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Part VI

**Environmental
Protection Agency**

**Department of Energy Waste Isolation
Pilot Plant; Notice of Final No-Migration
Determination**

ENVIRONMENTAL PROTECTION AGENCY

[FRL-3860-1]

Conditional No-Migration Determination for the Department of Energy Waste Isolation Pilot Plant (WIPP)

AGENCY: Environmental Protection Agency.

ACTION: Notice of final no-migration determination.

SUMMARY: In response to a petition from the Department of Energy (DOE), the Environmental Protection Agency (EPA) is today making a determination of no migration for placement of hazardous waste at DOE's Waste Isolation Pilot Plant (WIPP), located near Carlsbad, New Mexico. Today's determination imposes several conditions on such placement and is for a maximum of ten years. As a result of this determination, DOE may place a limited amount of untreated hazardous waste subject to the land disposal restrictions of the Resource Conservation and Recovery Act (RCRA) in the WIPP for the purposes of testing and experimentation. DOE submitted a petition to EPA for a no-migration determination in March 1989; EPA proposed to grant the petition in April 1990. After a careful review of public comments on the proposal, EPA has concluded that DOE has demonstrated, to a reasonable degree of certainty, that hazardous constituents will not migrate from the WIPP disposal unit during the testing period proposed by DOE, and that DOE has otherwise met the requirements of 40 CFR 268.6 for the WIPP. The approved petition requires DOE to remove the hazardous wastes from the underground repository if it cannot demonstrate the long-term acceptability of the disposal site by the end of the test period.

EFFECTIVE DATE: November 14, 1990.

ADDRESSES: The public docket for this determination is available for public inspection in Room M2427, U.S. Environmental Protection Agency, 401 M Street SW, Washington, DC, 20460, Monday through Friday, excluding Federal holidays. Members of the public may make an appointment to review docket materials by calling (202) 475-9327. Copies of docket materials may be made at no cost, with a maximum of 100 pages of material from any one regulatory docket. Additional copies are \$0.15 per page.

FOR FURTHER INFORMATION CONTACT: General questions about the regulatory requirements under RCRA should be directed to the RCRA/Superfund Hotline

at 800-424-9346 (toll free) or 202-382-3000 (local).

Specific questions about the issues discussed in this notice should be directed to Matthew Hale, Office of Solid Waste (OS-341), U.S. Environmental Protection Agency, 401 M Street SW, Washington, DC 20460, at 202-382-4746.

SUPPLEMENTARY INFORMATION:

Preamble Outline

- I. Background
 - A. RCRA Land Disposal Restrictions
 - B. Regulatory Status of Mixed Waste
 - C. WIPP Project
 - D. Regulatory Status of the WIPP
- II. DOE Petition and EPA Proposed Determination
- III. Summary of EPA Determination
- IV. Discussion of EPA Determination and Conditions of Determination
 - A. No-Migration Finding
 - B. Conditions of Determination
 1. Limitation to Testing and Experimentation
 2. Limitation on Volume
 3. Waste Retrieval
 4. Waste Retrievability
 5. Carbon Adsorption Device
 6. Air Monitoring Plan
 7. Waste Analysis
 8. Reporting Requirements
- V. Discussion of Major Issues
 - A. Appropriateness of "Exemption" for DOE
 - B. Timing of EPA Decision
 - C. Scope of Determination
 - D. EPA Oversight over the Test Phase
 - E. Site Suitability
 - F. Conditional Determination
 - G. Definition of No Migration
 - H. Definition of Unit Boundary
 - I. Waste Characterization
 - J. Retrievability
 - K. Human Intrusion
- VI. Conditions of No-Migration Determination

I. Background

A. RCRA Land Disposal Restrictions

The Hazardous and Solid Waste Amendments (HSWA) of 1984, which amend the Resource Conservation and Recovery Act (RCRA), imposed substantial new requirements on the land disposal of hazardous waste. In particular, the amendments prohibit the continued land disposal of hazardous wastes, unless either (1) the wastes meet treatment standards specified by EPA, or (2) the Administrator determines that the prohibition is not required in order to protect human health and the environment. This latter determination must be based on a demonstration by the owner/operator of the facility receiving the waste "that there will be no migration of hazardous constituents from the disposal unit or injection zone as long as the wastes remain hazardous." (RCRA sections 3004(d)(1),

(e)(1), and (g)(5).) The Department of Energy (DOE) has chosen to comply with the land disposal restrictions for certain transuranic (TRU) wastes to be shipped for testing and experimentation at its Waste Isolation Pilot Plant (WIPP) by pursuing the second option. Today's notice approves, with conditions, DOE's petition for the WIPP site.

EPA first promulgated standards and procedures for review of no-migration petitions under 40 CFR 268.6 in November 1986. These regulations, which apply to land disposal units other than underground injection wells, codify the statutory standard for no-migration findings, specify the information required in no-migration petitions, and establish EPA's procedures for approving or denying petitions (November 7, 1986, 51 FR 40572). EPA amended these regulations on August 17, 1988 (53 FR 31138) to add further procedural requirements and standards.¹ EPA is now developing additional no-migration standards to clarify or expand on certain parts of the current regulations. The Agency expects to propose these standards in the near future. In conjunction with this proposal, EPA has also developed draft no-migration guidance, a copy of which is available in the docket for this rulemaking.

To date, EPA has received 31 no-migration petitions submitted in accordance with 40 CFR 268.6. Today's notice, which addresses disposal of mixed radioactive and hazardous waste in a mined salt bed, is the Agency's first decision on any of these petitions under § 268.6. The other § 268.6 petitions, which primarily address land treatment operations, are currently under Agency review. In addition, EPA has received approximately 65 no-migration petitions for underground injection wells under 40 CFR part 148. Of these, 30 have been approved, 26 are still under review, and a number of others have been withdrawn.

B. Regulatory Status of Mixed Wastes

The hazardous wastes that are subject to today's notice are "mixed wastes." Mixed wastes are defined as a mixture of hazardous wastes regulated under Subtitle C of RCRA and radioactive wastes regulated under the Atomic Energy Act (AEA). Because section 1004 of RCRA excludes "source," "special nuclear," and "byproduct materials," as defined under the Atomic Energy Act,

¹ On July 26, 1988, EPA also promulgated standards under 40 CFR part 148 for no-migration determinations for underground injection wells (53 FR 28122).

from the definition of RCRA "solid waste," there has been some confusion in the past as to the scope of EPA's authority over mixed waste under RCRA. EPA clarified this question in a Federal Register notice on July 3, 1986.

EPA's clarification stated that the section 1004 exclusion applies only to the radioactive portion of mixed waste, not to the hazardous constituents. Therefore, a mixture of "source," "special nuclear," or "byproduct materials" and a RCRA hazardous waste must be managed as a hazardous waste, subject to the requirements of RCRA subtitle C (that is, RCRA standards for the management of hazardous waste). EPA's oversight under RCRA, however, extends only to the hazardous waste components of the mixed waste, not to the source, special nuclear, or byproduct materials themselves. The exempted radionuclides are instead addressed under the AEA.² DOE subsequently confirmed and clarified this interpretation in the Federal Register on May 1, 1987. Sections I.D and V.A of this notice further discusses the relationship between the AEA standards and the no-migration finding.

EPA's July 3, 1986 interpretation went into effect immediately in states not authorized to administer the RCRA hazardous waste program—that is, in the ten states and territories where EPA directly regulates hazardous waste under the Federal RCRA regulations. At the same time, the July 3, 1986 notice informed authorized states that they were required to apply for and receive authorization from EPA to regulate mixed waste under RCRA. To date, twenty-three states and territories (including New Mexico, where the WIPP is located) have obtained authority to regulate mixed waste under the state RCRA hazardous waste programs. Thus, mixed wastes are currently regulated as hazardous under Federal RCRA requirements in thirty-three states and territories.

C. WIPP Project

Today's notice addresses mixed waste that DOE intends to ship for testing and experimentation to the WIPP site near Carlsbad, New Mexico, during a preliminary test phase. At the site, the waste will be placed in a mined underground repository, located in a salt bed approximately 2,150 feet below the

² This interpretation, however, does not preclude EPA from requiring data on radionuclide content of wastes where necessary to carry out EPA's authorities under RCRA—for example, to ensure protection of personnel carrying out RCRA inspection or oversight sampling.

earth's surface. Over an approximately five-year period, DOE plans to test and evaluate the behavior of the waste in the repository, as well as the characteristics of the surrounding formation, to determine the site's acceptability for the long-term disposal of radioactive waste. Today's no-migration determination requires DOE to remove the waste from the repository if the site proves to be unacceptable for long-term disposal.

Over the long-term, the WIPP repository has been designed as a permanent disposal site for transuranic (TRU) radioactive wastes resulting from nuclear weapons production at ten DOE sites around the country.³ TRU wastes are defined as wastes contaminated with alpha-emitting radionuclides with an atomic number greater than 92 (that is, heavier than uranium) in concentrations of greater than 100 nanocuries per gram of waste. In addition, TRU wastes by definition have half-lives of more than twenty years, although the actual half-lives of radionuclides in waste to be placed in the WIPP are often hundreds or thousands of years. The TRU wastes targeted for the WIPP consist of a variety of materials, including tools, equipment, protective clothing, rags, graphite, glass, and other material contaminated during the production and reprocessing of plutonium; contaminated organic and inorganic sludges; contaminated process and laboratory wastes; and contaminated items from decontamination and decommissioning activities at DOE facilities. As TRU wastes, these wastes are distinguished from high-level radioactive waste, such as used reactor fuel, and low-level radioactive waste. Other disposal strategies are being developed for high-level and low-level radioactive wastes.

The land in the area of the WIPP is owned by the Federal government and administered by the Bureau of Land Management. The four-mile by four-mile plot of land overlying the repository has been temporarily withdrawn from public use by the Department of Interior; it is now under the control of DOE. Before DOE can bring waste to the site, however, either Congress or the Department of Interior must take new

³ The DOE facilities that intend to send TRU waste to the WIPP are Idaho National Engineering Laboratory, Idaho Falls, Idaho; Rocky Flats Plant, Golden, Colorado; Los Alamos National Laboratory, Los Alamos, New Mexico; Argonne National Laboratory, Argonne Illinois; Savannah River Plant, Aiken, South Carolina; Oak Ridge National Laboratory, Oak Ridge, Tennessee; Hanford Reservation, Richland, Washington; Mound Plant, Miamisburg, Ohio; Lawrence Livermore National Laboratory, Livermore, California; and Nevada Test Site, Mercury, Nevada.

land withdrawal action. The repository is designed to hold TRU wastes that are currently stored at the DOE generating facilities, as well as new TRU wastes that will be generated over the next 25 years. The underground waste disposal area of the WIPP, when completed, will cover 100 acres, with a total design capacity of 6.45 million cubic feet (or approximately 850,000 drums of waste). To date, 15 acres of underground disposal rooms have been mined.

Although DOE has conducted extensive studies of the WIPP site and the repository performance, uncertainties still remain. For example, concerns have been raised over the possibility that gas generated underground at the WIPP could, over the long term, build up to unacceptable pressures, leading to possible releases from the repository. To address this and other questions, DOE plans to conduct testing and experimentation over the next several years. This testing will include in-situ experiments with actual TRU wastes underground, as well as other investigations. These in-situ tests would initially involve wastes amounting to approximately 0.5 percent of the total repository capacity. From these tests, DOE hopes to gather data that will allow it to demonstrate compliance with EPA's standards for disposal of radioactive materials (40 CFR part 191 subpart B) and long-term no-migration of RCRA hazardous constituents, as well as in identifying any engineering modifications that may be necessary to meet these standards. DOE is also considering the need for an "operations demonstration" during the test period. The purpose of this demonstration, which might involve up to an additional three to eight percent of the total WIPP capacity, would be to show DOE's operational readiness to ship waste to the WIPP and to place it underground. (Today's approval does not cover placement of wastes for the purposes of the "operations demonstration." DOE would have to submit for EPA's consideration an amendment to its no-migration petition; any EPA decision on such an amendment would be proposed in the Federal Register, with opportunity for public comment.)

As a condition to today's approved petition, DOE must remove all hazardous wastes from the repository if it is unable to meet EPA standards for permanent disposal of hazardous and radioactive wastes at the conclusion of the test period.⁴ However, if the WIPP

⁴ Under 40 CFR 268.6(a)(5), petitioners seeking a no-migration demonstration must provide sufficient

proves acceptable as a permanent repository, and if DOE successfully petitions EPA for a long-term no-migration determination, DOE will then be able to begin full-scale disposal of waste at the site. Drums, metal boxes, and metal canisters of waste will be shipped to the WIPP from the generating sites and placed in underground rooms. Under current plans, the rooms will be backfilled with crushed salt and sealed. After an operating period of approximately 25 years, DOE plans to seal the shafts of the mine with cement-clay plugs and compacted salt and decommission the facility. After decommissioning, the salt of the Salado Formation will creep inward and is expected to encapsulate the waste within 60 to 200 years.

Access to the WIPP site will be restricted. The Department of Interior temporarily withdrew the lands on the WIPP site from public use in 1983, allowing DOE to begin construction of the facility. Before DOE can bring waste to the site, however, either Congress or the Department of Interior must take new land withdrawal action. In addition, DOE and the State of New Mexico have agreed to prohibit in perpetuity all subsurface mining, drilling, and resource exploration unrelated to the WIPP project at the WIPP site. As a further protection, the Federal government has acquired the entire surface and subsurface estate at the WIPP site. Finally, to discourage drilling in the vicinity of the repository in the distant future, DOE intends to place permanent warning markers at the site.

