish provisions for data quality evaluation to assure data generated are valid, comparable, complete, representative, and of known precision and accuracy.'' This requirement was satisfactorily incorporated in the QAPD, which is the quality assurance ''master'' document that establishes QA requirements for all activities overseen by the DOE Carlsbad Area Office. The EPA determined by means of audits that DOE adequately implemented the requirements of the QAPD, and also determined that DOE adequately qualified existing data in accordance with Section § 194.22(b). (See Docket A–93–02, Item V–B–2, CARD 22, Sections 22.A.6 and 22.J.5.) Therefore, EPA finds that DOE's data qualification was sufficiently rigorous to account for the DQCs identified in the WIPP compliance criteria.

Based on its review of data record packages and the QAPD, the Agency finds that DOE has assessed DQCs, to the extent practicable, for data used in the CCA. The EPA thus finds that DOE complies with § 194.22(c). The Agency expects that DOE will assess DQCs for future waste characterization and monitoring activities.

Section 194.22(d) requires DOE to provide information which describes how all data are qualified for use. SNL generated a table providing information of how all data in the PA were qualified. The EPA audited the existing QA programs and determined that the data were qualified for use by independent and qualified personnel in accordance with NQA requirements. On this basis, EPA finds DOE in compliance with § 194.22(d).

Section 194.22(e) allows EPA to verify execution of QA programs through inspections, record reviews, and other measures. As discussed above, EPA has conducted numerous audits of DOE facilities, and intends to conduct future inspections of waste generator site-specific QA plans under its authority. The Agency also intends to conduct inspections or audits to confirmed DOE's continued adherence to QA requirements for which EPA is certifying compliance.

In summary, EPA finds DOE in compliance with the requirements of § 194.22 subject to the condition that EPA separately approve the establishment and execution of site-specific QA programs for waste characterization activities at waste generator sites. (See Condition 2 of the proposed Appendix A to 40 CFR Part 194.)

The EPA received many public comments on § 194.22, but the most significant issue identified by commenters was the lack of objective evidence in the CCA to justify meeting the requirements at § 194.22(a)(2). The comments posed the fundamental question of whether or not EPA could certify, based solely on information provided by DOE in the CCA, that DOE established and executed a QA program for the eight areas considered important to the containment of waste in the disposal system. In response to such concerns, EPA believes it is necessary to explain and clarify the verification of these QA requirements.

The CCA does not alone provide all the documentation to verify compliance with the requirement of § 194.22(a)(2). Section § 194.22(e) requires EPA to verify that DOE has established and executed a QA program for the areas indicated in § 194.22(a)(2). The ''objective evidence'' for determining whether or not a QA program has been established and executed exists at the WIPP-related facilities and generator sites, and is gathered in the field audits and inspections. The function of the audits and inspections is to gather objective evidence to determine compliance of the QA programs with the applicable NQA standards.

Several WIPP organizations are responsible for establishing and executing the activities and items listed in the eight areas of § 194.22(a)(2). The CCA states that DOE provides the overall QA program requirements for WIPP via the CAO QAPD. The CAO QAPD requirements are further supported and amplified by the next tier of QA program documents, which includes the SNL quality assurance procedures (SNL QAPs), the WID Quality Assurance Program Description, and the individual site quality assurance program plans (e.g., QAPjPs). More documentation is found in DOE, WID and SNL implementing procedures and QA records. For example, ''Corrective Action Reports'' and ''Audit Reports'' provide objective evidence of implementation of certain NQA elements. Therefore, EPA finds that sufficient information for compliance with § 194.22(a)(2)(ii)–(viii), and for QA program implementation for waste characterization activities at LANL (§ 194.22(a)(2)(i)) was provided in the CCA and supporting documents to the extent practical.

The EPA verified that QA programs were established in accordance with § 194.22 through the CAO QAPD and supporting documents. The EPA expected to find objective evidence of compliance or noncompliance with the QA requirements within the QA records and activities of the WIPP organizations, including CAO, SNL, and WID. In accordance with § 194.22(e), the Agency conducted audits of these WIPP organizations to verify the appropriate execution of QA programs. (Docket A–93–02; Items II–A–43, II–A–44, II–A–45, II–A–46, II–A–47, II–A–48, and II–A–49) Documentation of evidence of audits that verified the execution of the QA programs is found in EPA's audit reports. The EPA's audits of CAO, SNL, and WID covered all aspects of the programs including, but not limited to: the adoption of the requirements of § 194.22 through the CAO QAPD, quality assurance procedures (''QAPs''), reports from previous audits, surveillance reports, and corrective action reports (''CARs''). The audits assessed the adequacy and implementation of the SNL and WID quality assurance programs in accordance with the requirements of § 194.22(a)(1). For example, for § 194.22(a)(2)(iv), the ''computations, computer codes, models and methods used to demonstrate compliance with the disposal regulations,'' EPA conducted audits of the SNL and WID quality assurance programs for computations, computer codes, methods and models. For all of the other areas in § 194.22(a)(2), CARD 22 (Section 22.B) should be consulted for information and

citations to audit reports. (Docket A–93–02, Item V–B–2)

In summary, EPA certifies compliance with the eight areas in § 194.22(a)(2) through inspections and audits. Most of the evidence demonstrating compliance is found at the WIPP-related facilities and generator sites. Such evidence was unreasonable to include in the CCA due to the voluminous nature of the information.

2. Waste Characterization (§ 194.24)

Section 194.24, waste characterization, generally requires DOE to identify, quantify, and track the chemical, radiological and physical components of the waste destined for disposal at the WIPP that can influence disposal system performance.

Section 194.24(a) requires DOE to describe the chemical, radiological and physical composition of all existing and to-be-generated waste, including a list of waste components and their approximate quantities in the waste. The 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 contain information on the waste material parameters, or components, that could affect repository performance. For to-be-generated waste (65% of the total WIPP inventory), DOE extrapolated information from the existing waste streams to determine the future amount of waste. The EPA reviewed this information 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 finds DOE in compliance with § 194.24(a).

Section 194.24(b) requires DOE to analyze waste characteristics and waste components for their impact on disposal system performance. Waste components affect waste characteristics and are integral to disposal system performance. The DOE identified waste-related elements pertinent to the WIPP as part of its screening for features, events, and processes. The features, events, and processes used in the performance assessment (''PA'') served as the basis from which characteristics and associated components were identified and further analyzed. (For further information on features, events, and processes, see Docket A–93–02, Item V–B–2, CARD 32; and the above preamble sections related to the PA.)

The DOE concluded that six characteristics were expected to have a significant effect on disposal system performance and were used in the PA as parameters or in conceptual models: solubility, formation of colloidal suspensions containing radionuclides, gas generation, shear strength of waste, radioactivity of specific isotopes, and transuranic (''TRU'') activity at disposal. The DOE identified eight waste components influencing the six significant waste characteristics: ferrous metals, cellulose, radionuclide identification, radioactivity of isotopes, TRU activity of waste, solid waste components, sulfates, and nitrates. Finally, DOE provided a list of waste characteristics and components assessed, but determined not to be significant for various reasons such as negligible impact on the PA. The EPA found that DOE used a reasonable methodology to identify and assess waste characteristics and components. The analysis appropriately accounted for uncertainty and the quality of available information. Therefore, EPA finds DOE in compliance with requirements in § 194.24(b).

Section 194.24(c)(1) requires DOE to specify numeric limits on significant waste components and demonstrate that, for those component limits, the WIPP complies with the numeric requirements of §§ 194.34 and 194.55. Either upper or lower limits were established for components that must be controlled to ensure that the PA results comply with the containment requirements. The DOE explicitly included numeric limits, identified as fixed values with no associated uncertainty, for four waste components. Lower limits were established for (1) ferrous and (2) non-ferrous metals (not included in DOE's original list of components, but added later due to its binding effect on organic ligands); upper limits were established for (3) cellulosics and (4) free water (not included in DOE's original list of components, but added later due to its inclusion in the Waste Acceptance Criteria).

The three components related to radioactivity (radionuclide identification, radioactivity of isotopes, TRU activity of waste) were effectively limited by the inventory estimates used in the PA and the WIPP LWA fixed-value limits. Both the PA inventory estimates and the WIPP LWA fixed-value limits were included in the PA calculations through parameters closely related to these components, and the results demonstrated compliance with EPA's standards.

Explicit limits were not identified for solid waste, sulfates, and nitrates, even though DOE identified these as components significant to performance. For solid waste, EPA determined that in the PA, DOE took no credit for the potential gas-reducing effects of solid waste (i.e., assumed a lower limit of zero) and demonstrated that the WIPP would still comply. For nitrates and sulfates, EPA determined that these components would not significantly affect the behavior of the disposal system as long as cellulosics were limited. Thus, EPA concurred that it is unnecessary to specify limits for nitrates, sulfates, and solid waste.

The EPA finds DOE in compliance with § 194.24(c)(1). The EPA concurred with DOE that it was not necessary to provide estimates of uncertainty for waste limits, so long as the PA demonstrated compliance at the fixed limits. However, since DOE's waste limits do not address uncertainty, the Department must account for uncertainty in the quantification of waste components when tracking compliance with the waste limits. That is, the fixed waste limits essentially constitute an upper confidence level (in the case of limits on the maximum amount of a waste component) or a lower confidence level (in the case of limits on the minimum amount of a component) for measurements or estimates of waste components that must be tracked. The DOE must demonstrate that the characterized waste components, including associated uncertainty (i.e., margin of error), meet the fixed waste component limits.

Section 194.24(c)(2) requires DOE to identify and describe the methods used to quantify the limits of important waste components identified in § 194.24(b)(2). The DOE proposed to use non-destructive assay (''NDA''), non-destructive examination (''NDE''), and visual examination (''VE'') as the methods used to quantify various waste components. (See Docket A–93–02, Item V–B–2, CARD 24, Section 24.F.1 for further information about the methods.) The DOE described numerous NDA instrument systems and described the equipment and instrumentation found in NDE and VE facilities. The DOE also provided information about performance demonstration programs intended to show that data obtained by each method could meet data quality objectives established by DOE. The EPA found that these methods, when implemented appropriately, would be adequate to characterize the important waste components. Therefore, EPA finds DOE in compliance with § 194.24(c)(2).

Section 194.24(c)(3) requires DOE to demonstrate that the use of process

knowledge[32] to quantify components in waste for disposal conforms with the quality assurance (''QA'') requirements found in § 194.22. The DOE did not submit site-specific information on the process knowledge to be used at waste generator sites as part of the CCA. The EPA requires such information to conduct proper review of whether use of the process knowledge is appropriate and reliable. The DOE provided some information on its overall plans for using process knowledge in the CCA. The DOE did not, however, provide specific information on the use of process knowledge or Acceptable Knowledge (''AK''—hereafter only ''AK'' is used; process knowledge is a subset of acceptable knowledge) at any waste generator site in the CCA, nor did it provide information demonstrating establishment of the required QA programs.