D. Regulatory Status of the WIPP

The WIPP is located in the State of New Mexico, which received authorization for mixed waste on July 25, 1990. (See 55 FR 28397, July 11, 1990.) As an "existing" hazardous waste management facility at the time of New Mexico's authorization for mixed waste, the WIPP is eligible for RCRA interim status. Facilities "in existence" (which include facilities under construction) at the time a waste is identified as hazardous under RCRA can obtain interim status if their owner/operators submit a part A application to EPA or the appropriate state. If DOE submits an application to New Mexico and secures interim status, it will be legally authorized to receive mixed waste at the

Information to assure the Administrator that the disposal unit will comply with other applicable Federal, State, and local laws. Therefore, if the WIPP cannot comply with radioactive disposal standards under 40 CFR part 191, it would not satisfy the conditions for a long-term no-migration determination.

WIPP—subject of course to the land disposal restrictions. The WIPP must also comply with the RCRA interim status standards, codified at 40 CFR part 265, and eventually obtain a RCRA permit under 40 CFR parts 264 and 270.

The interim status requirements of part 265 establish general facility standards. For example, the WIPP is required under these standards to have a waste analysis plan for its mixed waste, a contingency plan describing procedures that DOE will take in the case of an emergency, and a closure plan describing how the facility will be closed. In addition, the State of New Mexico has recently requested that DOE submit to it the RCRA part B permit application for the WIPP; this application must be submitted no later than six months after the State's request, or by February 28, 1991. The RCRA permit for the WIPP (if granted) will establish detailed operating, closure, and post-closure conditions in accordance with 40 CFR part 264, subpart X. (As a geological repository, the WIPP is regulated under the RCRA category of subpart X "miscellaneous units.") The permit's scope would extend to all facility activities related to mixed waste.

Several commenters on EPA's proposed decision on the WIPP expressed confusion over the relationship between a no-migration decision by EPA and a RCRA permit issued by the State. In explanation, EPA notes that its no-migration determination is relatively narrow in scope, only addressing the question of whether hazardous constituents will or will not migrate from the underground repository. To ensure no-migration, EPA's determination imposes certain conditions (e.g., a volume limitation and retrievability of waste); these conditions will be enforced by EPA. On the other hand, the State RCRA permit is significantly broader than a no-migration finding, since it will impose the full technical and general facility standards of 40 CFR part 264, and it will apply to the above-ground operations as well as operations underground. The permit may include certain requirements already imposed under EPA's no-migration determination, or it may establish more stringent requirements, if the State of New Mexico determines that they are necessary. The State permit will be issued under State procedures, which include public notice, comment, and an opportunity for a public hearing. The conditions of the permit will be enforced by the State.

As discussed earlier, EPA's authority under RCRA over waste destined for the

WIPP extends only to mixed hazardous and radioactive waste, and it is further limited to the hazardous components of the mixed waste. The potential release of radioactive material from the WIPP is addressed under the Atomic Energy Act (AEA). EPA has promulgated standards under the AEA limiting releases associated with the disposal of radioactive wastes. These standards, which are codified at 40 CFR part 191, consist of two parts: Subpart A dealing with releases during the operational phase of a permanent disposal facility, and subpart B, dealing with long-term releases after decommissioning. Under these regulations, a facility is not defined as a disposal site until it has been designated as a permanent repository and removal is not contemplated; since this decision will not be made for the WIPP until after the test phase, the WIPP is not legally subject to the part 191 standards. Under an agreement with the State of New Mexico, however, DOE has agreed to comply with the subpart A standards, beginning with the initial receipt of waste at the WIPP—that is, before the facility has been designated as a permanent repository. The subpart standards also do not yet apply to the WIPP because they have been remanded to EPA by the U.S. Court of Appeals at the First Circuit, and therefore are not in effect at this time. DOE, however, has agreed with the State of New Mexico to demonstrate compliance with the remanded standards (if final standards have not been developed) before a final decision is made to dispose of waste permanently in the repository. This decision will be made on the basis of data gathered during the test phase at the WIPP.

Finally, EPA emphasizes that today's finding addresses only the specific question of whether hazardous constituents will or will not migrate from the WIPP as long as the waste remains hazardous. Issues raised by the transportation of waste to the WIPP site, or by handling and possible treatment of waste before it reaches the WIPP, are beyond the scope of EPA's legal authority in evaluating no-migration petitions, and thus are not addressed in this notice.

II. DOE Petition and EPA Proposed Determination

The mixed waste DOE intends to ship to the WIPP for testing includes solvent-contaminated wastes, which became subject to the land disposal restrictions on November 8, 1986, and characteristic wastes (containing heavy metals such as lead), which became subject to the land

disposal restrictions on August 8, 1990. (However, it should be noted that EPA granted a two-year national capacity variance to mixed characteristic wastes, deferring the effective date of the disposal prohibition until May 8, 1992 (June 1, 1990, 55 FR 22520).) In addition, some mixed wastes are likely to include wastes that are hazardous under EPA's new toxicity characteristics rule (55 FR 11798), although the Agency has not yet promulgated land disposal restrictions for these wastes.

To comply with the land disposal restrictions, DOE has sought to demonstrate to EPA, in a non-migration petition submitted in March 1989, that placement of these wastes untreated in the WIPP repository will not lead to migration of hazardous constituents beyond the disposal unit boundary. In response to EPA concerns, DOE provided additional supporting material after its initial submission, including addenda in October 1989 and January 1990. DOE's final petition was bound into eight volumes in March 1990 (DOE/WIPP 89-003, Revision 1) and is included in the docket for this rulemaking.

After careful review of DOE's petition as well as information from numerous other sources, EPA proposed in the Federal Register of April 6, 1990 to grant DOE's petition with certain conditions. (See 55 FR 13068 for a more detailed discussion of the information provided by DOE and of the basis for EPA's proposed decision.) Under EPA's proposal, DOE would be allowed to place untreated mixed waste in the WIPP repository within the scope of the testing and experimentation activities described in the petition. EPA's proposal would not have allowed DOE to conduct its proposed operations demonstration, nor would it have allowed DOE to conduct two pilot-room tests, which had originally been suggested by EPA. If the testing failed to show that the WIPP could meet the no-migration standards for the long-term disposal of mixed waste, DOE would be required to remove the waste from the underground repository. The proposal also included the following conditions: (1) The waste must be placed in the WIPP in a retrievable form; (2) DOE must provide annual written reports on the test phase progress to EPA; (3) a carbon adsorption device capable of achieving a 95 percent efficiency, must be installed in the discharge system of the bin experiment rooms; (4) DOE must implement a specific air monitoring plan; (5) DOE must certify that it has secured control of the surface and subsurface estate at the WIPP site before wastes can be

placed in the repository;⁶ and (6) during the test phase, DOE must provide detailed waste characterization and analyses on the waste emplaced in the WIPP.

EPA provided a 60-day public comment period on its proposed determination and held public hearings in Carlsbad, Albuquerque, and Santa Fe, New Mexico, during the comment period. The Agency received 103 written comments on its proposal from both individuals and organizations, and more than 300 people testified at the three hearings. Today's decision is based on a careful review of the public's comments and clarifying information provided by DOE, as well as EPA's further evaluation of the suitability of the site based on a field visit to the WIPP site on July 23, 1990.

III. Summary of EPA Determination

After a review of DOE's petition, supporting information, and public comment, EPA finds that DOE has demonstrated, to a reasonable degree of certainty, that hazardous constituents will not migrate from the WIPP repository as a result of its planned test activities, as required by the statute and regulations at 40 CFR 268.6. This determination is based on the condition that DOE only place hazardous waste within the scope of the test phase operations described in its no-migration petition and its performance assessment test plan. Consistent with the determination, EPA is approving DOE's no-migration petition for the WIPP for the test phase operations, subject to the conditions laid out in section VI of this notice. It should be noted that the proposed operations demonstration and pilot room tests cannot be conducted under the terms of today's decision. Before these activities could be carried out, DOE would have to submit an amendment to its no-migration petition, which EPA would evaluate. EPA would then propose a decision for comment before a final decision would be made.

EPA's action today allows DOE to place untreated mixed waste subject to the RCRA land disposal restrictions in the WIPP for testing and experimentation to determine whether the site is appropriate for the long-term disposal of mixed waste (that is, whether disposal at the site will conform with standards for the permanent disposal of hazardous wastes). Only the waste specified by DOE in its petition may be placed in the

⁶ DOE recently secured the last outstanding mineral lease at the WIPP site, thereby satisfying this condition. As a result, EPA has eliminated this condition in its final determination.

WIPP under this determination.⁶ The quantity of waste that may be placed in the WIPP is limited to 8,500 drums, or 1 percent of the facility's final capacity. DOE may not begin permanent disposal of the mixed waste subject to the RCRA land disposal prohibitions at the site and must remove all waste from the underground repository if it cannot demonstrate no migration of hazardous constituents over the long term. (In addition to EPA's requirement that hazardous waste be removed from the repository, DOE has also committed to carry out such a removal in a consent agreement with the State of New Mexico.)

In making its no-migration finding, EPA concentrated on whether releases of non-radioactive hazardous constituents from the repository might occur during the test phase. In doing so, EPA addressed all possible routes of release, but focused in particular on the potential for volatile organic constituents released during testing to migrate out of the WIPP unit through the ventilation exhaust shaft. Because of the nature of the tests that will be conducted in the WIPP and their relatively short duration, EPA has concluded that releases of hazardous constituents from the unit through brine, salt, or other geological media is implausible during the test phase.

The retrievability of waste placed in the WIPP during the test phase is central to EPA's finding. Therefore, EPA has reviewed both the technical feasibility of retrieval and the practicability of DOE's retrieval plan. EPA has concluded that retrieval of wastes from the WIPP can be accomplished safely, and that DOE's commitment to retrieving the wastes and taking it above ground, if it proves necessary, is satisfactory. Finally, EPA considered the general design, construction, and mine maintenance program at the WIPP and has concluded that the mine is well-designed and will remain stable during

⁹ In its no-migration petition, DOE identified listed solvents and EP (Extraction Procedure) characteristic wastes as hazardous under RCRA. In addition, some of the waste described in DOE's petition may now be hazardous under the EPA's recently promulgated Toxicity Characteristics (TC) rule (55 FR 11798). EPA has not yet promulgated treatment standards for TC wastes; however, it is required to do so under the statute. Once these standards have been promulgated, TC wastes placed in the WIPP will be subject to the land disposal restrictions. Because EPA's review of DOE's petition considered potential migration of hazardous constituents from all of the waste DOE identified as scheduled for the WIPP, today's no-migration determination applies to wastes that are hazardous under the TC rule, as well as solvents and EP characteristics wastes, as long as the wastes were included in the petition.

the test period and well beyond. The specific conditions of today's finding are discussed in the following section and listed in summary form in section VI of this notice.

Although EPA's granting of DOE's petition is specifically based on a finding of no-migration of hazardous constituents from the unit during the test phase, EPA has thoroughly reviewed available information on the expected long-term performance of the WIPP repository. Given the geological stability of the area; the depth, thickness, and very low permeability of the salt formation in which the repository has been mined; and the properties of rock salt as an encapsulating medium, EPA believes that the WIPP is a promising site for the permanent disposal of mixed waste. To be sure, a number of uncertainties related to the long-term performance of the WIPP remain—for example, the extent and effects of gas generation, the effects of brine inflow into the repository, and the influence of a "disturbed rock zone" around the mined repository. DOE will be investigating these uncertainties in the test phase at the WIPP, and it will review whether technical modifications to the repository design or the waste are necessary to ensure compliance with the regulatory standards.

It should be remembered that today's decision is only for the disposal of mixed waste during the test phase for testing and experimentation to determine whether the site is appropriate for the long-term disposal of mixed wastes. Before DOE may move from the test phase to full-scale operations, it must petition EPA again and demonstrate no migration over the long term—that is, it must successfully address current uncertainties about long-term WIPP performance. Information gathered by DOE during the test phase will be central to such a demonstration. Any EPA decision to approve (or deny) a no-migration petition for permanent disposal at the conclusion of the test phase will be made with full opportunity for public comment, as prescribed in 40 CFR 268.6(g).

Further technical details regarding EPA's final decision are provided in a background document. In addition, major issues raised by public commenters are discussed in section V of today's notice, as well as in a response to comments document. Both the background document and the response to comments document are available in the public docket for this action.

IV. Discussion of EPA Determination and Conditions of Determination

A. No-Migration Finding

To make a no-migration determination, sections 3004 (d)(1), (e)(1), and (g)(5) of RCRA require EPA to find that "there will be no migration of hazardous constituents from the disposal unit or injection zone as long as the wastes remain hazardous." As EPA explained in the preamble to its proposed decision, it interprets this requirement to mean that constituents listed in appendix VIII of 40 CFR part 261 cannot migrate at hazardous levels from the disposal unit during the time that hazardous waste is present in the unit. If the hazardous waste within the unit becomes non-hazardous or if it is removed from the unit, further migration from the unit ceases to be an issue. In the case of the WIPP, DOE will have to remove all hazardous waste from the underground repository if it cannot demonstrate the long-term acceptability of the site; therefore, the effective period of EPA's finding is the test phase. Thus, EPA's decision today is based on the conclusion that the Appendix VIII constituents will not migrate at hazardous levels from the underground repository during the test phase and that DOE will remove all hazardous waste from the unit if testing cannot show that the site meets long-term no-migration standards.

EPA's no-migration finding for the WIPP test phase falls into several categories: Migration of hazardous constituents under anticipated test conditions in the repository; short-term stability of the repository; feasibility of retrieval; possible effect of accidents and spills; and effectiveness of controls against human intrusion during the test phase. These aspects of EPA's determination are discussed below.