After submission of the CCA, EPA subsequently received information regarding AK to be used at the Los Alamos National Laboratory (''LANL''). The EPA determined that DOE adequately described the use of AK for legacy debris waste at LANL. The EPA has confirmed establishment and execution of the required QA programs at that waste generator site through inspections. Therefore, EPA finds that DOE has demonstrated compliance with the § 194.24(c)(3) QA requirement for LANL. The EPA does not find, however, that DOE has adequately described the use of AK for any waste at LANL other than the legacy debris waste which can be characterized using the processes examined in EPA's inspection. (See Docket A–93–02, Item V–B–15 for further information on the conclusions of EPA's inspection. See Docket A–93–02, Item II–I–70 for a list of the items and processes inspected by EPA.) Furthermore, DOE has not demonstrated compliance with § 194.24(c)(3) for any other waste generator site. For any LANL waste streams using other characterization processes or any other waste generator site, before waste can be shipped to the WIPP, EPA must determine that the site has provided information on how AK will be used for waste characterization of the waste stream(s) proposed for disposal at the WIPP. Condition 3 of the final rule embodies this limitation. The site-specific use of process knowledge must conform with QA requirements, as addressed by Condition 2. (For further information on EPA's approval process, see § 194.8, ''Approval Process for Waste Shipment from Waste Generator Sites for Disposal at the WIPP.'')

Sections 194.24(c) (4) and (5) require DOE to demonstrate that a system of controls has been and will continue to be implemented to confirm that the waste components emplaced in the WIPP will not exceed the upper limit or fall below the lower limit calculated in accordance with § 194.24(c)(1) and that the system of controls conforms to the QA requirements specified in § 194.22. The DOE described a system of controls over waste characterization activities, such as the requirements of the TRU QA Program Plan (''TRU QAPP'') and the Waste Acceptance Criteria (''WAC''). The EPA found that the TRU QAPP established appropriate technical quality control and performance standards for sites to use in developing site-specific sampling plans. Further, DOE outlined two phases in waste characterization controls: (1) waste stream screening/verification (pre-shipment from waste generator site); and (2) waste shipment screening/verification (pre-receipt of waste at the WIPP). The tracking system for waste components against their upper and/or lower limits is found in the WIPP Waste Information System (''WWIS''). The EPA finds that the TRU QAPP, WAC, and WWIS are adequate to control important components of waste emplaced in the WIPP. The EPA audited DOE's QA programs at Carlsbad Area Office, Sandia National Laboratory and Westinghouse Waste Isolation Division and determined that DOE properly adhered to QA programs that implement the applicable Nuclear Quality Assurance standards and requirements. (See the preamble discussion of § 194.22, Quality Assurance, for further information.) However, in the CCA, DOE did not demonstrate that the WWIS is fully functional and did not provide information regarding the specific system of controls to be used at individual waste generator sites.

After submission of the CCA, EPA subsequently received information regarding the system of controls (including measurement techniques) to be used at LANL. The Agency confirmed through inspections that the system of controls—and in particular, the measurement techniques—is adequate to characterize waste and ensure compliance with the limits on waste components for some waste streams, and also confirmed that a QA program had been established and executed at LANL in conformance with Nuclear Quality Assurance requirements. Moreover, DOE demonstrated that the WWIS is functional with respect to LANL—i.e., that procedures are in place at LANL for adding information to the WWIS system, that information can be transmitted from LANL and incorporated into the central database, and that data in the WWIS database can be compiled to produce the types of reports described in the CCA for tracking compliance with the waste limits. At the same time, DOE demonstrated that the WWIS is functional with respect to the WIPP facility—i.e., that information incorporated into the central database can be retrieved at the WIPP and compiled to produce reports for tracking compliance with the waste limits. Therefore, EPA finds DOE in compliance with §§ 194.24(c)(4) and (5) for legacy debris waste at LANL. (Docket A–93–02, Items V–B–15 and V–B–2, CARD 24) The EPA's decision is limited to the waste that can be characterized using the systems and processes audited by DOE, inspected by EPA, and found to be adequately implemented at LANL.[33] The EPA does not find, however, that DOE has demonstrated compliance with § 194.24(c)(4) for any other waste stream at LANL, or with §§ 194.24(c)(4) and (5) at any other waste generator site.

For any LANL waste streams using other characterization processes or any other waste generator site, before waste can be shipped to the WIPP, EPA must determine that the site has implemented 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 paragraph (c) of § 194.24. The implementation of such a system of controls shall include a demonstration that the site has procedures in place for adding data to the 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

[32] Process knowledge refers to knowledge of waste characteristics derived from information on the materials or processes used to generate the waste. This information may include administrative, procurement, and quality control documentation associated with the generating process, or past sampling and analytic data. Usually, the major elements of process knowledge include information about the process used to generate the waste, material inputs to the process, and the time period during which the waste was generated.

[33] See Docket A–93–02, Item II–I–70 for a list of the systems and processes audited by DOE. See Docket A–93–02, Item II–I–51 for a description of the waste identifier and a discussion of the items and activities inspected by EPA. They include characterization methodologies and relevant procedures, such as that used for entering data into the WWIS database.

waste stream(s) proposed for disposal at the WIPP. Condition 3 prohibits DOE from shipping waste for disposal at WIPP until EPA has approved site-specific waste characterization programs and controls. The system of controls must also be implemented in accordance with the QA requirements of 40 CFR 194; see Condition 2. (For further information on EPA's approval process, see § 194.8, ''Approval Process for Waste Shipment from Waste Generator Sites for Disposal at the WIPP.'')

Section 194.24(d) requires DOE either to include a waste loading scheme which conforms to the waste loading conditions used in the PA and in compliance assessments, or to assume random placement of waste in the disposal system. The DOE elected to assume that radioactive waste would be emplaced in the WIPP in a random fashion. The DOE examined the possible effects of waste loading configurations on repository performance (specifically, releases from human intrusion scenarios) and concluded that the waste loading scheme would not affect releases. The DOE incorporated the assumption of random waste loading in its performance and compliance assessments (pursuant to §§ 194.32 and 194.54, respectively).

The EPA determined that, because the DOE had assumed random waste loading, a final waste loading plan was unnecessary. The EPA determined that, in the PA, DOE accurately modeled random placement of waste in the disposal system. Since EPA concurred with DOE that a final waste loading plan was unnecessary, DOE does not have to further comply with § 194.24(f), requiring DOE to conform with the waste loading conditions, if any, used in the PA and compliance assessment. Therefore, EPA finds that DOE complies with §§ 194.24(d) and (f).

Section 194.24(e) prohibits DOE from emplacing waste in the WIPP if its disposal would cause the waste component limits to be exceeded. Section 194.24(g) requires DOE to demonstrate that the total inventory emplaced in the WIPP will not exceed limitations on TRU waste described in the WIPP LWA. Specifically, the WIPP LWA defines limits for: surface dose rate for remote-handled (''RH'') TRU waste, total amount (in curies) of RH–TRU waste, and total capacity (by volume) of TRU waste to be disposed. (WIPP LWA, Section (7)(a)) In order to meet the §§ 194.24(e) and (g) limits, DOE intends to rely on the TRU QAPP, WAC, and a two-phase system of controls for waste characterization—pre-shipment (at waste generator sites) and pre-receipt (at the WIPP). The DOE stated that the WWIS will be used to track specific data related to each of the WIPP LWA limits; by generating routine WWIS reports, DOE will be able to determine compliance with the imposed limits. The WWIS will also be used to track information on each of the important waste components for which limits were established. The EPA finds that the WWIS is adequate to track adherence to the limits, and that the WWIS has been demonstrated to be fully functional at the WIPP facility; as discussed above, waste generator sites will demonstrate WWIS procedures before they can ship waste for disposal at the WIPP. Therefore, EPA finds DOE in compliance with §§ 194.24(e) and (g).

Section 194.24(h) allows EPA to conduct inspections and record reviews to verify compliance with the waste characterization requirements. As discussed above, EPA intends to monitor execution of waste characterization and QA programs at waste generator sites through inspections and record reviews.

In summary, EPA finds that DOE is in compliance with § 194.24, and that LANL has demonstrated compliance with §§ 194.24(c)(3) through (5) for legacy debris waste and may therefore ship TRU waste for disposal at the WIPP (as such shipments relate solely to compliance with EPA's disposal regulations; other applicable requirements or regulations still may need to be fulfilled before disposal may commence). The EPA's final determination of compliance is limited to the EPA's decision is limited to the legacy debris waste that can be characterized using the systems and processes audited by DOE, inspected by EPA, and found to be adequately implemented at LANL. It is important to note that EPA's LANL approval does not imply that DOE's internal certification processes can substitute for EPA's approval of waste generator sites or processes used to characterize waste stream(s)—including QA measures, use of process knowledge, and the system of controls (other than LANL's legacy debris waste approved in today's action). The EPA will inspect the individual certification process for each waste generator site and for one or more waste stream(s). (For further information on EPA's approval process, see § 194.8, ''Approval Process for Waste Shipment from Waste Generator Sites for Disposal at the WIPP.'')

The DOE may not ship other waste streams for emplacement at the WIPP until EPA determines that (1) DOE has provided adequate information on how process knowledge will be incorporated into waste characterization activities for a particular waste stream (or group of waste streams) at a generator site, and (2) DOE has demonstrated that the system of controls described in § 194.24(c)(4) and (5) has been established for the site. In particular, DOE must demonstrate that the WWIS system is functional for any waste generator site before waste may be shipped, and that the system of controls (including measurement techniques) can be implemented for each waste stream which DOE plans to dispose in the WIPP. As discussed in the preamble for § 194.22, DOE must also demonstrate that sites have established and executed the requisite QA programs described in §§ 194.22(a)(2)(i) and 194.24(c)(3) and (5).

The EPA received many public comments on § 194.24. The majority of the comments focused primarily on whether or not DOE could adequately characterize waste to be sent to the WIPP. In response to such concerns, EPA believes it is useful to explain and clarify the general process of waste characterization as required by § 194.24, and to describe the activities EPA expects to monitor for future waste characterization. First, § 194.24(a) requires DOE to describe the chemical, radiological, and physical composition of the wastes to be emplaced in the WIPP. Second, DOE must conduct an analysis that substantiates that: (1) all characteristics of the wastes which may influence containment in the repository have been identified and assessed (§ 194.24(b)(1)); (2) all components of the wastes which influence such waste characteristics have been identified and assessed (§ 194.24(b)(2)); and (3) any decision not to consider a waste characteristic or component on the basis that it will not significantly influence containment of the waste. (§ 194.24(b)(3)) Third, for each waste component identified as being significant, DOE is to specify a ''limiting value'' of the total inventory of such waste components to be emplaced in the repository. (§ 194.24(c)) Fourth, DOE must demonstrate that, for the total inventory of waste proposed to be emplaced in the disposal system, the WIPP will comply with the numeric requirements of §§ 194.34 and 194.55 for the upper and lower limiting values of the identified waste components. (§ 194.24(c)(1)) Fifth, DOE must identify and describe the methods used to quantify the limits of waste components. (§ 194.24(c)(2))

At this point, § 194.24 imposes requirements that shift the focus from information on, and assessment of, the total waste inventory to procedures for

characterization of the waste at individual waste generator sites and accurate assessment of the waste inventory. First, DOE must show that the AK used to quantify the waste components at the waste generator sites will conform with QA requirements of § 194.22. Then, to ensure that the generator sites ship only waste that conforms with the waste component limits, a system of controls must be implemented that tracks and measures the waste components destined for the WIPP. This system of controls must also comply with the QA requirements of § 194.22.

The approval process for site-specific waste characterization controls and QA programs includes a **Federal Register** notice, public comment period, and on-site EPA audits or inspections to evaluate implementation. (See Condition 2, Condition 3, and § 194.8.) Prior to an EPA audit or inspection, EPA expects to receive certain documents from DOE. To determine that the procedures used to characterize waste (e.g., measuring and testing, sample control, equipment assessments) are based on good technical practices, and the personnel are qualified to perform the task, EPA expects to receive the following general documents which conform with the requirements of § 194.22: Site-Specific Quality Assurance Program Plan (''QAPP'') and a report or reports from CAO's QA organization that verifies the establishment and implementation of the Nuclear Quality Assurance requirements identified in § 194.22.

Likewise, DOE will provide technical documents prior to an audit or inspection to verify the methods for characterizing, quantifying, and tracking waste. Such technical documents will include information on the use of both process knowledge and measurement methods for waste characterization. First, for measurement equipment such as NDA, NDE, and VE, DOE may provide information on measuring and testing, equipment assessments, sample control, data documentation, and software control. For AK, DOE may provide the AK package which provides information on the areas and buildings from which the waste stream was generated, the waste stream volume and time period of generation, the waste generating process described for each building, the process flow diagrams, and the material inputs or other information that identifies the chemical and radionuclide content of the waste stream and the physical waste form. In addition, the following supplemental information may be provided for AK records: process design documents, standard operating procedures, preliminary and final safety analysis reports and technical safety requirements, waste packaging logs, site databases, information from site personnel, standard industry information, previous analytical data relevant to the waste stream, material safety data sheets or other packaging information, sampling and analysis data from comparable or surrogate waste streams, and laboratory notebooks that detail the research processes and raw materials used in experiments.

The fundamental objective of EPA's review of DOE's waste characterization at waste generator sites is to ensure that the proposed system of controls can quantify and track both the radionuclides and the four waste component limits identified as important for the repository performance. Because DOE's defense missions varied at the sites, the waste generated and the methods to characterize waste vary accordingly. These variations in practices and methods result in the need to review two general areas: (1) AK packages and (2) the system of controls, including measurement methods and tracking procedures. Therefore, EPA finds that it is important to clarify what is entailed by both general areas.

Thirty-five percent of WIPP waste is currently classified as ''retrievably stored waste,'' which is TRU waste generated after the 1970's but before the implementation of the TRU Waste Characterization Quality Assurance Program Plan (''QAPP''). Retrievably stored waste containers will be classified into waste streams using acceptable knowledge.[34] All retrievably stored waste containers will be examined using radiography or visual examination to confirm the physical waste form (or ''Summary Category Group''), to verify the absence of prohibited items, and to determine the waste characterization techniques to be used. To confirm the results of radiography, a statistically selected number of the Contact-Handled Transuranic waste container population will be visually examined by opening the containers to inspect waste contents to verify the radiography results. If visual examination results for a drum conflict with the results of radiography, the drum and possibly the entire waste stream is reclassified, and a higher percentage of future drums will be required to undergo visual examination. Representativeness of containers selected for visual examination will be validated by reviewing documents that show that true random samples were collected. Repackaged retrievably stored waste may be handled as newly generated waste, with the Summary Category Group confirmed by using visual examination instead of radiography. Retrievably stored waste will be assayed using Non Destructive Assay (''NDA'')[35], and will undergo headspace-gas sampling and analysis for volatile organic compound concentrations.[36]

Sixty-five percent of all WIPP waste is to-be-generated TRU waste. To-be-generated waste characterization will begin with verification that processes generating the waste have operated within established written procedures. Waste containers will be classified into waste streams using acceptable knowledge. Hazardous and radioactive constituents in to-be-generated wastes will be documented and verified at the time of generation to provide acceptable knowledge for the waste stream.

Verifying that the physical form of the waste (Summary Category Group) corresponds to the physical form of the assigned waste stream is accomplished by visual examination during packaging of the waste into the drums. This process consists of operator confirmation that the waste is assigned to a waste stream that has the correct Summary Category Group for the waste being packaged into the drums. If confirmation cannot be made, corrective actions will be taken. A second operator, who is equally trained to the requirements of the WAC and TRU Waste Characterization QAPP, will provide additional verification by reviewing the contents of the waste

[34] AK is used by DOE to (1) delineate waste streams to facilitate further characterization; (2) identify radionuclide content as a basis for further radioassay (''NDA'') determinations, and identify the combustible and metal content to determine the radionuclide content as a basis for radiography and/or visual examination (''NDE/VE''); and (3) make hazardous waste determinations for wastes regulated under the Resource Conservation and Recovery Act.

[35] All waste containers will undergo NDA techniques to allow an item to be tested without altering its physical or chemical form. NDA techniques approved for use on WIPP containers can be classified as active or passive. Passive NDA methods measure spontaneously emitted radiations produced through radioactive decay of isotopes inside the waste containers. Active NDA methods measure radiations produced by artificially generated reactions in waste material.

[36] Results of head-space gas sampling and chemical analyses are compared with acceptable knowledge determinations to assess the accuracy of acceptable knowledge. Additional analysis of head-space gas for volatile organic compounds, and additional use of NDA, radiography, and other characterization methods may be employed to further characterize waste to meet regulations that apply to the hazardous (but not necessarily radioactive) portions of the WIPP waste. The requirements for hazardous waste are enforced by the State of New Mexico.

container to ensure correct reporting. If the second operator cannot provide concurrence, corrective actions will be taken. To-be-generated waste will not undergo radiography, as the waste will be identified by visual examination during packaging. All to-be-generated waste containers will undergo headspace-gas analysis for volatile organic compound and their concentrations, and NDA for radioisotopes and their activities.

Acceptable knowledge, visual examination during packing, NDA and headspace-gas sampling and analysis are used to further characterize homogeneous solids, soils/gravel, and debris waste. In addition, newly generated streams of such wastes will be randomly sampled a minimum of once per year and analyzed for total volatile and semi-volatile organic compounds and metals.

A system of controls is used to confirm that the total amount of each waste component that will be emplaced in the disposal system does not exceed the upper limiting value or fall below the lower limiting value for the component. The system of controls for WIPP waste has two phases for DOE's internal process. Phase I entails Waste Stream Screening and Verification, which will occur before waste is shipped to the WIPP, and is a three-step process. First, an initial audit of the site will be conducted by DOE's Carlsbad Area Office as part its audit program before the WIPP could begin the process of accepting waste from a site. The audit provides on-site verification of characterization procedures, data package preparation and recordkeeping. Second, the generator site personnel perform the waste characterization data package completeness/accuracy review and either accept or reject the data. Third, if the data are accepted, the site waste characterization data are transferred manually or electronically via the WWIS to the WIPP. At the WIPP, screening includes verification that all of the required elements of a waste characterization data package are present and that the data meet acceptance criteria required for compliance. Waste stream approval or rejection to ship to the WIPP is the outcome of Phase I.

Phase II includes examination of a waste shipment after it has arrived at the WIPP, and is a three-step process. First, upon receipt of a waste shipment, the WIPP personnel determine manifest completeness and sign the manifest before the driver may depart. Second, WIPP personnel determine waste shipment completeness by checking the bar-coded identification number found on each TRU waste container. The bar-coded identification number is noted and checked against the WWIS. The WWIS maintains waste container receipt and emplacement information. Third, waste shipment irregularities or discrepancies are identified and resolved. If there are discrepancies, the generator site is contacted for resolution. Finally, WIPP personnel compare the container identification number with a list of those approved for disposal at the WIPP. Waste shipment approval or rejection for disposal at the WIPP is the outcome of Phase II. (For further information on the system of controls, see Docket A–93–02, Item V–B–2, CARD 24, Section 24.H.2.)

In summary, all waste sent to WIPP will be appropriately and thoroughly characterized. First, the acceptable knowledge provides essential waste content information that later determines the waste categories. The AK process undergoes quality assurance checks to confirm good technical practices and qualified personnel. Then, the measurement techniques (NDA, NDE, VE) confirm the AK data, and further define the content and limits of the waste. Further confirmation of the accuracy of the waste characterization is provided by the extensive tracking system. Again, quality assurance checks are applied to the tracking and measurement controls. The waste characterization process, if implemented accordingly, provides complete and thorough characterization of the waste. The DOE has committed to implement this process. No waste generator site will be allowed to ship proposed waste streams to the WIPP until the waste characterization process detailed above is met at that generator site for the given waste stream(s).

3. Future State Assumptions (§ 194.25)

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 DOE 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 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.

The EPA proposed to find DOE in compliance with the requirements of § 194.25 because the future state assumptions that DOE made and documented in the CCA were inclusive of all relevant elements of the PA and compliance assessments and were consistent with the requirements of § 194.25. (62 FR 58816–7) The Agency reviewed the future state assumptions DOE made about hydrogeologic and geologic characteristics and found that DOE accurately characterized, screened, and modeled the potential changes from current conditions. For climatic changes, EPA found DOE's approach to be conservative and consistent with the compliance criteria, since DOE examined the worst-case scenario of increased precipitation at the WIPP rather than the potential effects of global warming, which could be beneficial to the WIPP. (§ 194.25(b)(3)) The EPA found that DOE's incorporation of these changes into the PA was adequate. Finally, EPA found that the CCA's approach to dealing with uncertainty, including use of conservative assumptions to compensate for uncertainty, are consistent with the features, events, and processes list, screening arguments, and model descriptions.

The EPA received no public comments on this topic beyond those addressed in the proposal, and so finds DOE in compliance with the requirements of § 194.25. For further information concerning EPA's evaluation of compliance with § 194.25, see CARD 25. (Docket A–93–02, Item V–B–2) For additional information on the features, events, and processes included in the PA and compliance assessments, see CARD 32 (Docket A–93–02, Item V–B–2) and the preamble discussion of performance assessment issues (Section VIII.B). For additional information on both geologic and hydrogeologic conditions of the WIPP, see the preamble discussion of § 194.14.

4. Expert Judgment (§ 194.26)

The requirements of 40 CFR 194.26 apply to expert judgment elicitation.

Expert judgment is typically used to elicit two types of information: numerical values for parameters (variables) that are measurable only by experiments that cannot be conducted due to limitations of time, money, and physical situation; and essentially unknowable information, such as which features should be incorporated into passive institutional controls to deter human intrusion into the repository. (61 FR 5228) Quality assurance requirements (specifically § 194.22(a)(2)(v)) must be applied to any expert judgment to verify that the procedures for conducting and documenting the expert elicitation have been followed.

The requirements of 40 CFR Part 194 prohibit expert judgment from being used in place of experimental data, unless DOE can justify that the necessary experiments cannot be conducted. Expert judgment may substitute for experimental data only in those instances in which limitations of time, resources, or physical setting preclude the successful or timely collection of data.

The CCA did not identify any formal expert elicitation activities. During the Agency's review of performance assessment (''PA'') parameters, EPA found inadequate explanation and information for 149 parameters that DOE claimed had been derived using professional judgment. The compliance criteria do not provide for utilization of ''professional judgement.'' Input parameters are to be derived from data collection, experimentation, or expert elicitation. The EPA requested that DOE provide additional information on the derivation of the 149 parameters. (Docket A–93–02, Items II–I–17, II–I–25, and II–I–27)

The DOE responded to EPA's requests by adding information to and improving the quality of the records stored in the Sandia National Laboratory (''SNL'') Records Center in order to enhance the traceability of parameter values. The EPA deemed the documentation provided by DOE adequate to demonstrate proper derivation of all but one of the ''professional judgment'' parameters—the waste particle size distribution parameter. For a comprehensive discussion of the technical review of PA parameters, see the preamble discussion of performance assessment, CARD 23 (Section 12.0), and EPA's ''Parameter Report'' and ''Parameter Justification Report.'' (Docket A–93–02, Items V–B–2, V–B–12, V–B–14) The EPA required DOE to use the process of expert elicitation to develop the value for the waste particle size distribution parameter. (Docket A–93–02, Item II–I–27)

The waste particle size parameter is important in performance assessments because the distribution of waste particle diameters affects the quantity of radioactive materials released in spallings from inadvertent human intrusion. Because particle diameters are uncertain and cannot be estimated either directly from available data or from data collection or experimentation, the waste particle size parameter had to be based on an elicitation of expert judgment.