No migration of hazardous constituents beyond the unit boundary. In the proposal, EPA explained in some detail its definition of the unit boundary for the WIPP and its standards for determining whether a constituent migrating from the unit is "hazardous." The proposed unit boundary was the Salado Formation at the WIPP site, bounded by the four-mile by four-mile land withdrawal area, except that, for air emissions during operations, the unit boundary was the point where the air exhaust ventilation shaft met the surface. EPA's definition of the unit boundary in today's decision is largely unchanged from the proposal; however, in response to public comment, it has slightly modified the unit definition as it applies to air emissions. In the final decision, the unit refers to that portion

of the Salado Formation that falls within the WIPP land withdrawal area: specifically, any movement of constituents above "hazardous" levels into overlying or underlying formations, or beyond the lateral boundaries of the land withdrawal area would constitute migration. This unit boundary would apply to migration via air emissions during operations as well as via ground water or other routes after closure of the unit. (This issue is discussed in more detail in section V.H of today's notice.) EPA's definition of "hazardous" levels of migration remains unchanged from the proposal. As discussed below in section V.G, EPA is relying on "health-based levels" to define migration—that is, levels that would be hazardous to a person exposed at the unit boundary for an entire lifetime.

The no-migration standard applies to all possible routes of release from the unit. EPA, however, has concluded that migration of hazardous constituents out of the unit during the test period is implausible by any route other than air. Waste will be containerized during the test period, and even if it were released from a container, there is no possibility that waste could migrate from the unit by ground water or directly through the salt rock within the test period. No commenters questioned this conclusion, which EPA discussed in the proposal.

Potential for Migration via Air Emissions. For air emissions during the test period, EPA's finding is based on a careful review of possible releases from the bin-scale and alcove tests DOE is planning to conduct during the test period. For reasons described below, EPA has concluded that any releases from the alcove-scale tests will be negligible. Therefore, it has focused its attention on the bin-scale tests. In these tests, headspace gases will be vented into the bin discharge system whenever the bins become pressurized through a pressure relief valve installed on each bin. The gases will then be passed on to the exhaust shaft. Because the purpose of the experiments is to gather data on the gas generation potential for the various types of wastes intended for disposal at the WIPP, the rate of gas generation and thus the amount of hazardous constituents expected to be released can only be estimated. Because of this uncertainty, DOE has proposed and EPA's decision today requires the inclusion of a carbon canister in the bin gas discharge system to remove any volatile organic constituents released from the bins. This carbon adsorption control device must be designed to achieve a control efficiency of at least 95 percent. As explained in its proposal,

EPA has taken this control device into account in its no-migration finding for air emissions.

For its assessment of releases from the bin-scale tests, EPA used the concentrations of volatile organic compounds measured in the headspace of 210 drums containing waste generated at DOE's Rocky Flats Plant and stored at the Idaho National Engineering Laboratory. As described in the WIPP no-migration proposal, DOE has been able to provide little or no information on sampling plans, sample handling procedures, or quality assurance/quality control measures for these data. Therefore, EPA views the analytical results on these headspace samples as being semiquantitative. Nevertheless, even if these data underestimate the constituent concentrations by as much as an order of magnitude, the concentration of constituents at the unit boundary are still expected to be below health-based levels.

The results of EPA's assessment are shown in Table 1 below along with levels of regulatory concern.

TABLE 1.—TEST PHASE COMPLIANCE POINT CONCENTRATIONS IN AIR

Constituents	Average headspace concentrations (g/m ³)	Compliance point concentrations (µg/m ³)	Levels of regulatory concern* (µg/m ³)
Carbon tetrachloride.....	1.85	0.0022	0.03
Methylene chloride.....	0.47	0.00069	0.3
Trichloroethylene.....	0.70	0.0010	0.3
1,1,1-Trichloroethane.....	13.2	0.012	10,000
1,1,2-Trichloro-1,2,2-trifluoroethane.....	1.22	0.0018	30,000

EPA conservatively assumed that both test rooms planned for the bin-scale tests are filled to capacity. The capacity of each room is 120 bins; therefore, the total number of bins is 240. EPA then assumed an average gas generation rate of 5 moles per drum per year, a figure that DOE characterizes as representing the upper bound of the range of credible gas generation rates. (Test Plan: WIPP Bin-Scale CH TRU Waste Tests, January 1990; SAND 89-0462). Each bin can hold the equivalent of six drum volumes of waste. Therefore, DOE's upper bound gas generation rate is equivalent to a total gas generation rate from all 240 experimental bins of 0.5 cubic meters per day. DOE has specified the general ventilation rate through the repository as 425,000 cubic feet per minute, which is equivalent to 17 million cubic meters per day. This entire volume of air is exhausted at the exhaust shaft and is available to mix with any gases released from the bin discharge system. The resulting dilution factor at the exhaust

shaft is 34 million. EPA applied the dilution factor to the average headspace concentrations, together with the control device efficiency, to calculate the concentration of constituents in the exhaust shaft.

The compliance point concentrations (with the carbon adsorption control device installed in the bin discharge system) are an order of magnitude below the level of regulatory concern for carbon tetrachloride and are two to seven orders of magnitude below any other level of regulatory concern. These figures represent the bin-scale tests alone; however, the contribution of the alcoves is negligible by comparison. Although it would not be allowable under today's decision, DOE has provided data to show that even when 10 percent of the wastes, equivalent to 85,000 drums are emplaced in the repository before sealing of the rooms, the concentrations in the exhaust shaft would be two to eight orders of magnitude below the levels of regulatory concern.

Because the alcove experiments involve only 3,850 drums (more than a factor of 20 lower), the concentrations in the exhaust shaft from the alcove drums would be a factor of at least three to nine orders of magnitude below the level of a regulatory concern. The actual concentrations would be even lower than this once the alcoves are sealed at the start of the experiment.

EPA recognizes that the actual bin gas generation rate may be higher than 5 moles per drum per year. However, even if the rate were significantly higher, concentrations at the unit boundary would still be below health-based levels, given the requirement for a carbon adsorption system designed for 95 percent efficiency. Therefore, EPA finds that DOE has demonstrated, to a reasonable degree of certainty, that hazardous constituents will not migrate beyond the repository boundary during the test phase at greater than health-based levels.

Short-term stability of the site. In the long term, salt creep will be the primary mechanism to seal the WIPP repository. In the short term, however, salt creep—which can lead to localized fracturing and rock fall—must be mitigated to ensure a stable repository environment. Repository stability has been greatly enhanced during the test phase by several design modifications to the experimental area. The most significant alteration is rockbolting, a standard mining technique to ensure stability. The roofs of all test alcoves and bin test rooms will be rockbolted. This practice alone should prevent excessive cracking

and rockfall during the entire test phase. The effects of early room closure, however, are of greater significance for the test alcoves because they cannot be inspected while the tests are underway, and because drums must be retrievable after the tests have been completed. For this reason, DOE will be reducing the dimensions of the test alcoves, which will slow down the rate of creep closure. Finally, DOE intends partially to backfill several alcoves with crushed salt to simulate disposal conditions. Backfilled test alcoves will be fitted with "stand-off" walls between the backfill and the mine walls, so that room closure does not impinge on the backfilled drums. These modifications ensure the successful retrieval of the drums from the alcoves at the conclusion of the test phase, if it proves necessary.

Feasibility of retrieval. Several commenters expressed concern that retrieval may not be technically feasible, and that, given this uncertainty, EPA cannot assume removal in its no-migration finding. These commenters pointed out specific instances where retrieval might be difficult or infeasible, such as in the case of fire or explosion. They also suggested that creep closure of the test alcoves would preclude removal—an issue discussed in the previous section. Finally, they argued that retrieval from backfilled alcoves has not been demonstrated and that considerable shuffling of waste underground during retrieval may have inherent risks.

EPA has concluded that DOE's Waste Retrieval Plan, in combination with mock retrievals, demonstrates that retrieval is technically feasible. All major aspects of the retrieval process are addressed in the plan, including radiological and hazardous waste contamination control, drum and bin handling, overpacking procedures for corroded or damaged drums, clean up of contamination, and backfill retrieval. While release or leakage of hazardous constituents from containers within the repository during the test period would certainly complicate retrieval, it would not render retrieval technically infeasible. Such events are adequately addressed by emergency response procedures defined for the WIPP. The specifics of the various emergency response procedures are detailed in several DOE publications referenced in the Waste Retrieval Plan. In addition, while EPA agrees with commenters that a fire or explosion would make retrieval more difficult, the Agency is imposing additional conditions to minimize the potential for such an event. (See section V.I.1 of today's notice for a detailed

description of this point.) Thus, adequate safeguards have been imposed and will be implemented in the event of an accidental release of hazardous constituents.

It should be noted that the Waste Retrieval Plan is backed by successful mock retrieval demonstrations, although EPA recognizes that mock retrieval demonstrations performed thus far at the WIPP did not include removal of waste from the alcoves themselves. Other aspects of the removal process, however, were simulated in the retrieval demonstration. Mock retrieval experiments on backfilled alcoves and on bins will be performed before any waste is placed in the WIPP.

EPA agrees with commenters that shuffling of the waste during the retrieval process could increase the risk of a release; however, safe movement of the waste containers is technically feasible, and EPA has concluded that DOE's routine container-management procedures are adequate. Furthermore, any removal activities will be conducted under the oversight of the State of New Mexico, either during RCRA interim status or under permit conditions, which will ensure an appropriate level of care. Finally, the Environmental Evaluation Group, an independent group established by Congress to provide review of the WIPP project, provides oversight over waste management and safety aspects of WIPP operations, including removal.

A number of commenters raised the possibility of drum corrosion during the test phase, which could lead to spillage and complicate retrieval. EPA has concluded, however, that the potential for significant drum corrosion during the test phase is limited and will not substantially affect the retrieval of wastes. While it is true that salt is very corrosive, the rate of corrosion of the drums being stored in the repository is expected to be low. This is because several key factors affecting the rate of drum corrosion allow for favorable drum storage conditions. In particular, the rate of corrosion is affected by the composition of the brine contacting the drums. That is, corrosion proceeds most rapidly if the brine is unsaturated and contains dissolved oxygen. However, the brine in the WIPP repository is both saturated with salt and contains low levels of dissolved oxygen; therefore, drum corrosion would be inhibited. Moreover, the rate of corrosion is directly affected by the amount of brine contacting the drums. Since the repository is expected to remain dry during the test period and thus there will be minimal drum-brine contact, EPA

does not expect the drums to corrode significantly. For these reasons, EPA has concluded that the useful drum life in the WIPP will exceed the period of this determination, including retrieval time, and it sees no reason to question DOE's statement that the drums will maintain integrity for twenty years.

In addition, EPA notes that containers at the WIPP will be subject to monitoring and inspection procedures required under RCRA 40 CFR part 265 (and, once a permit has been issued, under 40 CFR part 264). These requirements will be administered by the New Mexico Environmental Improvements Division, with EPA oversight. If any questionable drums were identified, mitigative measures—such as overpacking—could be undertaken. To be sure, drums that are sealed in the alcoves during the alcove tests cannot be routinely inspected. However, under DOE's test plan, these tests are expected to last approximately five years. Thus, inspection would be possible well within the useful life of the drum.

Finally, as EPA discusses in this and the following section, spillage from drums (however unlikely) can be contained and cleaned up, and corroded drums can be overpacked. Thus, EPA disagrees with commenters that drum corrosion might prevent the safe removal of drums from the WIPP, if removal proves necessary.

Limited effect of accidents and spills. Numerous commenters argued that accidents or spills at the WIPP site would complicate retrieval of wastes or might lead to migration. EPA agrees that accidents or spills might complicate retrieval, but it has nevertheless concluded that the cleanup of spills and the removal of contaminated material from the WIPP is technically feasible. The WIPP Retrieval Plan outlines DOE's planned approach to the removal of contaminated material; in addition, the feasibility of safe removal of such material was demonstrated in DOE's mock retrievals. Moreover, neither EPA nor public commenters identified any spill situations that by themselves would lead to a release from the repository.

EPA has addressed the possibility of fire or explosion in the WIPP by new waste characterization requirements in today's decision. Under these requirements, DOE must test every container shipped to the WIPP for flammable gases. If flammable gases are identified, the waste cannot be placed in the repository. Therefore, under the terms of EPA's determination, explosion or fire in the WIPP is not a credible

event. (After DOE has developed a greater body of data on wastes shipped to the WIPP, it is likely that waste characterization requirements addressing flammability can be relaxed. However, this could only take place through a modification of the determination, with opportunity for public comment.)

Effectiveness of controls against human intrusion. During the period covered by today's determination, DOE will maintain active control over the WIPP site, and unauthorized access will be prohibited. Furthermore, the site will be operating under RCRA interim status and permit conditions, administered by the State of New Mexico, and therefore will have to comply with the RCRA security requirements. These requirements include prevention of unknown entry of persons or livestock to the active portion of the facility. Finally, DOE has secured all mineral leases at the WIPP site, eliminating the possibility of the disturbance of the repository as a result of mining or drilling. For these reasons, the Agency has concluded that migration resulting from human intrusion will not occur during the term of the determination.

B. Conditions of Determination

1. Limitation to Testing and Experimentation

In EPA's proposed finding, it limited activities involving mixed waste at the WIPP repository to the testing and experimentation described in DOE's petition and referenced documents. The Agency has retained this condition in its final determination. Consequently, DOE will be restricted to its planned test phase activities, as described in the "WIPP Test Phase Plan: Performance Assessment," Revision O (DOE/WIPP 89-011, April 1990). Before DOE could conduct activities beyond the scope of this test plan, it would have to petition EPA to modify its no-migration finding.

Several commenters on the proposal expressed uncertainty about what specific activities would fall under the definition of "testing and experimentation"; in addition, the commenters asked for clarification of when DOE would have to notify EPA of changes from activities described in the performance assessment test plan.