The DOE conducted the expert judgment elicitation on May 5–9, 1997. The results of the expert elicitation consisted of a model for predicting waste particle size distribution as a function of the processes occurring within the repository, as predicted by the PA. The DOE completed a final report entitled, ''Expert Elicitation on WIPP Waste Particle Size Distributions(s) During the 10,000-Year Regulatory Post-closure Period.'' (Docket A–93–02, Item II–I–34) The particle size distribution derived from the expert elicitation was incorporated in the PA verification test (''PAVT'') calculations.

The EPA's review of DOE's compliance with the requirements of § 194.26 principally focused on the conduct of the elicitation process, since § 194.26 sets specific criteria for the performance of an expert judgement elicitation. The EPA observed DOE's elicitation process and conducted an audit of the documentation prepared in support of DOE's compliance with § 194.26. The scope of the audit covered all aspects of the expert judgment elicitation process, including: panel meetings, management and team procedures, curricula vitae of panel members, background documents, and presentation materials. The EPA also assessed compliance with the quality assurance requirements of § 194.22(a)(2)(v). The EPA found that the documentation was appropriate, that the panel members were appropriately qualified, and that the results of the elicitation were used consistent with the stated purpose; EPA, therefore, proposed to find DOE in compliance with § 194.26. (62 FR 58817–18)

Comments on EPA's proposed decision for § 194.26 related to two main issues: (1) Commenters questioned DOE's statement that it did not conduct any expert judgement activities in developing the CCA; and (2) commenters questioned the use or role of ''professional judgement'' in the development of input parameters used in the CCA. The DOE's understanding of expert judgment was consistent with EPA's use of the term ''expert judgment'' in the compliance criteria, namely a formal, highly structured elicitation of expert opinion. (Response to Comments for 40 CFR Part 194, Docket A–92–56, Item V–C–1, p. 8–4) However, EPA agrees that the CCA initially did not contain adequate information to ascertain whether a large number of the input parameters had been properly derived. The DOE subsequently provided additional information, and substantially improved the quality of the records at the SNL Records Center, which enabled EPA to confirm that all but one of the parameters were adequately supported.

In regard to the use of professional judgement in the development of input parameters, the compliance criteria in § 194.26 do not provide for derivation of input parameters through ''professional judgement.'' Input parameters used in the PA are to be derived from data collection, experimentation, or expert elicitation. The Agency, however, recognizes that raw data resulting from data collection or experimentation may require ''professional judgment'' in the development of input parameters. Professional scientific judgment may be used to interpolate, extrapolate, interpret, and apply data to develop parameter values but cannot substitute for data. (Expert judgment may substitute for data, but only when information cannot reasonably be obtained through data collection or experimentation.) The applicability of § 194.26 does not extend to professional scientific judgment used in such circumstances. (Docket A–92–56, Item V–C–1, p. 8–5)

Based on its review of documentation developed by DOE and its contractors, the results of EPA's audit, and consideration of public comments, EPA concludes that DOE complied with the requirements of § 194.26 in conducting the required expert elicitation. For further information on EPA's evaluation of compliance with § 194.26, see CARD 26. (Docket A–93–02, Item V–B–2)

5. Peer Review (§ 194.27)

Section 194.27 requires DOE 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.

The EPA proposed to find DOE in compliance with the requirements of § 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. The EPA received no public comments on this topic beyond those addressed in the proposal (62 FR 58818), and so finds DOE in compliance with the requirements of § 194.27. For further information concerning EPA's evaluation of compliance with § 194.27, see CARD 27. (Docket A–93–02, Item V–B–2)

D. Assurance Requirements

1. Active Institutional Controls (§ 194.41)

Section 194.41 implements the active institutional controls (''AICs'') assurance requirement. The disposal regulations define AICs 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.'' (40 CFR 191.12) 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 PA may not be considered for more than 100 years after disposal.

The DOE proposed to: construct a fence and roadway around the surface footprint of the repository; post warning signs; conduct routine patrols and surveillance; and repair and/or replace physical barriers as needed. The DOE also identified other measures that function as AICs, such as DOE's prevention of resource exploration at the WIPP and DOE's construction of long-term site markers. The DOE will maintain the proposed AICs for at least 100 years after closure of the WIPP, and the WIPP PA assumed that AICs would prevent human intrusion for that period.

The EPA reviewed the proposed 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, hydrocarbon exploration, construction, and hostile or illegal activities) and examined the assumptions made by DOE to justify the assertion that AICs will be completely effective for 100 years. The DOE stated in the CCA that the proposed AICs will be maintained for 100 years, and that regular surveillance could be expected to detect a drilling operation in a prohibited area that is set up in defiance or ignorance of posted warnings.

The EPA received public comments on its proposed certification decision stating that it was unreasonable to assume that AICs could be completely effective for 100 years. While EPA recognizes that 100 percent effectiveness of AICs over 100 years cannot be established with certainty, the proposed AICs are fully within DOE's present capability to implement and may be expected to be enforceable for a period of 100 years. Therefore, EPA found it reasonable for DOE to assume credit in the PA for 100 years. The EPA found the assumptions regarding longevity and efficacy of the proposed AICs to be acceptable based on the fact that the types of inadvertent intrusion which AICs are designed to obviate are not casual activities, but require extensive resources, lengthy procedures for obtaining legal permission, and substantial time to set up at the site before beginning.

Contributions from AICs in the PA are considered as a reduction in the rate of human intrusion. The EPA reviewed the CCA and the parameter inputs to the PA and determined that DOE did not assume credit for the effectiveness of active institutional controls for more than 100 years after disposal. The EPA found DOE's assumptions to be sufficient to justify DOE's assertion that AICs will completely prevent human intrusion for 100 years after closure. 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 finds DOE in compliance with § 194.41. For further information on EPA's evaluation of compliance for § 194.41, refer to CARD 41. (Docket A–93–02, Item V–B–2)

2. Monitoring (§ 194.42)

Section 194.42 requires DOE to monitor the disposal system to detect deviations from expected performance. The monitoring requirement distinguishes between pre-and post-closure monitoring because the monitoring techniques that may be used to access the repository during operations (pre-closure) and after the repository has been backfilled and sealed (post-closure) are different. Monitoring is intended to provide information about the repository that may affect the predictions made about the PA or containment of waste. The EPA proposed that DOE was in compliance with this requirement. (62 FR 58827)

Public comments on EPA's proposed decision stated that the monitoring plan presented by DOE does not comply with certain hazardous waste (Resource Conservation and Recovery Act) and Nuclear Regulatory Commission (''NRC'') requirements. However, the monitoring techniques and parameters suggested by commenters are not required by § 194.42, which requires only that the post-closure monitoring plan be complementary to certain applicable hazardous waste monitoring requirements. The purpose of this language is to eliminate potential overlap with hazardous waste monitoring requirements while ensuring that monitoring will be conducted even if not required by the applicable hazardous waste regulations. (Response to Comments for 40 CFR Part 194, Docket A–92–56, Item V–C–1, p. 14–7)

One commenter stated that DOE should monitor additional parameters and perform remote monitoring to prolong the length of time that data is gathered. The EPA determined that monitoring the additional parameters would provide no significant benefit because these parameters were not identified as significant to the containment of waste or to verifying predictions made about the repository. The EPA also determined that additional remote monitoring of the panel rooms would neither provide significant information on the performance of the repository nor verify predictions about its performance.

The plans in the CCA addressed both pre-closure and post-closure monitoring and included the information required by the compliance criteria. Therefore, EPA finds that DOE is in compliance with the requirements of § 194.42. Under its authority at § 194.21, EPA intends to conduct inspections of DOE's implementation of the monitoring plans that DOE has set forth. For further information on EPA's evaluation of compliance for § 194.42, see CARD 42. (Docket A–93–02, Item V–B–2)

3. Passive Institutional Controls (§ 194.43)

The compliance criteria at § 194.43 require a description of passive institutional controls (''PICs'') that will be implemented at the WIPP. The EPA defined PICs in the disposal regulations as markers, public records and archives, government ownership of and restrictions on land use at a site, and any other means of preserving knowledge of a site. (40 CFR 191.12) PICs are intended to deter unintentional intrusions into a disposal system by people who otherwise might not be aware of the presence of radioactive waste at the site.

Section 194.43 requires DOE to: (1) identify the controlled area with markers designed, fabricated, and emplaced to be as permanent as practicable; (2) place records in local State, Federal, and international archives and land record systems likely to be consulted by individuals in search of resources; and (3) employ other PICs intended to indicate the location and dangers of the waste. In accordance with § 194.43(b), DOE also must indicate the period of time that PICs are expected to endure and be understood by potential intruders. Finally, DOE is permitted to propose a credit for PICs in the PA, as explained in § 194.43(c). This credit must be based on the proposed effectiveness of PICs over time, and would take the form of reduced likelihood in the PA of human intrusion over several hundred years. The compliance criteria prohibit DOE from assuming that PICs could entirely eliminate the likelihood of future human intrusion into the WIPP.

The EPA proposed that DOE complied with § 194.43(a) and (b) because the measures proposed in the CCA are comprehensive, practicable, and likely to endure and be understood for long periods of time. The EPA also proposed a condition that DOE submit additional information concerning the schedule for completing PICs, the fabrication of granite markers, and commitments by various recipients to accept WIPP records. (62 FR 58827–29) The EPA did not receive any comments disputing this decision, and so finds DOE in compliance with § 194.43(a) and (b). However, DOE must fulfill Condition 4 of Appendix A to 40 CFR Part 194 no later than the final recertification application. For further information on EPA's evaluation of compliance with § 194.43, see CARD 43. (Docket A–93–02, Item V–B–2)

Some commenters expressed the concern that PICs in general, and DOE's plan in particular, would not be sufficient to prevent drilling or other intrusions into the WIPP over 10,000 years. The EPA has never asserted that PICs, as an assurance measure, could or must be sufficient to prevent human intrusion into a site entirely or for a specified period (such as 10,000 years). In fact, the WIPP compliance criteria prohibit DOE from assuming that PICs can completely eliminate the likelihood of human intrusion. (§ 194.43(c)) DOE's design incorporates features that will serve to promote the endurance and comprehensibility of PICs over time, such as: redundant markers, highly durable materials with low intrinsic value, messages in multiple languages, and record storage in multiple locations. Also, the CCA clearly discusses the manner in which DOE accounted in the design for possible, realistic failures. The Agency believes that the existence of site-specific markers and records, designed to be durable over long periods of time, will greatly improve the chances that future generations will retain knowledge of the hazard posed by waste stored at the WIPP.

The EPA proposed to deny DOE's request under § 194.43(c) that the likelihood of human intrusion into the WIPP during the first 700 years after closure be reduced by 99 percent based on the anticipated effectiveness of PICs. The EPA denied the credit because DOE did not use an expert judgment elicitation to derive the credit, as explicitly envisioned by the Agency. The EPA expected that an expert judgment elicitation that makes use of the best available information and expertise would be used to account for the considerable uncertainties associated with a prediction of the ability of PICs to prevent human intrusion hundreds of years into the future. Since the WIPP is located in an area of resource exploitation, the uncertainty was not sufficiently reflected in the near 100 percent credit proposed in the CCA.

The Agency received comments both supporting and refuting this decision. Comments supporting EPA's proposed decision tended to reflect the position that any PICs credit would be too uncertain for use in the PA. In opposition to EPA's decision, comments stated that EPA drew improper conclusions about DOE's use of expert judgment and treatment of uncertainty. These comments requested that EPA reverse its denial of PICs credit, or at least consider future credit proposals, but did not identify why EPA's conclusions were incorrect other than to reiterate positions taken in the CCA that were explicitly assessed by EPA in the proposal. (62 FR 58828) Therefore, EPA sees no cause to reverse its decision to deny DOE's request for PICs credit under § 194.43(c). However, EPA's final decision today applies only to the credit proposal in the CCA and should not be interpreted as a judgment on the use of PICs credit in performance assessments generally. In the future, DOE may present to EPA additional information derived from an expert elicitation of PICs credit. Any future PICs credit proposals will be considered in the context of a modification rulemaking, and will be subject to public examination and comment.

4. Engineered Barriers (§ 194.44)

Section 194.44 requires DOE to conduct a study of available options for engineered barriers at the WIPP and submit this study and evidence of its use with the compliance application. Consistent with the assurance requirement found at 40 CFR 191.14, 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 the PA and EPA's subsequent evaluation. Based on the comparative study that constitutes Appendix EBS of the CCA, DOE proposed magnesium oxide (MgO) backfill as an engineered barrier and proposed to emplace bags of MgO between and around waste containers in the repository. The EPA proposed to find DOE in compliance with § 194.44 because DOE conducted and documented the required study in a manner consistent with the WIPP compliance criteria and proposed to implement an engineered barrier to delay the movement of water or radionuclides. (62 FR 58829)

Public comments on the proposal stated that the waste should be treated before being placed in the repository. Commenters stated that treatment of waste could serve to provide additional confidence in the safety of the disposal system beyond that demonstrated by the performance assessment, based on the assumption that waste treatment would reduce the potential effects of a repository breach. Commenters therefore urged EPA to encourage DOE to treat the waste in order to add additional assurance in the predicted performance of the WIPP.

Section 194.44 of the compliance criteria requires DOE to perform a comparison of the benefits and detriments of waste treatment options (referred to as ''engineered barriers'' by EPA and as ''engineered alternatives'' by DOE). DOE's evaluation incorporated such treatment methods as vitrification and shredding. Based on this

evaluation, DOE selected the use of MgO as an engineered barrier. The EPA determined that MgO will be an effective barrier, based on DOE's scientific evaluation of the proposed barrier's ability to prevent or substantially delay the movement of radionuclides toward the accessible environment.

Section 194.44 does not require specific engineered barriers or the implementation of more than one engineered barrier. Since DOE will employ the use of a barrier as required by this section, and since the performance assessment results showed compliance with the containment requirements with the use of this barrier, EPA does not consider it necessary to require DOE to treat waste prior to emplacement. However, EPA agrees that waste treatment or additional barriers may further enhance the containment ability of the WIPP. In the future, if DOE were to select a new treatment option (such as vitrification) that differs significantly from the option in the most recent compliance application, DOE must inform EPA prior to making such a change. (§ 194.4(b)(3)(i) and (vi)) The EPA will evaluate the information provided by DOE and determine if the certification warrants modification.

Other commenters expressed concern that DOE failed to consider alternatives to the proposed 55-gallon steel waste drums that could reduce releases or the formation of gas in the repository due to the degradation of carbon. Commenters further stated that DOE failed to consider adequately how engineered barriers could reduce releases from four human intrusion scenarios: fluid injection, air drilling, stuck pipe, and direct brine release.

The EPA recognized that gas production from waste drum degradation was a relevant issue and so included consideration of ''improved waste containers'' in the list of factors for DOE to consider when evaluating engineered barriers. (40 CFR 194.44(b)) The DOE did, in fact, consider various aspects of waste packages in the engineered barrier study. Appendix A of Appendix EBS (p. A–10) states that the ''improved waste container'' options scored low in a qualitative assessment because of their minimal ability to improve conditions with respect to waste solubility and shear strength. As explained in CARD 44 (Docket A–93–02, Item V–B–2), DOE also examined the effects of engineered barriers on the long-term performance of the WIPP using the Design Analysis Model (''DAM''), which provided a relative comparison of the potential benefits of the different barriers on the performance of the repository. There was no attempt to determine the absolute effect of the barriers on the performance of the repository since the objective of the study (in accordance with the WIPP compliance criteria) was only to provide DOE with information for use in the selection or rejection of additional engineered barriers. (Docket A–93–02, Item V–B–2, CARD 44, Section 44.C.4) It was not necessary for DOE to show the absolute effect of each barrier on the WIPP's performance in the face of a specific human intrusion scenario such as air drilling. Rather, it was sufficient for DOE to consider the relative ability of barriers to prevent or delay radionuclide migration in the event of human intrusion.

Other comments expressed concern that the ''containment'' and ''assurance'' requirements were not kept separate, as was intended by EPA's disposal standards. The separation of the requirements is valid only to the extent that engineered barriers may be used to meet the containment requirements, but must be used to meet the assurance requirements. The effects of all engineered barriers employed at the WIPP must be considered in performance assessments. Excluding such barriers from consideration would result in inaccurate modeling of the disposal system, which is defined in § 191.12(a) to include engineered barriers. (Response to Comments for 40 CFR Part 194, Docket A–92–56, Item V–C–1, pp. 16–10, 16–13) Although not required to comply with § 194.44, DOE and others performed calculations showing that the WIPP can comply with the containment requirements with or without the use of MgO as an engineered barrier. (Docket A–93–02, Items IV–D–12 and IV–G–7)

The EPA finds that DOE complies with § 194.44. The 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 water or radionuclides toward the accessible environment. The DOE provided sufficient documentation to show that MgO can effectively reduce actinide solubility in the disposal system. The DOE proposed to emplace a large amount of MgO around waste drums in order to provide an additional factor of safety and thus account for uncertainties in the geochemical conditions that would affect CO_2 generation and MgO reactions. For further information on EPA's evaluation of compliance for § 194.44, see CARD 44. (Docket A–93–02, Item V–B–2) For further information regarding the PA modeling of solubility and chemical conditions in the repository, see CARD 23—Models and Computer Codes. (Docket A–93–02, Item V–B–2)

5. Consideration of the Presence of Resources (§ 194.45)

Section 194.45 implements the assurance requirement that the disposal system be sited so that the benefits of the natural barriers of the disposal system will compensate for any increased probability of disruptions to the disposal system resulting from exploration and development of existing resources. (61 FR 5232) In issuing the WIPP compliance criteria, EPA determined that the performance assessment (''PA'') is the appropriate tool to weigh the advantages and disadvantages of the WIPP site because the PA demonstrates whether potential human intrusion will cause unacceptably high releases of radioactive material from the disposal system. Comments on § 194.45 for the proposed certification decision did not address the question of compliance with this requirement but instead focused on the criterion itself, stating that it was inconsistent with the original basis for the assurance requirements to be qualitative in nature. The EPA believes that the presence of resources requirement is reasonable because the performance assessment must account for the increased potential for human intrusion into the disposal system due to the presence of known resources, based on historical rates of drilling and mining in the vicinity of the WIPP. (Docket A–92–56, Item V–C–1, p. 17–1) In any case, it is beyond the scope of the certification rulemaking to fundamentally re-examine or change the disposal regulations or compliance criteria as they relate to the presence of resources.

Because the PA incorporated human intrusion scenarios and met EPA's release limits in accordance with the WIPP compliance criteria, EPA determines that DOE has demonstrated compliance with § 194.45. For discussion of comments on human intrusion scenarios, results, and other aspects of the PA, refer to Section B (''Performance Assessment: Modeling and Containment Requirements'') of this preamble. For further information on EPA's evaluation of compliance for § 194.45, refer to CARD 45. (Docket A–93–02, Item V–B–2)

6. Removal of Waste (§ 194.46)

Section 194.46 requires DOE to provide documentation that the removal of waste from the disposal system is feasible for a reasonable period of time

after disposal. In the proposed certification decision on WIPP, EPA proposed that DOE was in compliance with this requirement.

Public comments on EPA's proposed decision expressed concern that there would be no way to remove the waste once the WIPP repository is sealed. The technology used to dispose of the waste is substantially the same as the technology that would be used to remove it. This technology may reasonably be expected to remain available for at least 100 years after the repository is sealed. Public comments also stated that EPA and DOE should identify the limitations of DOE's removal of waste plan. In Appendix WRAC of the CCA, DOE acknowledges the expense and hazard of removing the waste from the repository. The purpose of the requirement at § 194.46 is to demonstrate that the removal of waste remains possible, not necessarily simply or inexpensive, for a reasonable period of time after disposal. (50 FR 38082)

The DOE demonstrated that it is possible to remove waste from the repository for a reasonable period of time after disposal. Therefore, EPA determines that DOE is in compliance with § 194.46. For further information on EPA's evaluation of compliance with § 194.46, see CARD 46. (Docket A–93–02, Item V–B–2)

E. Individual and Ground-water Protection Requirements (§§ 194.51–55)

Sections 194.51 through 194.55 of the compliance criteria implement the individual protection requirements of 40 CFR 191.15 and the ground-water 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 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 DOE 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. The EPA required that the CCA identify the maximum annual committed effective dose and the location where it occurs, and explain how DOE arrived at those results.

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. The 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 proposed that DOE complied with § 194.51. The Agency received no public comments on this topic beyond those addressed in the proposal (62 FR 58831), and so finds DOE in compliance with the requirements of § 194.51.

Section 194.52 requires DOE to consider in compliance assessments all potential exposure pathways for radioactive contaminants from the WIPP. The DOE must assume that an individual consumes two liters per day of drinking water from any underground source of drinking water outside the WIPP area.

The DOE considered the following pathways: 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.

The EPA proposed 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. The Agency received no public comments on this topic beyond those addressed in the proposal (62 FR 58831), and so finds DOE in compliance with the requirements of § 194.52. For further information concerning EPA's evaluation of compliance for §§ 194.51 and 194.52, see CARD 51/52. (Docket A–93–02, Item V–B–2)

Section 194.53 requires DOE to consider in compliance assessments underground sources of drinking water (''USDWs'') near the WIPP and their interconnections. A USDW 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 DOE identified three potential USDWs near the WIPP—the Culebra Member of the Rustler Formation, the Dewey Lake Red Beds, and the Santa Rosa Sandstone of the Dockum Group—despite incomplete data showing that they meet the regulatory definition of a USDW. The DOE did not analyze underground interconnections among these water bodies, instead assuming conservatively that people would draw water directly from the Salado Formation, bypassing other USDWs closer to the surface and thus resulting in greater exposure.

The EPA proposed that DOE complied with § 194.53 because DOE adequately considered potential USDWs near the WIPP. The Agency received a few public comments that raised questions about DOE's approach to evaluating USDWs. For example, some commenters questioned DOE's assertion that USDWs such as Laguna Grande de la Sal would not be contaminated if the WIPP is left undisturbed. In fact, the compliance assessments assumed that water in the Salado Formation constituted a hypothetical USDW that would provide drinking water after being diluted. Radionuclide concentrations would be expected to be greatest in the Salado at the subsurface boundary of the WIPP, since the disposal system is located in that geologic formation. Thus, by demonstrating that EPA's drinking water standards would be met where radioactive contamination would be greatest, DOE also showed that other, more distant potential aquifers also would comply. This conservative approach compensates for substantial uncertainties that would otherwise be involved in the calculation of radionuclide transport to potential USDWs.