With respect to the first point, DOE could conduct in the repository only those tests or experiments designed to provide data to demonstrate the long-term acceptability of the WIPP. Thus, DOE's planned "operations demonstration" has been explicitly excluded from the allowed activities;

other nontesting activities would similarly be excluded. For clarification, EPA has modified this condition, which originally read "placement of waste for the primary purpose of conducting an operations demonstrated is prohibited under this variance * * *," by dropping the word "primary." Several commenters suggested that the inclusion of the word "primary" amounted to an invitation to DOE to conduct a full-scale operations demonstration with the excuse that some testing was also going on. This was not EPA's intention, and therefore it has modified the condition accordingly. EPA, however, stresses that it does not understand this condition as preventing DOE from incidentally testing some operational aspects of its system when it places waste underground for permissible testing. Such activity, in EPA's view, would not constitute an "operations demonstration" in the sense that DOE as well as DOE critics have used the phrase up to this point. In addition, EPA recognizes that some mixed wastes might be generated underground as a result of legitimate experimentation or air monitoring in the WIPP repository. These wastes, which might no longer have any experimental purposes, could nevertheless be stored in the repository until a final determination on the site was made. Because the materials were originally placed in the WIPP for permissible testing, continued storage of the wastes in the repository would be consistent with the terms of EPA's decision.

With respect to the second point, tests and experiments conducted under today's determination would have to be consistent with the activities described in DOE's performance assessment test plan and its no-migration petition. For example, where substantially different wastes or waste containers are used, where waste volumes were increased above 0.5 percent (but less than one percent), or where tests outside DOE's planned three-phase bin and alcove-scale tests are contemplated, DOE would be required to notify EPA and, if the changes might affect the basis of EPA's finding, seek a modification to that finding. The only exception to this would be those wastes that are described in DOE's no-migration petition that are modified through various treatment technologies; because the composition of these wastes, if changed, would contain fewer toxic constituents, the Agency does not believe it would have to be notified before the wastes could be placed in the repository. EPA does note, however, that the pilot-room tests originally

suggested by EPA and now contemplated by DOE, would be excluded under today's decision, because they go substantially beyond the program described in DOE's test plan and furthermore are inconsistent with other conditions of the determination (e.g., the volume limit and retrievability of wastes).

2. Limitation on Volume

In its proposed determination, EPA did not set a specific limit on the amount of mixed waste that DOE could place in the repository during the test phase. Instead, EPA argued that, because of the experimental nature of the test phase, DOE needed a reasonable degree of flexibility in carrying out its experimental program. Although several commenters supported EPA's approach, many opposed it, arguing that it was open-ended and allowed DOE to expand the scope of the test phase indefinitely. Although EPA continues to believe that its no-migration finding, as proposed, significantly restricts the nature of DOE activities during the test phase, the Agency nonetheless understands the concerns of the commenters. Therefore, it has decided to place a volume limitation of 8,500 drums or 1 percent of the total projected WIPP volume on wastes that can be placed in the repository under this determination.

In setting a volume limit, EPA notes that DOE's "WIPP Test Phase Plan" called for bin and alcove-scale testing of waste amounting to 0.5 percent of the projected WIPP capacity, while in Congressional testimony, DOE indicated that bin, alcove, and pilot-room tests might require waste amounting to approximately 2 percent of the WIPP capacity. Because EPA has determined that the pilot-room tests, as currently planned, could not be conducted under the proposed no-migration finding, it believes that the 2 percent volume limit would be inappropriate. At the same time, EPA also believes that limiting DOE to the amounts specified in the current test plan might not provide sufficient flexibility for DOE to modify those plans, particularly in response to comments from reviewing organizations. Consequently, EPA has decided to impose a limit of 1 percent of total WIPP capacity (or 8,500 drums); a figure that provides some flexibility to DOE and at the same time gives the public assurance of an opportunity to comment if significant increases over DOE's proposed waste volumes are needed.

EPA emphasizes that it is not basing the 1 percent limit on any technical determination of how much waste would be necessary for DOE to carry out an adequate testing program. Rather,

EPA in effect is defining a limit that it would consider to be a significant departure from the activities described in DOE's no-migration petition and its final test plan. Before DOE could exceed that limit, it would have to re-petition EPA, and any EPA approval of an expanded test program would have to undergo public comment. EPA also emphasizes that the 1 percent figure represents an upper limit on the amount of waste that may be placed in the WIPP under today's determination. This limit would not override the condition that waste could be placed in the WIPP only for testing and experimentation within the scope of DOE's test plan. Waste would not be allowed in the repository for purposes other than testing and experimentation, even if the volume of waste involved did not exceed the 1 percent limit.

Many commenters also suggested that EPA shorten the proposed ten-year expiration date for petition approval. EPA has not adopted this suggestion, because, as it discussed in the proposed decision, it believes such a limit might artificially constrain legitimate testing. EPA does not believe the difference between five years (the projected length of DOE's test phase) and ten years is significant in terms of the likelihood of release of hazardous constituents from the repository. Furthermore, it has concluded that this difference in time will not significantly effect retrievability. However, EPA acknowledges that the timing and procedures for removal of waste if DOE is not able to demonstrate the long-term acceptability of the WIPP at the close of the ten-year period was not clear in the proposed finding. Therefore, the Agency has amended the conditions of the finding to address this concern. This issue is discussed below.

3. Waste Retrieval

The requirement that DOE retrieve wastes from the repository if it cannot demonstrate the long-term acceptability of the site remains unchanged from the proposal. As discussed above in section IV.A, EPA has found such retrieval to be feasible within the general parameters of the plans submitted with the petition. In addition, EPA has added a clause spelling out in more detail the timing of retrieval. Under this requirement, DOE must submit to EPA a specific retrieval schedule no later than six months after it is determined that the WIPP cannot meet the long-term disposal standards, or six months before the expiration of the petition approval (*i.e.*, 10 years after petition approval), whichever comes first. This schedule would have to detail

retrieval procedures and include a schedule for the removal of the waste as rapidly as technically feasible. Before retrieval took place, the plan would be subject to public comment and EPA approval.

4. Waste Retrievalability

DOE is required to place all waste in the repository in a readily retrievable manner. This condition is unchanged from the proposal. By "readily retrievable," EPA means adoption of the specific measures identified in DOE's petition to maintain room stability (*i.e.*, room sizing, rock bolting), the use of easily retrieved waste containers (*e.g.*, boxes, bins, and drums), and the absence of backfilling—except in alcove tests where standoff walls will be used. (EPA notes that testing in pilot-scale rooms, which the Agency originally suggested and DOE is now considering, would not be allowed under this condition, because—as currently planned—they would involve backfilling of waste in the pilot rooms without standoff walls. DOE would have to seek a modification of the no-migration finding, with opportunity for public comment, before conducting such tests.)

5. Carbon Adsorption Device

Today's decision requires DOE to install a carbon adsorption control device in the bin discharge system of each room designed to achieve a 95 percent control efficiency. The Agency believes a 95 percent control efficiency is readily achievable. (See 55 FR 25454.) The design must be based on a total design gas volume consisting of a design gas generation value of at least 5 moles per drum per year from the bins and the volume of gas used to purge the bin exhaust manifold. EPA also wishes to clarify that the design value for the frequency of carbon replacement must be verified by testing and modified as needed to prevent breakthrough from occurring. The testing must consist of measurements of the adsorption capacity of carbon for the bin exhaust gases, as described in the petition. EPA is also requiring DOE to maintain design records, including any test data, and operating records in the facility operating record, as described in the notice of the proposed decision. (See 55 FR 13068, Section IV.J.) Records must be maintained for the term of today's determination (*i.e.*, ten years from today's date), or three years after the creation of the records, whichever is longer. In addition, the records must be maintained during the course of any enforcement action for which they are relevant.

EPA is not requiring DOE to perform testing to verify the control efficiency of the carbon bed. However, DOE must monitor the bin exhaust manifold to show that no migration above health-based levels occurs at the unit boundary. This must be further confirmed by monitoring at the exhaust shaft. Although the 5 moles per drum per year design value for gas generation is believed to be conservative, the overall average rate of gas generation from TRU wastes is not known with certainty; this is the purpose of the bin and alcove tests. The control efficiency actually achieved will be higher or lower depending on the rate at which gas is generated during the tests. However, even if gas generation rates were to be as high as 25 moles per drum per year, the design would still achieve the no-migration standard.

6. Air Monitoring Plan

EPA is requiring air monitoring for activities conducted under today's no-migration finding to confirm that there is no migration of hazardous constituents above health-based levels beyond the unit boundary. As described in its notice of proposed decision (55 FR 13068), EPA has concluded that the only possible migration pathway during the test phase is through the exhaust shaft. Therefore, in accordance with the requirements of 40 CFR 268.6(c), the Agency is requiring DOE to implement the air monitoring plan submitted with its petition, subject to the clarifications, modifications, and reporting requirements described in the notice of proposed decision, except as noted below.

In its proposed decision, EPA solicited comment on whether additional monitoring should be conducted in the underground repository with portable explosimeters to detect any buildup of methane, hydrogen, or other flammable gases. No comments were received in favor of portable explosimeters. Therefore, EPA has decided not to require their use. At the same time, however, EPA has determined that only by testing individual waste containers to be placed in the WIPP can it be assured that no fire or explosion hazard exists. Thus, EPA is including an additional condition requiring such testing, as described in section IV.B.7.a of today's notice.

EPA also solicited comment on whether to allow a reduction in monitoring frequency from weekly to monthly. EPA received no comments on this question and has decided to retain a weekly minimum monitoring frequency. Furthermore, EPA solicited comment on whether other constituents, in addition to the five constituents proposed, should

be targeted for routine quantitation. No comments were received on this question; therefore, EPA has decided to retain the five target constituents listed in the notice of proposed decision, with provisions for targeting additional constituents, as described in the proposal.

In the proposal, EPA spelled out a variety of quality assurance and quality control requirements, making mention of the "Report on Minimum Criteria to Assure Data Quality." Since that time, EPA has revised this report and has retitled it "Quality Assurance and Quality Control" (August 1990), a copy of which has been placed in the docket to this rule. Therefore, EPA is requiring DOE to follow the requirements of the revised report, in addition to adhering to the specific quality control requirements described in the DOE monitoring plan and EPA's notice of proposed decision. EPA wishes to clarify that it intends the "method limit of quantitation," the term used in the notice of its proposed decision, to be synonymous with the term "method detection limit," or MDL, used in the report, "Quality Assurance and Quality Control." In addition, EPA is requiring DOE to maintain documentation of all aspects of quality assurance and quality control, as described in the revised report, in the WIPP facility operating record; this documentation must be available for inspection by the Agency. The records must be maintained for the term of today's determination or three years after they are created, whichever is longer. In addition, the records must be maintained during the course of any enforcement action for which they are relevant.

Initial monitoring results underground at the WIPP have revealed significant background levels of 1,1,1-trichloroethane and carbon tetrachloride.⁷ The levels measured can interfere with the evaluation of accuracy if the approach described in the notice of proposed decision is used. Therefore, EPA is changing the method by which relative accuracy is determined. Instead of computing accuracy based on a matrix spike alone (as the relative difference between the concentration recovered from the sampler and the concentration of the targeted analyte as determined from the known concentration in the audit gas cylinder), the computation should be adjusted for

⁷ Significant levels of methylene chloride were also detected in background samples. However, laboratory contamination is the most likely explanation for the measured levels of methylene chloride.

the actual background concentration measured in a matrix duplicate at the time the matrix spike is collected. Therefore, DOE must collect and analyze both a matrix spike and a concurrent matrix duplicate.

EPA further solicited comment on what specific quality assurance (QA) objectives it should require for data acceptability. DOE requested that EPA allow less accurate measurements at concentrations near the detection limit. The data provided by DOE, however, gave no basis for establishing an alternative QA objective for accuracy, due to high background levels. Because of this, and because EPA is not requiring data that are below the method detection limit (MDL) to be used in the evaluation of relative accuracy (the MDL is generally considerably higher than the limit of sensitivity of the analytical procedure), EPA has concluded that the plus or minus 10 percent requirement can be achieved. Therefore, no change is being made to the QA objectives established in the notice of proposed decision.

Finally, EPA proposed to require calibration of the ventilation exhaust fans on a quarterly basis. In its comments on the proposal, DOE interpreted this to mean a full dynamic calibration, which it argued is needed only on a yearly basis. EPA means to require only a check on the fan calibration on a quarterly basis, using the methods described in the notice of proposed decision. EPA agrees that a full calibration is needed only on a yearly basis.

Several commenters expressed concern that EPA is allowing monitoring at the top of the exhaust shaft instead of at the entrance to the shaft. They argued that EPA should require DOE to monitor the entrance and exit of the shaft to demonstrate EPA's statement that there will be no difference between measurements. EPA disagrees with these commenters. Even if, as suggested by one commenter, the integrity of the concrete shaft liner were compromised, it is inconceivable that any depletion of concentrations of hazardous constituents could be detected, given the large volume of air that the exhaust shaft is designed to handle during operation. EPA's overriding concern regarding the specific location of the exhaust shaft monitoring station is that it be situated so as to enable ready access for operation and maintenance purposes. Indeed, EPA views ready accessibility as one of a number of important quality assurance objectives. Therefore, EPA continues to accept

monitoring at the top of the exhaust shaft.

7. Waste Analysis

a. *Flammability.* EPA received a number of comments that flammable gases could build up in waste containers, creating a fire and explosion hazard. After reviewing these comments and new information made available during the public comment period, EPA has concluded that, while a fire or explosion is unlikely, the possibility of accidental ignition of flammable gases in waste containers cannot be ruled out. Were a fire or explosion to occur as a result of accidental ignition of flammable gases in the void space of a waste container, retrieval could be much more difficult, should retrieval become necessary. Moreover, such an event could itself cause migration above hazardous levels beyond the uniboundary.

For these reasons, EPA believes that no waste container should be emplaced in the underground repository if it contains flammable mixtures of gases in any layer of confinement, or mixtures of gases that could become flammable when mixed with air. To assure a sufficient margin of safety, EPA defines any mixture as potentially flammable if it exceeds 50 percent of the lower explosive limit (LEL) of the mixture in air.

To ensure that individual waste containers have met the prohibition on flammable gases, the Agency is requiring that every waste container be tested for hydrogen, methane, and volatile organic compounds (VOCs) as a class. Given the heterogeneity of the waste package, the Agency is also requiring that headspace sampling be representative of the entire void space of the waste container. EPA expects that all layers of confinement in a container will have to be sampled until DOE can demonstrate to the Agency, based on the data collected, that sampling of all layers is either unnecessary or can be safely reduced. The testing of wastes that exhibit high rates of radiolysis should be performed a relatively short time before the container is actually emplaced underground. Otherwise, hydrogen levels could build up to flammable levels following sample collection and analysis. Therefore, DOE must determine, and document, the length of time that headspace gases can be expected to remain below flammable levels (i.e., 50 percent of the mixture LEL) after sampling has been performed, for both newly generated and retrievably stored wastes, and to ensure that the waste containers are emplaced in the WIPP within that time.

If testing reveals the presence of significant levels of flammable VOCs, DOE must perform an explicit flame test to determine if a flammable mixture can be formed with air. Significant levels of flammable VOCs are defined as measured concentrations (excluding methane) of 500 parts per million or greater. If testing shows that VOCs are insignificant, i.e., below 500 parts per million, DOE may determine the lower explosive limit of the mixture from the lower explosive limits of methane and hydrogen using the Le Chatelier formula, as described in Section V.I.a of today's notice.

All testing must satisfy the quality assurance and quality control requirements described in EPA's report "Quality Assurance and Quality Control" (August 1990) and must meet quality assurance objectives of plus or minus 10 percent on precision and accuracy. DOE must also maintain records on all testing performed and other documentation needed to comply with this condition at the generating site or in the WIPP facility operating record. These records must be available for inspection by EPA, and must include documentation of all aspects of quality assurance and quality control, as described in the above-referenced document. Records must be maintained for the term of today's decision, or three years after they are generated, whichever is longer. They also must be retained for the duration or any enforcement action related to this part of today's decision.

b. *RCRA Constituents—Short-term characterization.* In response to comments regarding the accuracy of the waste composition estimates provided by DOE in its no-migration petition, EPA is modifying its proposal to require that DOE analyze headspace gases in containers that are shipped to the WIPP and compare the results of this analysis to the estimated values provided in the no-migration petition. Since it was the values in the petition that EPA evaluated in today's decision, DOE must ensure that the analytical data derived from the actual test-phase wastes are similar to the petition estimates. Wastes that are not compositionally similar may not be placed in the WIPP.

(1) *Bin-scale tests.* DOE must compare actual measurements of headspace concentrations of volatile organics in each of the drums containing wastes to be used in the bin-scale tests to the headspace concentrations reported in DOE's petition. The comparisons must be made in terms of both maximum and mean concentrations. (EPA considers only headspace concentrations to be

necessary because migration through air was determined to be the only viable route of migration during the test phase.)

The comparison of the maximum concentrations is designed to ensure that the wastes to be emplaced in the WIPP are in fact similar to the wastes described in the petition. In its proposed decision, EPA noted concerns with the precision and accuracy of some of the analytical data in the petition and took this uncertainty into account during its evaluation. To address concerns over the quality of its data, DOE will be conducting an extensive characterization program on wastes to be shipped to the WIPP for the bin-scale and alcove tests under greatly improved quality assurance/quality control (QA/QC) procedures. (See e.g., DOE's Pre-Test Waste Characterization Plan, Revision 8, in the docket to today's decision.) Because of improved data quality, EPA expects these new data to differ somewhat from those contained in the petition. However, the Agency believes that the measured maximum concentrations identified in individual drums in DOE's pretest waste characterization program should be generally comparable to the maximum values reported in the petition.

There are no established criteria for quantitatively defining "comparability" in this context. EPA, however, has concluded that, if the measured headspace concentration in a given drum are no more than a factor of two over the maximum reported for the drum in the petition, the wastes are reasonably comparable. In selecting a factor of two, EPA notes that some differences between the new data and that contained in the petition are expected. This is because the new data will represent a larger sample and analytical results may be more accurate. (As noted in EPA's proposal, the precision and accuracy of the analytical data in the petition were not always well documented.) For these reasons, EPA has concluded that it is reasonable to expect some concentrations will be measured that will exceed the maximum values reported in the petition. EPA, however, also believes that the data should not be significantly different and concludes that a factor of two represents a reasonable expectation.

Accordingly, DOE may place the contents of individual drums into bins for the bin-scale tests if the measured headspace concentrations do not exceed the reported maximums by more than a factor of two.⁸ Testing and verification

must be completed before the waste is shipped to the WIPP. If the measured concentration of any of the pertinent hazardous constituents in a drum headspace exceeds the allowable maximum, the contents of the drum from which the sample was collected cannot be shipped to or emplaced in the WIPP, unless DOE subsequently treats the waste so as to reduce headspace concentrations to below the maximum levels. Alternatively, DOE may petition EPA to modify the conditions of its determination. Any such modification would require public comment. Further, DOE must maintain records of all relevant test data at the generating site or the WIPP for the term of today's determination, or three years after the data are generated, whichever is longer. In addition, records must also be retained for the duration of any enforcement action for which they are relevant.

The maximum allowable concentrations for hazardous constituent by waste type (the maximum reported concentrations multiplied by two) are presented in Table 2.

TABLE 2.—MAXIMUM HEADSPACE CONCENTRATIONS

[In volume percent]

Constituent	Type I	Type II	Type III	Type IV
Carbon tetrachloride.....	0.08	0.16	0.58	8.18
Methylene chloride.....	0.44	0.84	0.50	1.42
1,1,1-Trichloroethane.....	1.88	5.68	2.12	14.96
Trichloroethylene.....	0.08	0.34	0.28	0.28
1,1,2-Trichloro-1,2,2-trifluoroethane.....	0.05	1.62	5.74	20.80

EPA's no-migration finding for air releases was based upon the mean headspace concentrations of volatile constituents reported by DOE. Accordingly, EPA has concluded that comparison of the new, pre-test characterization data with the mean concentrations reported in the petition is also necessary to ensure that EPA's estimates of volatile emissions are valid for the actual test-phase wastes. In determining a reasonable factor for this comparison, EPA considered the "safety margin" indicated by the no-migration demonstration. For the constituents of concern, this safety margin ranges from approximately eleven to well over sixteen million, varying by constituent. EPA has no reason to believe that the

representative of the entire headspace within the drum, including the headspace within inner bags.

headspace concentrations for 1,1,1-trichloroethane and 1,1,1-trichloro-1,2,2-trifluoroethane (with safety factors of six and seven orders of magnitude, respectively) could be high enough to alter the no-migration finding. For the other constituents (carbon tetrachloride, methylene chloride, and trichloroethylene), the safety factors are lower (one, two, and two orders of magnitude, respectively). EPA, therefore, has concluded that DOE must compare the new headspace data for these constituents to the mean values reported in the petition.⁹ To ensure that the no-migration finding remains valid for these constituents, EPA is requiring that the mean values for the test phase wastes cannot exceed ten times the mean values reported in the petition.

EPA is confident that the factor of ten (back-calculated from the modeling for carbon tetrachloride) is sufficiently conservative for all three of the constituents. Even though no additional safety factor has been added for carbon tetrachloride, EPA notes that the modeling upon which the calculation was based contains several conservative assumptions (e.g., that both test rooms are filled to capacity). EPA also notes that, during the test phase, emissions will be monitored and it will be clear well in advance if emission levels are approaching the no-migration limits, and corrective measures could be taken. Therefore, EPA is comfortable with a safety factor of ten for the comparison of the mean values.

DOE must compare the predicted mean values (multiplied by ten) against the average of the measured concentrations of the headspaces of all drums of a single waste type used to make up each bin. That is, the mean from the population of drums going to each bin (by waste type) must be compared with the reported mean for that waste type. If the calculated mean exceeds the reported mean by more than a factor of ten, that bin cannot be emplaced at the WIPP under today's decision. Testing and verification must be completed before the waste is shipped to or emplaced in the WIPP. As with comparisons of maximum concentrations, DOE must maintain records of all relevant test data at the generating site or at the WIPP facility for the term of today's determination, or for three years after generation, whichever is longer.

The allowable average concentrations for each waste type in drums to be used

⁸ As with the condition related to flammability discussed previously, DOE must demonstrate that samples collected for these analyses are

⁹ See footnote 8.

in a single bin are presented in Table 3.¹⁰

TABLE 3.—MEAN HEADSPACE CONCENTRATIONS

[In volume percent]

Constituent	Type I	Type II	Type III	Type IV
Carbon tetrachloride.....	0.24	0.26	0.30	6.90
Methylene chloride.....	0.39	0.42	0.33	0.93
Trichloroethylene.....	0.25	0.28	0.29	0.36

(2) *Alcove tests.* EPA has found emissions from the alcove tests to be inconsequential in comparison to the bin-scale tests. Accordingly, EPA is not requiring testing of the headspace of drums used in the alcove tests to demonstrate comparability with reported concentrations in DOE's petition.¹¹ Before any drums can be shipped to the WIPP for alcove tests, however, DOE must verify (by waste type), through results of the bin-scale tests conducted up to that point, that the measured mean concentrations for specific hazardous constituents do not exceed the reported mean values by more than a factor of ten. (See Table 3.) (This condition would not require DOE to conduct all bin-scale tests before the alcove tests could proceed; however, based on discussions with DOE, EPA believes that most of the bin-scale tests will be conducted before the alcove tests begin.) EPA is also not requiring DOE to test the drums to determine maximum concentrations for specific hazardous constituents, because it believes that sufficient data will have been compiled from tests conducted in bin-scale drums to determine if there is a concern. In this regard, EPA notes that the drums for both the bin-scale and the alcove tests will be randomly selected from the population of each appropriate waste type. Therefore, there is no reason to believe that the wastes used in the alcove tests will be any more or less accurately characterized by the data in the petition than will be the wastes used in the bin-scale tests. For this reason,

¹⁰ The allowable concentrations are the reported mean concentrations for each waste type multiplied by ten. In calculating the mean headspace concentrations, EPA used one-half the detection limit indicated in the no-migration petition to represent concentrations where the constituent was not detected.

¹¹ Although today's decisions does not require DOE to characterize RCRA constituents in the drums to be used in the alcove tests, DOE has informed EPA that it intends to test some statistical number of drums that are to be used in the alcove test. In addition, as discussed earlier, DOE will be required to test the headspace of drums used in the alcove tests for flammability.

EPA has concluded that the data collected from the drums selected for the bin-scale tests can be appropriately extrapolated to the drums for the alcove tests.

c. *RCRA Constituents—Long-term characterization.* In its proposed decision, EPA expressed some concern over the limited waste characterization data provided by DOE in support of its petition. While EPA concluded that the data were sufficient for the no-migration demonstration for the test phase, it also believed that further characterization was required, before any finding could be made for the operational and post-closure phases. EPA believes that this further characterization will be necessary both to further confirm DOE's estimates of waste composition and to ensure that the wastes are sufficiently similar to allow the results of test-phase experimentation to be extrapolated to the wastes that DOE wishes to emplace at the WIPP in the operational phase. That is, the Agency wished to ensure that the test-phase wastes are accurately represented by the estimates and are representative of the remainder of the wastes.¹² In addition, more accurate source term data may prove necessary, EPA believes, in long-term modeling exercises. Toward these ends, the Agency proposed to require DOE to report all characterization data that will be collected.

After carefully reviewing public comments, EPA continues to believe that the data provided by DOE in its petition are sufficient for its finding with respect to the WIPP test phase, where air emissions are the major concern (especially given the standards on headspace concentrations and flammability imposed in today's decision). The additional waste characterization data under development by DOE during the test phase will be important for any review of a subsequent no-migration petition for operational and post-closure periods, where groundwater migration and other issues may arise; however, the data are not needed for today's decision.

¹² By "representative," EPA is referring to those factors that should contribute to migration of hazardous constituents. The purpose of the test-phase experiments is to evaluate gas-generation processes and provide a database of information that can be used to predict gas generation potential of the wastes that are planned to be emplaced during the operational phase. Thus, the issue of whether the test-phase wastes are "representative" deals with whether the results of the test-phase experiments can be extrapolated to the remaining wastes. To that end, DOE's approach is based upon an "envelope" or "bounding" concept wherein wastes whose characterization (for gas-generation potential) is within that envelope would be considered "represented" by the test-phase wastes.

Accordingly, EPA has not included detailed requirements for waste characterization of the test-phase wastes (beyond the headspace concentrations and flammability limits) or of wastes generated at the ten DOE sites as a condition for today's final decision. However, DOE is developing waste characterization plans, including sample collection, preservation, and analytical procedures, to demonstrate the extent to which the test phase wastes are representative of the other wastes from the ten sites, and to confirm the actual levels of RCRA constituents in headspace gases and sludges. If certain wastes that are generated at the ten sites are not represented (as defined in footnote 12) by the wastes that were tested during the test phase, they could not be shipped to the WIPP without further Agency evaluation, including the possibility for public comment or treatment of the waste.