Even using an analysis that was designed to maximize radionuclide releases, DOE showed that the WIPP will comply with EPA's limits for radionuclides in ground water by a wide margin. The EPA therefore finds DOE in compliance with § 194.53. For further information concerning EPA's evaluation of compliance with § 194.53, see CARD 53. (Docket A–93–02, Item V–B–2)

Sections 194.54 and 194.55 relate to the scope and results of compliance assessments conducted to determine

compliance with the individual dose and ground-water protection requirements. The EPA found that DOE appropriately evaluated and screened out natural features, processes, and events related to undisturbed performance, and proposed to find DOE in compliance with § 194.54. (62 FR 58832) The Agency received no specific comments on this decision. Comments on issues that could affect predictions of undisturbed performance, such as site characterization or ground-water modeling, are discussed separately in this preamble and did not necessitate changes to compliance assessments. (See ''Geologic Scenarios and Disposal System Characteristics'' under the Performance Assessment sections of this preamble.) The EPA therefore finds that DOE complies with § 194.54. For further information on EPA's evaluation of compliance with § 194.54, see CARD 54. (Docket A–93–02, Item V–B–2)

The EPA found that compliance assessments conducted by DOE appropriately documented uncertainty, documented probability distributions for uncertain parameters, randomly sampled across the distributions, and generated and displayed a sufficient number of estimates of radiation doses and ground-water concentrations. Further, the resulting estimates of radiation doses and radionuclide concentrations in ground water (and independent calculations by EPA) were well below the limits in § 191.15 and Subpart C of 40 CFR Part 191. In its proposal, the Agency found that DOE is in compliance with the requirements of § 194.55, and received no comments disputing this decision, which is therefore finalized. For further information on EPA's evaluation of compliance for § 194.55, see CARD 55. (Docket A–93–02, Item V–B–2)

IX. Does DOE Need to Buy Existing Oil and Gas Leases Near the WIPP?

The EPA finds that DOE does not need to acquire existing oil and gas leases in the vicinity of the WIPP in order to comply with EPA's disposal regulations. These existing leases, and EPA's need to evaluate their effects on the WIPP, are addressed by the 1992 WIPP Land Withdrawal Act (''LWA'') which provides for EPA's regulatory authority at the WIPP.[37] (See Section X of this preamble, entitled ''Why and How Does EPA Regulate the WIPP,'' for more information on the WIPP LWA.) The 1992 WIPP LWA withdrew the geographic area containing the WIPP facility from all forms of entry, appropriation, and disposal under public land laws. The WIPP LWA transferred jurisdiction of the land to the Secretary of Energy explicitly for the use of constructing, operating, and conducting other authorized activities related to the WIPP. The WIPP LWA prohibits all surface or subsurface mining or oil or gas production is prohibited at all times on or under the land withdrawal area. (WIPP LWA, section 4(b)(5)(A)) However, section 4(b)(5)(B) states that existing rights under two oil and gas leases (Numbers NMNM 02953 and 02953C) (referred to as ''the section 4(b)(5)(B) leases'') shall not be affected unless the Administrator determines, after consultation with DOE and the Department of the Interior, that the acquisition of such leases by DOE is required to comply with EPA's final disposal regulations.

Before DOE can emplace waste in the WIPP, DOE must acquire the leases, unless EPA determines that such acquisition is not required. (WIPP LWA, section 7(b)(2)) This determination is separate and apart from the WIPP LWA requirement for EPA to conduct the certification decision by notice-and-comment rulemaking. (WIPP LWA, section 8(d)). Nonetheless, the Agency chose to address this matter as part of the certification process because the determination of whether potential drilling on the leases could possibly affect the integrity of the WIPP is closely related to similar determinations that must be made to determine compliance with the disposal regulations and WIPP compliance criteria. (See §§ 194.32(c), 194.54(b))

As discussed in the proposed certification decision, EPA examined DOE's analysis of a number of potential activities in the life cycle of a well-drilling, fluid injection (for both waterflooding and brine disposal), and abandonment—that could affect the WIPP disposal system. The Agency agreed with DOE that the effects of drilling a borehole would be highly localized, due to well casing procedures and borehole plugging practices. The EPA found that the effects of fluid injection can also be expected to be localized, due to underground injection control requirements. Finally, even abandoned boreholes would have little consequence on waste panels more than a meter away. Because the closest possible approach of a borehole drilled from the section 4(b)(5)(B) leases is over 2400 meters (8000 feet) from the WIPP waste disposal rooms, EPA determined that such a borehole would have an insignificant effect on releases from the disposal system (and in turn, on compliance with the disposal regulations). (62 FR 58835–58836)

For the reasons discussed above, EPA concluded in its proposed rule that the Secretary of Energy does not need to acquire Federal Oil and Gas Leases No. NMNM 02953 and No. NMNM 02953C. (62 FR 58836) A number of comments on the proposed rule suggested that DOE conducted inadequate performance assessment analyses on drilling activities occurring prior to or soon after disposal in the vicinity of the WIPP, but only one commenter took issue directly with EPA's decision to not require the Secretary of Energy to acquire the Section 4(b)(5)(B) leases. This commenter questioned the impact of drilling activities by lease holders.

The DOE's analysis of drilling for the performance assessment indicated that wells drilled into the controlled area, but away from the waste disposal room and panels, will not adversely affect the disposal system's capability to contain radionuclides. A slant-drilled borehole from outside the Land Withdrawal Area, into the section 4(b)(5)(B) lease area at least 6000 feet below the surface, would be at least 2400 meters (8000) feet away from the WIPP disposal rooms and would thus have an insignificant effect on releases from the disposal system or compliance with the disposal regulations. The EPA finds that potential activities at the section 4(b)(5)(B) leases will not cause the WIPP to violate the disposal regulations. (For more information on drilling scenarios, see the preamble discussions related to performance assessment.) Therefore, EPA determines that it is not necessary for the Secretary of Energy to acquire the Federal Oil and Gas Leases No. NMNM 02953 and No. NMNM 02953C.

X. Why and How Does EPA Regulate the WIPP?

The WIPP Land Withdrawal Act is the statute that provides EPA the authority to regulate the WIPP. The EPA's obligations and the limitations on EPA's regulatory authority under that law are discussed below.

A. The WIPP Land Withdrawal Act

The EPA's oversight of the WIPP facility is governed by the WIPP Land Withdrawal Act (''LWA''), passed initially by Congress in 1992 and amended in 1996. (Prior to the passage of the WIPP LWA in 1992, DOE was self-regulating with respect to the WIPP; that is, DOE was responsible for determining whether its own facility complies with applicable regulations for radioactive waste disposal.) The WIPP LWA delegates to EPA three main tasks, to be completed sequentially, for reaching a compliance certification decision. First, EPA must finalize

[37] Pub. L. 102–579, sections 4(b)(5) and 7(b)(2).

general regulations which apply to all sites—except Yucca Mountain—for the disposal of highly radioactive waste.[38] These regulations, located at Subparts B and C of 40 CFR Part 191 (''disposal regulations''), were published in the **Federal Register** in 1985 and 1993.[39]

Second, EPA must develop, by rulemaking, criteria to implement and interpret the general radioactive waste disposal regulations specifically for the WIPP. The EPA issued the WIPP compliance criteria, which are found at 40 CFR Part 194, in 1996.[40]

Third, EPA must review the information submitted by DOE and publish a certification decision.[41] Today's action constitutes EPA's certification decision as required by section 8 of the WIPP LWA.

Today's action also addresses the requirement at section 7(b)(2) that, before DOE can emplace waste in the WIPP, DOE must acquire existing oil and gas leases near the WIPP unless EPA determines that such acquisition is not required in order for DOE to comply with the disposal regulations. The EPA determines that acquisition of the leases is not necessary. For further discussion of this requirement, refer to the preamble section entitled, ''Does DOE need to buy existing oil and gas leases near the WIPP?''

Besides requiring EPA to issue a certification decision, the WIPP LWA also requires the Agency to conduct periodic recertifications, if the facility is initially certified. Every five years, EPA must determine whether documentation submitted by DOE demonstrates that the WIPP continues to be in compliance with the disposal regulations.[42] Recertifications are not conducted through rulemaking, and are not addressed by today's action. However, the WIPP compliance criteria address the process by which EPA intends to conduct recertifications, including publishing public notices in the **Federal Register** and providing a public comment period. (§ 194.64) For further information on recertification, refer to the preamble sections entitled, ''EPA's Future Role at the WIPP'' and ''How will the public be involved in EPA's future WIPP activities?''

B. Limits of EPA's Regulatory Authority at the WIPP

As discussed above, the WIPP LWA conveys specific responsibilities on EPA to ensure the safety of the WIPP as a permanent disposal facility. The Agency's primary responsibility, described in section 8 of the WIPP LWA, is to determine whether the WIPP facility will comply with EPA's disposal regulations. Members of the public have expressed, in written comments and in oral testimony on the proposed rule, a desire for the Agency to oversee other aspects of the WIPP's operation. In response to such concerns, EPA must clarify that its authority to regulate DOE and the WIPP is limited by the WIPP LWA and other statutes which delineate EPA's authority to regulate radioactive materials in general. The limitations on EPA's authority necessarily limit the scope of the present rulemaking.

A number of commenters suggested that EPA should explore alternative methods of waste disposal, such as neutralizing radioactive elements, before proceeding with a certification decision. Others stated that the WIPP should be opened immediately because underground burial of radioactive waste is less hazardous than the current strategy of above-ground storage. In the WIPP LWA, Congress did not delegate to EPA the authority to abandon or delay the WIPP because future technologies might evolve and eliminate the need for the WIPP. Also, Congress did not delegate to EPA the authority to weigh the competing risks of leaving radioactive waste stored above ground compared to disposal of waste in an underground repository. These considerations are outside the authority of EPA as established in the WIPP LWA, and thus outside the scope of this rulemaking. However, as technologies evolve over the operating period of the WIPP, DOE may incorporate them into the facility design through a modification or during the required recertification process. The EPA will evaluate how any such changes in design or activities at the WIPP may affect compliance with the radioactive waste disposal regulations.

Some commenters requested that EPA consider certain factors in making its certification decision. These factors include reviews by organizations other than EPA, and the political or economic motivations of interested parties. The EPA's certification decision must be made by comparing the scope and quality of relevant information to the objective criteria of 40 CFR Part 194. Where relevant, the Agency has considered public comments which support or refute technical positions taken by DOE. Emotional pleas and comments on the motives of interested parties are factors that are not relevant to a determination of whether DOE has demonstrated compliance with the disposal regulations and WIPP compliance criteria, and are therefore outside the scope of this rulemaking.

Finally, the hazards of transporting radioactive waste from storage sites to the WIPP is of great concern to the public. Transportation is entirely outside EPA's general authority for regulating radioactive waste. Moreover, in the WIPP LWA, Congress did not authorize any role for EPA to regulate transportation. Instead, the WIPP LWA reiterated that DOE must adhere to transportation requirements enforced by the U.S. Nuclear Regulatory Commission and the U.S. Department of Transportation. (WIPP LWA, section 16) Because all transportation requirements for the WIPP are established and enforced by other regulators, EPA does not address the issue further in today's action.

The preamble section entitled, ''What is EPA's response to general comments received on the certification decision?'' provides further discussion of general issues, including several related to the scope of EPA's certification rulemaking.