Over the past several months, EPA—and the state of New Mexico—has reviewed a number of documents concerning DOE's pre-test waste characterization plans. EPA will continue to provide comments to DOE to assist DOE in evaluating whether the waste characterization data that DOE will be collecting are sufficient to make a long-term finding for the WIPP. If adequate data are not collected, EPA will not be in a position to approve any no-migration petition for the operational and post-closure phases, if DOE submits such a petition. At a minimum, the wastes should be analyzed for the following constituents:

Acetone	Hydrazine
Benzene	Methanol
Bromoform	Methylene chloride
Butanol	4-Methyl-2-pentanone
Nitrobenzene	1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane	Trichloroethylene
Tetrachloroethylene	1,1,2-Trichloro-1,2,2-trifluoroethane
Toluene	1,3,5-Trimethylbenzene
2-Butanone	1,2,4-Trimethylbenzene
Carbon tetrachloride	m-Xylene
Chloroform	o-Xylene
Chlorobenzene	p-Xylene
Cyclohexane	Cadmium
1,1-Dichloroethane	Chromium
1,2-Dichloroethane	Lead
1,2-Dichloroethane	Mercury
cis-1,2-Dichloroethane	Selenium
Ethyl benzene	Silver
Ethyl ether	
Formaldehyde	

Testing for these constituents should include headspace analysis of all waste types for the organic compounds, as well as total analysis of the sludges for both the organic compounds and the metals.¹³ Since these data are not

¹³ As indicated in Section 1.D of today's notice, the state of New Mexico is responsible for enforcing

Continued

necessary for today's finding, but rather will be evaluated as part of a subsequent review of a petition for the operational and post-closure periods (if DOE chooses to submit such a petition). EPA has concluded that the specifics of this testing should not constitute a condition in today's decision.

8. Reporting Requirements

Reporting requirements associated with EPA's final no-migration determination are unchanged from the proposal—that is, annual written reports are required on the status of DOE's performance assessment during the test phase—except that the final determination requires that DOE send reports to EPA's Region VI office in Dallas, Texas, as well as to the EPA Office of Solid Waste at EPA headquarters. Because Region VI will have direct enforcement authority over the WIPP, EPA believes that it is important for reports to go directly to the regional office as well as to EPA headquarters.

V. Discussion of Major Issues

EPA received more than 400 comments on its proposal, some supporting EPA's proposed decision and others opposing it. Commenters raised a wide variety of issues, including the general scope of EPA's review and its proposed decision; the suitability of the site; the consistency of EPA's proposed approach with the statutory no-migration standards; adequacy of waste characterization; the feasibility and likelihood of retrieval; the impact of possible human intrusion; and many other issues. The major issues raised by the public are discussed below as well as in other sections of this notice. These and the other issues raised by commenters are also discussed in detail in a Response to Comment document prepared by EPA. This document is available in the public docket to this decision.

A. Appropriateness of "Exemption" for DOE

A number of commenters criticized EPA for proposing to grant to DOE what they regarded as an "exemption" from the hazardous waste regulations for its WIPP operations. They questioned why EPA would grant an "exemption" or "variance" to DOE for radioactive wastes, given the risks of this material. Numerous commenters also questioned

DOE's record at other sites, and argued that DOE should be required to comply with all applicable regulations—without special "exemptions" or "variances"—before it was allowed to place waste in the WIPP repository for any purposes.

EPA stresses that it is not granting an "exemption" to DOE from the hazardous waste regulations. This action, however, is a "variance" only in a very narrow sense. HSWA establishes two routes by which a regulated party may dispose of waste in compliance with the land disposal restrictions: It may pretreat wastes according to specified treatment standards, or it may dispose of the waste in a unit that meets the stringent no-migration standard. DOE has chosen the second route of complying with these restrictions—an option that in some respects the more stringent of the two. For example, if DOE were to choose treatment as its approach, DOE would no longer be required to demonstrate that no hazardous constituents would migrate from the WIPP before the treated waste (which might still remain hazardous) could be placed underground. In any case, EPA reemphasizes that its action today in no way exempts DOE from the hazardous waste regulations; instead, it is a determination by EPA that the placement of untreated mixed waste in the WIPP during the test phase complies with the statutory and regulatory restrictions on land disposal under RCRA. Furthermore, it should be noted that the WIPP must also comply with the other hazardous wastes standards of RCRA, as well as other applicable standards. Other standards applicable to the WIPP are described in Section I.D of this notice.

EPA recognizes the concerns of many commenters over acknowledged problems at other DOE sites. EPA, however, does not believe that problems at other sites should rule out approval of a no-migration petition for the WIPP. The issue at hand is whether there will be any migration of hazardous constituents from the WIPP disposal unit. EPA has carefully and independently reviewed all the information from other sources. As a consequence of this review, EPA has concluded that DOE has demonstrated, to a reasonable degree of certainty, that hazardous constituents will not migrate from the disposal unit, under the conditions prescribed in Section VI of this notice.

B. Timing of EPA Decision

A number of commenters expressed concern about what they considered to be EPA's undue haste in proposing to grant DOE's no-migration petition for

the WIPP, and they criticized EPA's tentative schedule for a final decision. They suggested that EPA may have taken undue shortcuts in the regulatory process, or that DOE's petition was given an insufficient level of technical review.

EPA disagrees with these commenters. The Agency deliberated on DOE's original petition for more than a year before its proposed no-migration determination for the WIPP in April 1990, and it spent an additional five months in the review of public comments before reaching a final decision. In the course of this review, EPA conducted a complete and thorough evaluation of DOE's petition, material provided by DOE in support of its petition, independent studies of the WIPP, and public comments on the proposed no-migration determination. In addition, EPA staff conducted three investigatory visits to the WIPP site. The results of EPA's review are summarized in today's notice and in the Agency's proposed decision in April 1990. Technical details are provided in EPA's Response to Comments Document and its Background Document, both of which are available in the docket for this rulemaking.

EPA acknowledges that it placed a high priority on the review of DOE's WIPP petition. The Agency disagrees, however, that it took any undue shortcuts in the review or omitted any significant procedural steps. EPA's decision was made in full accord with the procedures for no-migration determinations, codified at 40 CFR 268.6; and with EPA's procedures for site-specific decisions under RCRA. EPA modeled its procedures for handling the WIPP no-migration petition (as well as other no-migration petitions now under review) on its procedures for handling RCRA delisting petitions. These procedures ensure a thorough and complete Agency review, with public notice and full opportunity for public comment.

C. Scope of Determination

In its proposed no-migration determination for the WIPP, EPA noted that it did not consider the release and possible risks associated with radioactivity; rather, its review addressed the release of hazardous constituents from the disposal unit. EPA pointed out in its proposal that the statutory language on no-migration referred to the release of hazardous constituents, which do not include radionuclides, and risks of radioactivity from the materials DOE is placing in the WIPP fall within the scope of the Atomic

RCRA interim status standards at the WIPP and for issuing a RCRA permit to the facility. In carrying out these responsibilities, the State may require additional or more stringent waste characterization requirements.

Energy Act rather than RCRA. The Agency further noted that risks associated with transportation lay outside the scope of its no-migration review. Finally, EPA did not seek to determine whether the approach proposed by DOE—that is, deep geologic disposal of TRU wastes at the WIPP site—was the best possible alternative for handling that waste. Despite EPA's explanation of the scope of its no-migration review, numerous commenters raised issues related to radioactivity, transportation, and alternatives to the WIPP. EPA understands that concerns of these commenters; however, it continues to believe these concerns lie outside the scope of its legal authority and are better addressed in other forums.

Radioactivity was a major concern of many commenters. A number, in particular, argued that, since EPA's charge is to protect human health and the environment, it must address the release of radionuclides in any evaluation of the non-migration potential of waste from the WIPP. EPA, however, believes that the potential for radioactive releases from source, special nuclear, and byproduct material is not within the scope of the non-migration determination. First, as EPA explained in its proposed no-migration finding for the WIPP, the Agency's authority over mixed wastes under RCRA extends only to the hazardous components of the waste, not to the radionuclides exempted from RCRA. (EPA explained this position more fully in its mixed waste clarification notice of July 3, 1986, 53 FR 37045. See also Section I.B above). Second, release of radionuclides is not within the specific mandate of the no-migration language in RCRA or the regulatory standards codified at 40 CFR 268.6. Under the statute, EPA may not find a method of disposal protective of human health unless " * * * it has been demonstrated to the Administrator, to a reasonable degree of certainty, that there will be no migration of hazardous constituents from the disposal unit * * * for as long as the waste remains hazardous." Hazardous constituents are a term of art under the statute, referring to compounds listed in 40 CFR part 261, appendix VIII. No type of radionuclide is listed in the appendix. Moreover, EPA regulations at 40 CFR 268.6 do not contemplate evaluation of the radioactive risks of a given unit.

EPA acknowledges that it has a general authority and responsibility under RCRA and other acts to protect human health and the environment, and that this standard is an overriding consideration in any no-migration

decision, including a decision regarding the WIPP. The Agency believes, however, that the standards issued by EPA under the Atomic Energy Act and the Clean Air Act are the proper standards for protection of human health and the environment for radiation risks at the WIPP site. Air emissions from the WIPP during the test phase will have to comply with the Clean Air Act standards for radioactive releases in 40 CFR part 61 and (under agreement with the State of New Mexico) with AEA standards issued under 40 CFR part 191 subpart A. In chapter 6 of its Final Safety Analysis Report, DOE calculated radionuclide emissions from the WIPP according to EPA-approved models to document compliance with Clean Air Act and AEA standards. DOE is also preparing a NESHAP notice of anticipated start-up to file with EPA, in accordance with Clean Air Act standards. Finally, long-term releases of radionuclides will be controlled under AEA disposal standards codified at 40 CFR part 191 subpart B. These regulations, which were specifically designed to address potential radioactive releases, are the appropriate authority for addressing any such releases at the WIPP site.

EPA also acknowledges public concerns about transportation safety and agrees that it is important for DOE to take every necessary measure to ensure the safety of shipments to the WIPP. The question of transportation risks, however, lies outside the scope of EPA's no-migration authority, and therefore the Agency has not addressed them in its review. Instead, overall issues of transportation safety for the WIPP project are addressed under the National Environmental Policy Act (NEPA) through the Environmental Impact Statement process and by the Nuclear Regulatory Commission, which by agreement with DOE has oversight over shipping containers and the waste form during transportation.

Finally, EPA has reviewed comments suggesting that alternatives other than the WIPP—for example, long-term storage of TRU wastes at the sites of generation—should be chosen for management of TRU wastes. The Agency continues to believe that deep geological burial is a promising strategy for the disposal of radioactive waste. But, in any case, the question of whether acceptable alternatives to the WIPP exist, or whether other approaches might be preferable, lies outside the scope of EPA's review. Under the statute, DOE may place untreated mixed waste in the WIPP repository if it can meet the statutory standards for no

migration. Alternative approaches to deep geological burial are more appropriately addressed under the NEPA process.

D. EPA Oversight Over the Test Phase

Several commenters of EPA's proposed determination argued that EPA should assert direct oversight over the testing and experimentation during the test phase. For example, some commenters argued that, before any waste was placed in the repository, EPA should make a finding that in-situ testing at the repository was both necessary and sufficient. Others identified what they considered to be flaws in DOE's test plans—e.g., sealing the alcoves in the alcove-scale tests—and argued that EPA should not allow waste to be placed in the repository before those flaws were addressed.

Although EPA believes that DOE has generally laid out a reasonable test program for the WIPP, it disagrees with commenters who argue that the Agency must find, as part of today's determination, that DOE's test plans are necessary and sufficient. The question before EPA is whether there will be any migration of hazardous constituents beyond the unit boundary for as long as the waste remains hazardous, not whether alternatives to in-situ testing are available, or whether DOE's testing program has shortcomings. If DOE can demonstrate no migration for the test phase, which EPA concludes it has done, then it has met the statutory standard for placement of untreated hazardous wastes in the WIPP.

At the same time, the results of the test phase will be critical in review of a no-migration petition for long-term disposal at the WIPP, if DOE chooses to submit one. EPA, therefore, has put DOE on notice that data from the bin and alcove tests must be of good quality. For example, if the adequacy of alcove seals cannot be demonstrated, any data derived from the alcove tests will be of questionable value. Similarly, it is essential for the long-term finding that DOE adequately characterize test waste for RCRA constituents. Toward this end, EPA has described in some detail in section IV.B.7 of this notice the types and quality of data on waste characterization it expects to see in any petition for long-term disposal. However, for the reasons discussed above, the Agency has concluded that it is not appropriate to address the scope or details of DOE's test plans in today's decision—except insofar as they involve possible migration of waste from the disposal unit or the retrievability of the waste.

E. Site Suitability

In reaching its proposed determination, EPA reviewed more than 300 studies of the WIPP site, not only by DOE and its contractors, but also by independent researchers and groups such as the U.S. Geological Survey and the Environmental Evaluation Group. The overwhelming conclusion that EPA drew from these studies is that the WIPP has been located in a remarkably stable formation, and that it is a promising site for the permanent disposal of radioactive waste. Although there remain some questions about the site, which DOE will be addressing during the test phase, EPA expressed its conclusion that the site was sufficiently well characterized for the test phase to proceed. Thus, EPA agreed with the National Academy of Sciences and DOE's Blue Ribbon Panel that it makes sense to begin testing in the WIPP repository as soon as regulatory requirements are satisfied.

Several commenters on the petition, however, raised issues associated with the suitability of the WIPP site. Commenters, for example, expressed concern about the possibility of karst formation in the vicinity of the WIPP site and the general role of dissolution processes in the area; the assumed existence of a pressurized brine pool below the repository; and the rate of brine inflow into the repository. These issues are discussed briefly below and are addressed in more detail in EPA's Response to Comment document for this rulemaking.

A number of commenters expressed concern that the WIPP landscape had the characteristics of a karst terrain. A karst terrain is a kind of topography that is typically formed over limestone, dolomite, or gypsum through dissolution processes; it is usually characterized by closed depressions or sinkholes; caves, and underground drainage. The implication for the WIPP, according to commenters, is that contamination from the repository if it reached the overlying Ruetter formation, could be transported rapidly to the accessible environment. Commenters also suggested that ground water in overlying karst formations might attack the repository shaft seals, after closure, and enter the Salado Formation—the salt bed in which the WIPP repository has been constructed. This might lead to dissolution of the halite, allowing a potential pathway for migration past the unit boundary.

The commenters' argument that the WIPP area is karstic is based primarily on the presence of several acknowledged and alleged dissolution features in the WIPP area. These include

sinkholes in Nash Draw, several kilometers from the WIPP site; dissolution features identified in the WIPP 33 drill hole, just outside the site boundary; and "Barrows Bathtub," a depression about one kilometer from the proposed underground disposal area. Such features, according to commenters, demonstrate that the WIPP site is found in a mature karst area and that wastes can be expected to leak from the WIPP shortly after closure.

As a result of commenters' concerns, EPA reevaluated the question of karst in reaching its final decision. This reevaluation included a field investigation of the WIPP site, in the company of one of the commenters. The tour covered the most important features that the commenters believed were karstic in the vicinity of the WIPP. The closest of these was approximately one kilometer from the surface buildings at the facility. On the basis of this review, EPA has concluded that karst is not now an issue at the WIPP, and is unlikely to become one for many thousands of years, if ever.

EPA recognizes the presence of some localized, surface dissolution features in the general area of the WIPP, particularly in Nash Draw. This is not surprising, given that the geologic units within the area are composed of rock that would be susceptible to dissolution under the correct hydrologic and geochemical conditions. However, evidence suggests that these are ancient features and that current rates of dissolution are extremely slow. For example, dissolution rates at the Nash Draw have been estimated at one-third of a foot every one thousand years, rates that would not threaten the WIPP repository for millions of years. In addition, the widespread occurrence of caliche—a surface feature indicating arid conditions and limited surface dissolution—in the WIPP area suggest the stability of the surface landscape over at least the last 10,000 years. At the same time, borings drilled at and near the WIPP site have failed to encounter solution channels indicative of a karst environment. Finally, it should be noted that the Salado Formation lies 260 meters below the surface, shielded by relatively impermeable rocks. Thus, the repository horizon is isolated from any ongoing dissolution process. The fact that the Salado Formation in the area of the WIPP has remained largely unaffected by dissolution processes over its 225-million-year history is evidence of its stability.

Numerous commenters also expressed concern about the presence and possible effects of pressurized brine in the

Castile formation underlying the Salado. One bore hole in the immediate vicinity of the repository—WIPP 12—encountered a large brine pocket in the Castile. Geophysical measurements suggest that this pocket extends underneath the repository itself. Commenters expressed the concern that this brine might, in the long run, threaten the WIPP through dissolution processes or, if a bore hole were drilled at some future date through the repository into the brine pocket, pressurized brine might force contamination to the surface.

After reviewing the comments and other data in the record, EPA continues to believe that the brine pockets in the Castile formation—although they contain a substantial amount of fluid—do not offer a significant threat to the repository. Castile deformation, which led to the formation of the brine pockets, was initiated millions of years ago in association with major tectonic tilting of strata in the Delaware Basin. The region is tectonically inactive at present, implying that new development of major Castile features is not occurring. In addition, the brine pool is completely saturated with respect to halite and therefore has no potential to dissolve the surrounding host rock. Since the Castile and Salado Formations are hydrologically distinct, there is no credible hydrologic connection between the two formations. Finally, because of restrictions on access, there is no realistic possibility of a borehole reaching brine pockets below the repository during the test period. Therefore, this issue does not arise for today's determination. DOE's performance assessment, however, is addressing the possible effects of such a borehole after repository closure.

A number of commenters also expressed concern about the effects of brine inflow into the repository and the validity of permeability values used for the Salado Formation. EPA has reviewed the information pertinent to this discussion and believes that, while a good understanding of brine inflow into the repository exists, additional studies must be conducted to understand the true nature of brine inflow and to quantify inflow in a manner more indicative of facility conditions. These tests will be performed during the WIPP test phase. They will be important in any decision on the long-term acceptability of the WIPP site. Brine inflow, however, will not be a problem during the test phase and thus is not an issue for today's decision.

Finally, commenters expressed concern that DOE's petition and EPA's proposed decision did not fully address the long-term closure scenario expected at the repository. Commenters cited data predicting high rates of gas generation and argued that this gas might delay or prevent creep closure of the repository. As a worst case, gas generation exceeding lithostatic pressure might fracture surrounding salt or threaten the seal system of the repository. In fact, DOE, EPA, and other groups have recognized that the issue of gas generation, and its relation to repository performance, must be adequately addressed before permanent disposal of waste takes place at the WIPP. The major purpose of DOE's in-situ tests in the WIPP with actual wastes is to explore the issue of gas generation. Today's decision will allow these tests to proceed. The Agency believes that the end of the test phase is the appropriate time for it to make a determination of whether the repository is or is not suited for long-term disposal, since the results of the experiments performed during the test phase will help quantify gas generation rates, as well as identify different mitigative measures if the rates prove unacceptable.

F. Conditional Determination

Several commenters took issue with EPA's "conditional" approach in its proposed decision. EPA's proposed determination was based on: (1) The finding that hazardous constituents would not migrate from the disposal unit during the test period, and (2) the requirement that DOE remove the waste at the conclusion of the test period unless it could demonstrate that there would be no migration over the long-term. According to commenters, this approach is inconsistent with the statute, which requires a finding that hazardous constituents will not migrate from the unit as long as the waste remains hazardous. The commenters argued that, under the statutory standard, DOE should be required to demonstrate that hazardous waste permanently placed in the repository would not migrate from the unit before DOE could place any waste underground, even temporarily. EPA, however, continues to believe that its proposed approach is consistent with the statute and has not amended its finding.

As commenters point out, RCRA specifies that hazardous constituents must not migrate from the unit for as long as the waste remains hazardous. The phrase "from the unit" is a key element of this standard. If the waste is

removed from the unit at the end of the test period, migration of hazardous constituents from the unit after that time is clearly impossible, because there are no longer any hazardous constituents in the unit to migrate. Consequently, in the case of temporary placement, for example during the WIPP test phase, the appropriate question is whether hazardous constituents will migrate during the period of temporary placement. (As discussed elsewhere in today's notice, EPA has concluded that hazardous constituents will not migrate from the unit during the test phase.) At the same time, of course, it is important to see that removal at the end of the test period is reasonably assured. EPA judge DOE's no-migration petition for the WIPP on these grounds. (See Section V.G for discussion of this point.)

One group of commenters argued further that, if EPA were to continue with its "conditional" approach, it should review DOE's test plan to ensure that in-situ testing at the WIPP was necessary to demonstrate long-term no migration and that the specific tests to be conducted would be sufficient. Although EPA has commented on DOE's test plan, EPA disagrees with these commenters on the type of EPA review that is necessary. On the basis of its review, EPA has concluded that DOE's test plan is well designed and the testing will yield important information on the long-term performance of the repository. EPA, however, has not and believes that it should not formally analyze DOE's in-situ testing at the WIPP to determine whether it is necessary or sufficient, and it does not believe such an analysis is within the scope of a no-migration review. As long as DOE can demonstrate that hazardous constituents will not migrate from the disposal unit, it is legally entitled to place prohibited waste in the WIPP. There is nothing in the statute that further compels a petitioner to demonstrate that placement in the unit is "necessary."

G. Definition of No Migration

Sections 3004 (d)(1), (e)(1), and (g)(5) of RCRA state that land disposal is prohibited, unless "it has been demonstrated to the Administrator, to a reasonable degree of certainty, that there will be no migration of hazardous constituents from the disposal unit or injection zone as long as the waste remains hazardous." In its proposed no-migration decision on the WIPP, EPA adopted the same interpretation of this standard as it had in its no-migration regulations for underground injection wells; that is, the Agency interpreted the standard to prohibit the migration of hazardous constituents in

concentrations high enough to render the waste hazardous. (See 53 FR 28122, July 26, 1988.) Critics of this approach argued that Congress clearly meant that not a single molecule of a hazardous constituent could migrate from the unit, as long as the waste remaining in the unit was hazardous. Under this standard, DOE's WIPP no-migration petition could not have been approved, because at least some molecules of volatile organics listed as hazardous constituents will migrate via the air route during operations—although most likely at several orders of magnitude below levels of detection.

In today's decision, EPA is retaining its proposed definition of "no migration" of hazardous constituents. As explained in detail in the preamble to the proposed decision, EPA believes that this approach is fully consistent with the language of the statute and is protective of human health and the environment. EPA also notes that its interpretation of "no migration" was recently upheld in a decision on the underground injection well rules by the U.S. Court of Appeals for the District of Columbia. (*NRDC v. EPA* No. Slip. Op. (D.C. Cir. 1990).) In this decision, the Court accepted EPA's argument that "no migration of hazardous constituents * * * for as long as the waste remains hazardous" may be read to mean no migration of constituents above hazardous (or health-based) levels. As a result, EPA has decided to retain the same standard in its final decision on the WIPP petition.

H. Definition of Unit Boundary

In today's finding, EPA has slightly modified its definition of the disposal unit boundary in response to public comments. In the proposal, EPA defined the unit boundary (or point of compliance) for groundwater migration as the Salado Formation, laterally bounded by the limits of the four-mile by four-mile land withdrawal area. For air emissions during operations of the WIPP, EPA defined the unit boundary as the point where the air shaft met the surface.

Numerous commenters expressed concern about the extent of the unit boundary for groundwater, arguing that it might allow broad areas of contamination underground; they objected to EPA arguing that there would be no migration from the unit even if the hazardous constituents moved up to two miles laterally. Several commenters suggested that the unit boundary in no case should be greater than the mined repository, and should probably be less. One group of

commenters also pointed to what they believed was an inconsistency between the unit boundary for air and for groundwater. They argued that the unit boundary should be the same in both cases and that the unit boundary for air, therefore, should be no farther than the top of the Salado. After reviewing these comments, EPA has decided to retain its definition of the lateral boundary of the unit (i.e., the boundary of the land withdrawal area within the Salado Formation), but to define the boundary for air emissions as the top of the Salado Formation.

EPA has rejected commenters' suggestion that the unit boundary be defined as the mined area (or some smaller area). As the Agency explained in detail in its proposed finding, it believes that, in the context of a geological repository, some credit should be given for the surrounding formation in which a waste is placed. The purpose of placing waste in a geologic repository is to isolate it from the general environment; it is not to prevent any movement of waste, however slight, within that formation. In fact, some lateral movement of waste into the surrounding formation can be an inevitable, and desirable, aspect of repository performance—as it is in the case of the WIPP. A no-migration standard that prohibited any lateral movement would run counter to the concept of a geological repository, without providing for any additional environmental protection or protecting against any meaningful release.

In taking this general position, EPA believes that it is being consistent with the intent of Congress, for example as expressed in the Senate Report on the 1984 HSWA amendments: "In determining appropriate confinement from which migration shall not be allowed to occur, the term disposal unit or injection zones should be construed . . . in terms of the overall integrity of the disposal practice, keeping in mind, in particular, the potential for contamination of ground-water or surface water resources" (S. Rep. No. 284 98th Cong. 1st Sess. at 15). Wastes confined to the boundaries of the unit, as defined in EPA's final determination, would remain more than 1,000 feet from the nearest unconfined ground water. EPA also notes that its position is consistent with the recent court decision on its no-migration rules for underground injection wells. (*NRDC v. EPA*, No. Slip. Op. (D.C. Cir. 1990).) In this decision, the court supported EPA's position that the term injection zone (which for underground injection wells is analogous to the unit) includes

confining material surrounding the porous formation into which the waste is actually injected. Similarly, EPA believes it is appropriate to consider at least a portion of the confining salt at the WIPP as part of the unit.

Critics of EPA's proposed definition of the WIPP unit suggested no alternative boundaries, other than somewhere within the furthest extent of the mined area. As discussed above, EPA has rejected this alternative. In the absence of any rationale for an intermediate boundary between the mined area and the proposed boundary, EPA has decided to retain the proposed approach. EPA emphasizes that the WIPP unit, under this definition, is fully isolated from the surrounding environment. If waste remains within the unit boundary, no meaningful movement of waste will have occurred, and no contamination of ground-water resources will result. Further, although there will undoubtedly be some lateral migration of contaminated material along marker beds within the salt formation, all projections indicate that this migration will be very limited, in no way approaching the boundaries of the unit. (The most likely route of migration, instead, would be up the closed shafts to overlying formations.) Therefore, extensive underground movement of waste is not expected, regardless of the definition of unit.

In the case of air migration, EPA recognizes that its proposed definition caused some confusion. To address commenters' concerns, EPA has amended the unit definition for air during operations, placing the boundary at the top of the Salado Formation. The issue of where DOE should monitor to demonstrate compliance at that point, however, is a different question. (See section IV.B.6 for a discussion of this point.)