C. Compliance With Other Environmental Laws and Regulations

The WIPP must comply with a number of other environmental and safety regulations in addition to EPA's disposal regulations—including, for example, the Solid Waste Disposal Act and EPA's environmental standards for the management and storage of radioactive waste. Various regulatory agencies are responsible for overseeing the enforcement of these Federal laws. For example, the WIPP's compliance with EPA's radioactive waste management regulations, found at Subpart A of 40 CFR Part 191, is addressed by an EPA guidance document which describes how EPA intends to implement Subpart A at the WIPP. (Copies of the WIPP Subpart A Guidance are available by calling the WIPP Information Line at 1–800–331–WIPP or from EPA's WIPP home page at www.epa/gov/radiation/wipp.) Enforcement of some parts of the hazardous waste management regulations has been delegated to the State of New Mexico. The State's authority for such actions as issuing a hazardous waste operating permit for the WIPP is in no way affected by EPA's certification decision. It is the responsibility of the Secretary of Energy to report the WIPP's compliance with all applicable Federal laws pertaining to public health and the environment.[43] Compliance with environmental or

[38] WIPP LWA, section 8(b).

[39] 50 FR 38066–38089 (September 19, 1985) and 58 FR 66398–66416 (December 20, 1993).

[40] 61 FR 5224–5245 (February 9, 1996).

[41] WIPP LWA, section 8(d).

[42] WIPP LWA, section 8(f).

[43] WIPP LWA, sections 7(b)(3) and 9.

public health regulations other than EPA's disposal regulations and WIPP compliance criteria is not addressed by today's action.

XI. How Has the Public Been Involved in EPA's WIPP Activities?

Section 8(d)(2) of the WIPP LWA requires that the Administrator's certification decision be conducted by informal (or ''notice-and-comment'') rulemaking pursuant to Section 4 of the Administrative Procedure Act (''APA''). Notice-and-comment rulemaking under the APA requires that an agency provide notice of a proposed rulemaking, an opportunity for the public to comment on the proposed rule, and a general statement of the basis and purpose of the final rule.[44]

The WIPP compliance criteria, at Subpart D of 40 CFR Part 194, established a process of public participation that exceeds the APA's basic requirements, and provides the public with the opportunity to participate in the regulatory process at the earliest opportunity. The WIPP compliance criteria contain provisions that require EPA to: publish an advance notice of proposed rulemaking (''ANPR'') in the **Federal Register**; allow public comment on DOE's compliance certification application (''CCA'') for at least 120 days, prior to proposing a certification decision; hold public hearings in New Mexico, if requested, on the CCA; provide a minimum of 120 days for public comment on EPA's proposed certification decision; hold public hearings in New Mexico on EPA's proposal; produce a document summarizing the Agency's consideration of public comments on the proposal, and maintain informational dockets in the State of New Mexico to facilitate public access to the voluminous technical record, including the CCA. The EPA has complied with each of these requirements.

A. Public Involvement Prior to Proposed Rule

The EPA received DOE's CCA on October 29, 1996. Copies of the CCA and all the accompanying references submitted to EPA were placed in EPA's dockets in New Mexico and Washington, DC. On November 15, 1996, the Agency published in the **Federal Register** (61 FR 58499) an ANPR announcing that the CCA had been received, and announcing the Agency's intent to conduct a rulemaking to certify whether the WIPP facility will comply with the disposal regulations. The notice also announced a 120-day public comment period, requested public comment ''on all aspects of the CCA,'' and stated EPA's intent to hold public hearings in New Mexico.

The EPA published a separate notice in the **Federal Register** announcing hearings to allow the public to address all aspects of DOE's certification application. (62 FR 2988) Public hearings were held on February 19, 20 and 21, 1997, in Carlsbad, Albuquerque and Santa Fe, New Mexico, respectively. In addition to the public hearings, EPA held three days of meetings in New Mexico, on January 21, 22 and 23, 1997, with the principal New Mexico Stakeholders. Detailed summaries of these meeting were placed in Docket A–93–02, Category II–E.

The Agency received over 220 sets of written and oral public comments in response to the ANPR. The Agency reviewed all public comments submitted during the ANPR 120-day comment period or presented at the preliminary meetings with stakeholders. The EPA provided responses to these comments in the preamble to the proposed certification as well as in the compliance application review documents (''CARDs'') for the proposed certification decision. The CARDs also addressed late comments—and comments on the completeness of DOE's CCA—received after the close of the public comment period (on March 17, 1997) but before August 8, 1997. (62 FR 27996–27998) All relevant public comments, whether received in writing, or orally during the public hearings, were considered by the Agency as the proposed certification decision was developed. For further discussion of EPA's completeness determination and other pre-proposal activities, see the preamble to the proposed certification decision, 62 FR 58794–58796.

B. Proposed Certification Decision

On October 30, 1997, EPA published a Notice of Proposed Rulemaking in the **Federal Register**, fulfilling the requirements of the WIPP compliance criteria at § 194.62. (62 FR 58792–58838) The notice announced the Administrator's proposed decision, pursuant to section 8(d)(1) of the WIPP LWA, as amended, to issue a certification that the WIPP facility will comply with the disposal regulations, and solicited comment on the proposal. The notice also marked the beginning of a 120-day public comment period on EPA's proposed certification decision. Finally, the notice announced that public hearings would be held in New Mexico during the public comment period.

C. Public Hearings on Proposed Rule

Further information on the hearings was provided in a **Federal Register** notice published on December 5, 1997. (62 FR 64334–64335) The Agency conducted hearings in three cities in New Mexico—Carlsbad, Albuquerque, and Santa Fe—on January 5 through 9, 1998. The EPA took a number of steps to ensure that citizens were aware of the hearings and to accommodate requests to testify before the EPA panel. For example, EPA placed forty-six notices in newspapers across the State to advertise the hearings and provided a manned, toll-free telephone line for pre-registration. The Agency also allowed on-site registration, and extended the hours of the hearings in both Albuquerque and Santa Fe in order to allow everyone present who wished to testify the opportunity to do so.

D. Additional Public Input on the Proposed Rule

In addition to the public hearings, EPA held two days of meetings in New Mexico, on December 10–11, 1997, with the principal New Mexico stakeholders, including the New Mexico Attorney General's Office, the New Mexico Environmental Evaluation Group (''EEG''), Concerned Citizens for Nuclear Safety, Citizens for Alternatives to Radioactive Dumping, and Southwest Research and Information Center. Detailed summaries of these meetings were placed in Docket A–93–02, Item IV–E–8. Additional meetings were also held in January 1998 in New Mexico and Washington, DC with the New Mexico EEG (IV–E–10 and IV–E–11) and other stakeholders (IV–E–11).

In response to concerns expressed in meetings with stakeholders and in public hearings, EPA performed additional analyses of air drilling (a specialized drilling method which stakeholders raised as an issue which could potentially affect the WIPP if it occurred near the site). In light of the significant public interest in this issue, EPA conducted its analysis and released its report during the comment period on the proposed rule, in order to allow an opportunity for the public to comment on EPA's technical analysis. The Agency published a **Federal Register** notice of availability for the report and provided a 30-day public comment period. (63 FR 3863; January 27, 1998) The report was placed in the public docket and also sent electronically to a number of interested stakeholders, including the New Mexico Attorney General, the New Mexico Environmental Evaluation Group, Citizens for Alternatives to Radioactive

[44] 5 U.S.C. 553.

Dumping, Concerned Citizens for Nuclear Safety, and Southwest Research and Information Center.

E. Final Certification Decision, Response to Comments Document

Today's notice of EPA's final certification decision pursuant to section 8(d)(1) of the WIPP LWA fulfills the requirement of the WIPP compliance criteria at § 194.63(a). Also in accordance with § 194.63(b), EPA is publishing a document, accompanying today's action and entitled ''Response to Comments,'' which contains the Agency's response to all significant comments received during the comment period on the proposed certification decision. (Docket A–93–02, Item V–C–1) (For further discussion of EPA's treatment of ANPR and other pre-proposal comments, refer to the preamble to the proposed rule, 62 FR 58794–58796.) All comments received by EPA, whether written or oral, were given equal consideration in developing the final rule. All comments received by the Agency were made available for public inspection through the public docket. (Docket A–93–02, Categories IV–D, IV–F, and IV–G)

F. Dockets

In accordance with 40 CFR 194.67, EPA maintains a public docket (Docket A–93–02) that contains all information used to support the Administrator's proposed and final decisions on certification. The Agency established and maintains the formal rulemaking docket in Washington, D.C., as well as informational dockets in three locations in the State of New Mexico (Carlsbad, Albuquerque, and Santa Fe). The docket consists of all relevant, significant information received to date from outside parties and all significant information considered by the Administrator in reaching a certification decision regarding whether the WIPP facility will comply with the disposal regulations. The EPA placed copies of the CCA in Category II–G of the docket. The Agency placed supplementary information received from DOE in response to EPA requests in Categories II–G and II–I.

The final certification decision and supporting documentation can be found primarily in the following categories of Docket A–93–02: Category V–A (final rule and preamble), Category V–B (Compliance Application Review Documents and Technical Support Documents), and Category V–C (Response to Comments document).

The hours and locations of EPA's public information dockets are as follows: Docket No. A–93–02, located in room 1500 (first floor in Waterside Mall near the Washington Information Center), U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C., 20460 (open from 8:00 a.m. to 4:00 p.m. on weekdays); 2) EPA's docket in the Government Publications Department of the Zimmerman Library of the University of New Mexico located in Albuquerque, New Mexico, (open from 8:00 a.m. to 9:00 p.m. on Monday through Thursday, 8:00 a.m. to 5:00 p.m. on Friday, 9:00 a.m. to 5:00 p.m. on Saturday, and 1:00 p.m. to 9:00 p.m. on Sunday); 3) EPA's docket in the Fogelson Library of the College of Santa Fe in Santa Fe, New Mexico, located at 1600 St. Michaels Drive (open from 8:00 a.m. to 12:00 midnight on Monday through Thursday, 8:00 a.m. to 5:00 p.m. on Friday, 9:00 a.m. to 5:00 p.m. on Saturday, 1:00 p.m. to 9:00 p.m. on Sunday); and 4) EPA's docket in the Municipal Library of Carlsbad, New Mexico, located at 101 S. Halegueno (open from 10:00 a.m. to 9:00 p.m. on Monday through Thursday, 10:00 a.m. to 6:00 p.m. on Friday and Saturday, and 1:00 p.m. to 5:00 p.m. on Sunday). As provided in 40 CFR Part 2, a reasonable fee may be charged for photocopying docket materials.

XII. How Will the Public be Involved in EPA's Future WIPP Activities?

The EPA's regulatory role at the WIPP does not end with its initial certification decision. The Agency's future WIPP activities will include periodic recertifications, review of DOE reports on activities at the WIPP, assessment of waste characterization and QA programs at waste generator sites, announced and unannounced inspections of the WIPP and other facilities, and possibly modification, revocation, or suspension of the certification for cause. These activities are described above in the preamble section entitled ''EPA's Future Role at the WIPP.'' The EPA has provided for public involvement in these activities through rulemaking procedures, **Federal Register** notices and public comment periods, and by making information available in its public dockets. (See the preamble sections entitled ''Dockets'' and ''Where can I get more information about EPA's WIPP activities?'' for more information regarding EPA's rulemaking docket.)

While a suspension may be initiated at the discretion of the Administrator in order to promptly reverse or mitigate a potential threat to public health, any modification or revocation of the certification will be conducted through rulemaking. (§§ 194.65–66) To modify or revoke the certification, EPA will first publish a Notice of Proposed Rulemaking in the **Federal Register**. This notice will announce EPA's proposed action, describe the basis for the decision, and provide the opportunity for public comment on the proposal. Documentation related to the decision will be made available to the public through EPA's docket. Any final rule on modification or revocation will also be published in the **Federal Register**. In addition, EPA will release a document which summarizes and responds to significant public comments received on its proposal.

The recertification process—EPA's periodic review of the WIPP's continued compliance with the disposal regulations and WIPP compliance criteria—will include many of the same elements as notice-and-comment rulemaking. For example, EPA will publish a **Federal Register** notice announcing its intent to conduct such an evaluation. The certification application for recertification will be placed in the docket, and at least a 30-day period will be provided for submission of public comments. The Agency's decision on whether to recertify the WIPP facility will again be announced in a **Federal Register** notice. (§ 194.64)

Although not required by the APA, the WIPP LWA, or the WIPP compliance criteria, EPA intends to place in the docket all inspection or audit reports and annual reports by DOE on conditions and activities at the WIPP. The Agency also plans to docket information pertaining to the enforcement of certification conditions. For the enforcement of Conditions 2 and 3 (regarding quality assurance (''QA'') and waste characterization programs at waste generator sites), a number of additional steps will be taken. As described in § 194.8 of the WIPP compliance criteria, before approving QA and waste characterization controls at generator sites, EPA will publish a **Federal Register** notice announcing EPA inspections or audits. The requisite plans and other appropriate inspection or audit documentation will be placed in the docket, and the public will be allowed the opportunity to submit written comments. A comment period of at least 30 days will be provided. Thus, EPA's decisions on whether to approve waste generator QA program plans and waste characterization controls'—and thus, to allow shipment of specific waste streams for disposal at the WIPP'—will be made only after EPA has conducted an inspection or audit of the waste generator site and after public comment has been solicited on the matter. The Agency's decisions will be conveyed by a letter from EPA to DOE.

A copy of the letter, as well as the results of any inspections or audits, will be placed in EPA's docket.

XIII. Where Can I Get More Information About EPA's WIPP Activities?

The EPA's docket functions as the official file for Agency rulemakings. The EPA places all information used to support its proposed and final decisions in the docket, which is available for review by the public. For the WIPP certification rulemaking, information is placed in Air Docket Number A–93–02. The official docket is located in Washington, DC, and informational dockets are provided in three cities in New Mexico. (See the ''Dockets'' section of this preamble for more information on the location and hours of EPA's WIPP dockets.) The contents of the docket include technical information received from outside parties and other information considered by EPA in reaching a certification decision, as well as the Agency's rationale for its decision. The technical support documents which describe the basis for EPA's certification decision are discussed below; sources of more general information on EPA's WIPP activities are also addressed.

A. Technical Support Documents

For more specific information about the basis for EPA's certification decision, there are a number of technical support documents available. The Compliance Application Review Documents, or CARDs, contain the detailed technical rationale for EPA's certification decision. This document is found at Docket A–93–02, Item V–B–2.

The CARDs discuss DOE's compliance with the individual requirements of the WIPP compliance criteria. Each CARD is a section in the document which is numbered according to the section of 40 CFR Part 194 to which it pertains. For example, CARD 23 addresses § 194.23, ''Models and Computer Codes.'' Each CARD: restates the specific requirement, identifies relevant information expected in the CCA, explains EPA's compliance review criteria, summarizes DOE's approach to compliance, and describes EPA's compliance review and decision. The CARDs also list additional EPA technical support documents and any other references used by EPA in rendering its decision on compliance. All technical support documents and references are available in Docket A–93–02 with the exception of generally available references and those documents already maintained by DOE or its contractors in locations accessible to the public. (Instructions for obtaining access to DOE documents can be found at Docket A–93–02, Item V–B–1.)

B. WIPP Information Line, Mailing List, and Internet Homepage

For more general information and updates on EPA's WIPP activities, interested citizens may contact EPA's toll-free WIPP Information Line at 1–800–331–WIPP. The hotline offers a recorded message, in both English and Spanish, about current EPA WIPP activities, upcoming meetings, and publications. Callers are also offered the option of joining EPA's WIPP mailing list. Periodic mailings, including a WIPP Bulletin and fact sheets related to specific EPA activities, are sent to members of the mailing list (currently numbering over 800). The WIPP internet homepage, at www.epa.gov/radiation/wipp, provides general information on EPA's regulatory oversight of the WIPP. **Federal Register** notices are also announced on the homepage, and a number of documents (ranging from outreach materials and hearings transcripts to technical support documents) are available to review or download.

XIV. With What Regulatory and Administrative Requirements Must This Rulemaking Comply?

A. Executive Order 12866

Under Executive Order 12866, (58 FR 51735; October 4, 1993), the Agency must determine whether the regulatory action is ''significant'' and therefore subject to OMB review and the requirements of the Executive Order. The Order defines ''significant regulatory action'' as one that is likely to result in a rule that may: (1) have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or (4) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order. Pursuant to the terms of Executive Order 12866, it has been determined that this final rule is a ''significant regulatory action'' because it raises novel policy issues which arise from legal mandates. As such, this action was submitted to OMB for review. Changes made in response to OMB suggestions or recommendations are documented in the public record.

B. Regulatory Flexibility

The Regulatory Flexibility Act (''RFA'') generally requires an agency to conduct a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small not-for-profit enterprises, and small governmental jurisdictions. This final rule will not have a significant impact on a substantial number of small entities because it sets forth requirements which apply only to Federal agencies. Therefore, I certify that this action will not have a significant economic impact on a substantial number of small entities.

C. Paperwork Reduction Act

The EPA has determined that this proposed rule contains no information collection requirements as defined by the Paperwork Reduction Act (44 U.S.C. 3501 et seq).

D. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (''UMRA''), Pub. L. 104–4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local and tribal governments and the private sector. Pursuant to Title II of the UMRA, EPA has determined that this regulatory action is not subject to the requirements of sections 202 and 205, because this action does not contain any ''federal mandates'' for State, local, or tribal governments or for the private sector. The rule implements requirements that are specifically set forth by the Congress in the Waste Isolation Pilot Plant Land Withdrawal Act (Pub. L. 102–579) and that apply only to Federal agencies.

E. Executive Order 12898

Pursuant to Executive Order 12898 (59 FR 7629, February 16, 1994), entitled ''Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,'' the Agency has considered environmental justice related issues with regard to the potential impacts of this action on the environmental and health conditions in low-income, minority, and native American communities. The EPA has complied with this mandate. The requirements specifically set forth by

the Congress in the Waste Isolation Pilot Plant Land Withdrawal Act (Pub. L. 102–579), which prescribes EPA's role at the WIPP, did not provide authority for EPA to examine impacts in the communities in which wastes are produced, stored, and transported, and Congress did not delegate to EPA the authority to consider alternative locations for the WIPP.

The EPA involved minority and low-income populations early in the rulemaking process. In 1993 EPA representatives met with New Mexico residents and government officials to identify the key issues that concern them, the types of information they wanted from EPA, and the best ways to communicate with different sectors of the New Mexico public. The feedback provided by this group of citizens formed the basis for EPA's WIPP communications and consultation plan. To help citizens, including a significant Hispanic population in Carlsbad and the nearby Mescalero Indian Reservation, stay abreast of EPA's WIPP-related activities, the Agency developed many informational products and services. The EPA translated into Spanish many documents regarding WIPP, including educational materials and fact sheets describing EPA's WIPP oversight role and the radioactive waste disposal standards. The EPA also established a toll-free WIPP Information Line, recorded in both English and Spanish, providing the latest information on upcoming public meetings, publications, and other WIPP-related activities. The EPA also developed a vast mailing list, which includes many low-income, minority, and native American groups, to systematically provide interested parties with copies of EPA's public information documents and other materials. Even after the final rule, EPA will continue its efforts toward open communication and outreach.

F. Small Business Regulatory Enforcement Fairness Act of 1996

The Congressional Review Act, 5 U.S.C. 801 et seq., as added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take effect, the agency promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. Section 804, however, exempts from section 801 the following types of rules: rules of particular applicability; rules relating to agency management or personnel; and rules of agency organization, procedure, or practice that do not substantially affect the right or obligations of non-agency parties. (5 U.S.C. 804(3)) The EPA is not required to submit a rule report regarding today's action under section 801 because this is a rule of particular applicability.

G. National Technology Transfer & Advancement Act of 1995

Section 12 of the National Technology Transfer & Advancement Act of 1995 is intended to avoid ''re-inventing the wheel.'' It aims to reduce the costs to the private and public sectors by requiring federal agencies to draw upon any existing, suitable technical standards used in commerce or industry. To comply with the Act, EPA must consider and use ''voluntary consensus standards,'' if available and applicable, when implementing policies and programs, unless doing so would be ''inconsistent with applicable law or otherwise impractical.'' The EPA has determined that this regulatory action is not subject to the requirements of National Technology Transfer & Advancement Act of 1995 as this rulemaking is not setting any technical standards.

H. Executive Order 13045—Children's Health Protection

This final rule is not subject to E.O. 13045, entitled ''Protection of Children from Environmental Health Risks and Safety Risks'' (62 FR 19885, April 23, 1997), because it does not involve decisions on environmental health risks or safety risks that may disproportionately affect children.

List of Subjects in 40 CFR Part 194

Environmental protection, Administrative practice and procedure, Nuclear materials, Radionuclides, Plutonium, Radiation protection, Uranium, Transuranics, Waste treatment and disposal.

Dated: May 13, 1998.

Carol M. Browner,

Administrator.

For the reasons set out in the preamble, 40 CFR Part 194 is amended as follows.

PART 194—CRITERIA FOR THE CERTIFICATION AND RE-CERTIFICATION OF THE WASTE ISOLATION PILOT PLANT'S COMPLIANCE WITH THE 40 CFR PART 191 DISPOSAL REGULATIONS

1. The authority citation for part 194 is revised to read as follows:

Authority: Pub. L. 102–579, 106 Stat. 4777, as amended by Pub. L. 104–201,110 Stat. 2422; Reorganization Plan No. 3 of 1970, 35 FR 15623, Oct. 6, 1970, 5 U.S.C. app. 1; Atomic Energy Act of 1954, as amended, 42 U.S.C. 2011–2296 and 10101–10270.

2. In § 194.2, a definition is added in alphabetical order to read as follows:

§ 194.2 Definitions.

* * * * *

Administrator's authorized representative means the director in charge of radiation programs at the Agency.

3. Section 194.8 is added to subpart A to read as follows:

§ 194.8 Approval Process for Waste Shipment from Waste Generator Sites for Disposal at the WIPP

(a) *Quality Assurance Programs at Waste Generator Sites.* 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) *Waste Characterization Programs at Waste Generator Sites.* 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:

(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 paragraph (c) of § 194.24. 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.

4. Appendix A to Part 194 is added to read as follows:

Appendix A to Part 194—Certification of the Waste Isolation Pilot Plant's Compliance With the 40 CFR Part 191 Disposal Regulations and the 40 CFR Part 194 Compliance Criteria

In accordance with the provisions of the WIPP Compliance Criteria of this part, the Agency finds that the Waste Isolation Pilot Plant (''WIPP'') will comply with the radioactive waste disposal regulations at part 191, subparts B and C, of this chapter. Therefore, pursuant to Section 8(d)(2) of the WIPP Land Withdrawal Act (''WIPP LWA''), as amended, the Administrator certifies that the WIPP facility will comply with the disposal regulations. In accordance with the Agency's authority under § 194.4(a), the certification of compliance is subject to the following conditions:

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

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

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

Condition 4: § 194.43, Passive institutional controls.

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

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

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

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

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

(b) Upon receipt of the information required under paragraph (a) of this condition, the Agency will place such documentation in the public dockets identified in § 194.67. The Agency will determine if a modification to the

compliance certification in effect is necessary. Any such modification will be conducted in accordance with the requirements at §§ 194.65 and 194.66.

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