I. Waste Characterization

1. Flammability

In evaluating the potential for release of hazardous constituents in its proposed decision, EPA considered the potential for fire and explosion at the WIPP. The Agency noted that the Waste Acceptance Criteria (WIPP-WAC) prohibits explosives and compressed gases in TRU Wastes and requires that pyrophoric materials be rendered safe by mixing them with chemically stable materials, such as concrete or glass, or be processed to render them nonhazardous. In addition, the Nuclear Regulatory Commission requires that all waste containers be equipped with one or more carbon composite filters designed to prevent pressure buildup or

the accumulation of flammable gases prior to shipment to the WIPP, as specified in "TRUPACT-II Authorized Methods for Payload Control" (TRAMPAC).¹⁴ EPA suggested that these requirements, in conjunction with the maintenance of general ventilation in the underground repository, make the possibility of fire or explosion extremely unlikely.¹⁵

EPA continues to believe that a fire or explosion is unlikely. It acknowledges, however, the concerns of commenters that flammable gases could build up in waste containers, creating a fire and explosion hazard. The Agency has reanalyzed the available information and has concluded that the accidental ignition of flammable gases in waste containers cannot be ruled out, given the available data on waste characterization. At the same time, EPA has concluded that spontaneous combustion within an individual waste container, i.e., without an ignition source, is not credible.¹⁶

Were a fire or explosion to occur as a result of accidental ignition of flammable gases in the void space of a waste container, retrieval could become more difficult, should retrieval be necessary. Moreover, such an event could itself cause migration of hazardous constituents above health-based levels beyond the unit boundary. For these reasons, EPA has concluded that no waste container should be emplaced in the underground repository if it contains flammable mixtures of gases in any layer of confinement, or mixtures of gases that could become flammable when mixed with air. To assure a sufficient margin of safety, EPA considers any mixture to be potentially flammable if it exceeds 50 percent of the lower explosive limit (LEL) of the mixture in air.

EPA, consequently, is requiring DOE to ensure that individual waste containers have met the prohibition of flammable gases. DOE must implement this provision by testing each waste drum or individual container for hydrogen, methane, and volatile organic compounds (VOCs) as a class. EPA is

¹⁴ The Agency notes that TRAMPAC also sets limits on the thermal wattage, i.e., decay heat of individual waste containers to control the rate of generation of hydrogen gas by radiolysis (DOE, *Safety Analysis Report for the TRUPACT-II Shipping Package, Appendix 1.3.7, revision 2, June 1989*).

¹⁵ The Agency notes that the WIPP-WAC also places restrictions on the total quantity of fissile material in a waste container to ensure criticality safety.

¹⁶ See the conclusions in the Sandia National Laboratory memorandum from Slezak and Lappin to Marcer and Fredrickson, January 5, 1990.

establishing this condition because it does not judge available process knowledge to be sufficiently reliable or accurate to allow a determination on the flammability hazard of individual waste packages.

EPA recognizes that headspace testing of every drum or individual container on a continuing basis may pose a significant burden on DOE. Without sufficient data, however, EPA feels compelled to require that DOE conduct testing, given the potential consequences of a fire or explosion. Once sufficient data have been collected, however, EPA will consider the extent to which continued testing is necessary. Test data may well show that flammable gases are only present at levels well below the lower explosive limit, either for certain wastes (e.g., TRUCON content code or item description code) or from particular generating sites. If the test data in fact show that no fire or explosion hazard exists, DOE should submit the data to EPA and request that the testing requirement be modified accordingly. Any change in the terms of this condition will be made under the procedures of 40 CFR 268.6(e), which include public notice and opportunity for comment.

EPA is also requiring that headspace sampling be representative of the entire void space of the waste container. Initially, the Agency believes that each individual layer of confinement within the container will have to be sampled, given the limited data available for inner bags. EPA, however, expects that once DOE accumulates enough data, it may be able to show that for most package configurations in which bags are twisted and taped, similar levels of flammable gases will be found in all layers of confinement.¹⁷ However, it is anticipated that the occurrence of detectable quantities of free liquids, as determined by real-time radiography of visual inspection, will continue to indicate the need to sample the layer in which it occurs, unless DOE can demonstrate otherwise.

EPA also believes that testing of wastes that exhibit high rates of radiolysis should be conducted within a relatively short time period of when the container is actually placed underground. Otherwise, hydrogen levels could build up to flammable levels following sample collection and analysis. DOE has accumulated

¹⁷ EPA notes that DOE intends to open up and disassemble the drums selected for the bin-scale tests for visual inspection. Therefore, this requirement should not increase radiation exposure to workers.

considerable data on radiolysis rates for various materials in TRU wastes. DOE used such data in its application to the Nuclear Regulatory Commission for a certificate of compliance for the TRUPACT-II shipping package to determine the length of time a waste drum must aspirate (i.e., vent) before it can be shipped after retrieval from storage.¹⁸ Similarly, EPA is requiring DOE to determine, and document, the length of time during which headspace gases can be expected to remain below flammable levels (i.e., 50 percent of the mixture LEL) after sampling has been performed, for both newly generated and retrievably stored wastes, and to ensure that waste containers are emplaced at the WIPP within that time.

If testing reveals the presence of significant levels of flammable VOCs, an explicit flame test must be performed to determine if a flammable mixture can be formed with air. American Society for Testing and Materials (ASTM) Method E 681-85, "Concentration Limits of Flammability of Chemicals," or equivalent, are acceptable test methods. Significant levels of flammable VOCs are indicated by measured concentrations (excluding methane) of 500 parts per million or greater, as propane, as determined by gas chromatography and flame ionization detection (GC/FID) or of 500 parts per million or greater, by volume, as determined by gas chromatography and mass spectrometry (GC/MS).¹⁹ If testing shows that VOCs are insignificant, i.e., below 500 parts per million, the lower explosive limit of the mixture may be determined from the lower explosive limits of methane and hydrogen using the Le Chatelier formula as follows: If LEL_1 and LEL_2 are the lower explosive limits of hydrogen and methane, respectively, and C_1 and C_2 are the measured concentrations of hydrogen and methane, respectively, expressed as volume percent, then if the fraction, C_1/LEL_1 and C_2/LEL_2 sum to 0.5 or greater, the mixture is considered to be flammable when mixed with air.²⁰

¹⁸ DOE, TRUPACT-II Content Codes (TRUCON), DOE-WIPP 89-004, Revision 3, July 1989, and DOE, Safety Analysis Report for the TRUPACT-II Shipping Package, Appendix 1.3.7, Revision 2, June 1989.

¹⁹ For purposes of determining concentration levels using GC/MS, only noncombustible compounds may be excluded from the sum total of non-methane VOC, e.g., carbon tetrachloride, tetrachloroethylene, chloroform, and bromoform.

²⁰ The lower explosive limits of hydrogen and methane are 4.0 and 5.0 percent, respectively, in air [Bureau of Mines, "Flammability Characteristics of Combustible Gases and Vapors," Bulletin 627, 1965].

2. RCRA Constituents

In its proposal, EPA expressed some concern with the quality of the waste characterization data provided by DOE in support of its petition. However, given the nature of the wastes, the safety margins between predicted emission levels and health-based levels, and required controls on air emissions, EPA concluded that the information provided by DOE (based primarily upon process knowledge) was sufficient to demonstrate, to a reasonable degree of certainty, no migration of hazardous constituents during the test phase. Many commenters, nevertheless, criticized the quality and completeness of DOE's waste characterization information and DOE's approach to waste characterization. Several commenters noted the critical role played by waste characterization in the prediction of no migration and stressed that EPA needed accurate waste descriptions, supported by detailed analysis, to evaluate the potential environmental impacts of waste disposal. In responding to these comments, EPA has differentiated between short-term issues (relevant to today's decision for the test phase) and long-term issues (relevant to a decision for the operational and post-closure phases, should DOE submit a petition for these phases).

a. *Short-term issues.* Many of the commenters expressed concern with the Agency's acceptance of waste characterization data based primarily upon process knowledge. Commenters stated that, in the case of the WIPP, waste characterization requirements have not been met.

EPA disagrees with the commenters' position that DOE's waste characterization information is insufficient for a no-migration determination for the test phase. DOE's analysis of the wastes included an evaluation of the materials and processes from which the wastes were generated as well as actual chemical analysis of the wastes. In the former case, DOE provided flow diagrams and narrative descriptions of the processes that generated all 128 of the identified waste Content Codes as well as an identification of the RCRA hazardous constituents used in the process. DOE also provided estimated concentrations for each of the hazardous constituents expected in the wastes. This was designed to be a conservative characterization, in which it was assumed that any hazardous constituents that were used in a process would be present in the resulting waste stream, regardless of known physical

processes that would reduce the likelihood that the constituents would in fact be present (e.g., volatilization). EPA notes that no comments were received indicating that wastes from the processes described by DOE would be expected to be compositionally different from the DOE-estimated compositions.

The bulk of the analytical data presented by DOE to corroborate the conclusions of the above-described characterization were focused on the only viable route of release during the test phase—namely, through the air. For this characterization, DOE provided results from over 200 headspace analyses, representing all four of the identified waste types; these samples were analyzed for numerous gases, including nine organics. Other analyses for which results were reported included Toxicity Characteristic and Extraction Procedure leaching tests, total volatiles, and total metals. While these analyses were not typically conducted on all four of the waste types, EPA notes that these tests are not directly relevant for characterizing the most likely route of release during the period that is subject to today's decision (i.e., the test phase).

Additionally, EPA in its proposal considered the "safety margin" indicated by calculations of air emissions. That is, even if the concentrations of hazardous constituents were significantly underestimated, the no-migration standard would still be met during the test phase.²¹ Additional assurances are provided by the air monitoring systems that will be operated to allow detection of emissions. Based upon the safety margin indicated by these factors, the Agency concludes that the level of waste characterization is acceptable for the test phase. Nevertheless, to ensure that the wastes to be used in the binscale tests are similar in composition to those described in the no-migration petition, EPA is requiring that DOE test the headspace of the wastes shipped to the WIPP (as a measure of the waste constituents' propensity to migrate through air) and compare the results to the values provided in DOE's no-migration petition. This comparison must be conducted and the waste must be found to be compositionally similar before the waste can be sent to and emplaced in the WIPP; if the waste is not similar to the estimated concentrations provided in the no-migration petition, the waste cannot be shipped to the WIPP unless it is

modified compositionally, such that it is compositionally similar. The details of this comparison are described in section IV.B.7.b of today's notice.

Other commenters stated that, to the extent that DOE has provided any laboratory analysis of wastes intended for the WIPP, it is solely headspace analysis (i.e., analysis of the constituents' concentrations in the air under the lid of the drum) used as a surrogate for the waste in the drum. These commenters maintained that headspace analysis, while extremely useful for homogeneous phases, is limited, at best, for analyzing heterogeneous wastes such as those intended for the WIPP. In the opinion of these commenters, headspace analysis is unreliable as a surrogate for direct analysis of liquids and solids in drums due to uneven partitioning of constituents.

The Agency recognizes that there are limitations on the utility of headspace analysis as a surrogate for analysis of waste composition. Certainly headspace analysis is not appropriate for all evaluations for all waste types. In some cases, however, headspace analysis is the most relevant measurement. For purposes of the test-phase determination, headspace analysis is primarily used in the evaluation of gas generation and explosivity hazards. Since it is the composition of the gas that is of concern, analysis of the headspace (i.e., the actually evolved gas) is the most appropriate parameter to consider. If concentrations in the waste were used for the explosivity evaluation, the composition of the evolved gas would be modeled, or predicted, rather than actually measured.

EPA agrees with the commenters' concerns regarding the validity of a single headspace sample (under the lid) as representative of potentially evolved gases from heterogeneous wastes. This is especially problematic when the drums contain several inner layers of confinement, as do the drums that will be emplaced in the WIPP. Specifically, questions exist as to whether the headspace beneath the lid is compositionally different from the headspace in the inner layers. EPA is addressing this issue in the context of the testing condition related to headspace analysis. In that condition, EPA is requiring that DOE take representative samples of the headspace (which may require, in some cases, for DOE to take samples from inner bags) and analyze them to confirm its assertion that the headspace beneath

the lid is, in fact, representative of the total evolved gas within the drums.

EPA also agrees that headspace analysis is not a suitable surrogate for direct analyses of the waste for purposes of evaluations where the total composition is a factor. However, for volatile organic constituents, EPA believes that headspace analysis can be a useful tool for determining whether the constituents are present. That is, if a volatile constituent is present in the waste, it is reasonable to assume that it will also be present in the headspace. Accordingly, results from headspace analyses were used to confirm the presence of volatile hazardous constituents, not to quantify their concentrations in the wastes.

Several commenters argued that DOE's quality assurance/quality control of waste characterization data was deficient. Others noted that DOE had been unable to provide adequate sampling plans and sample handling procedures for analytical work. EPA raised similar concerns with DOE's procedures, but, for the reasons described in the proposal and further elaborated upon above, the Agency has concluded that the data are sufficient for the test phase demonstration. At the same time, EPA advises DOE that it expects additional analytical data to support a long-term demonstration, where significantly greater quantities of waste are involved and routes of possible migration are not limited to release of volatiles to the air during operations.

b. *Long-term issues.* EPA notes that the "safety margin" for the long-term showing (i.e., the operational and post-closure phases) has not been determined. For that reason, the Agency believes that additional waste characterization data are needed to reduce the uncertainties before a decision on a long-term no-migration determination can be made. EPA, however, has decided not to make such testing a condition of today's decision, because the collection of such data is not relevant to the decision during the test phase; EPA, however, expects DOE to develop and implement waste characterization plans, including appropriate sample collection, preservation, and analytical procedures, that will allow a demonstration of the extent to which the test phase wastes are representative of the other wastes from the ten generating sites and that allows greater precision in estimating potential for long-term migration (e.g., through routes such as ground water). If such data are not collected, EPA will not be in a position to approve a no-

²¹ The safety factor assumes that an explosivity hazard is not present. To ensure against such a hazard, EPA placed an additional condition on the decision (see section IV.B.7).

migration petition for the operational and post-closure phases, if DOE submits such a petition. EPA's expectations related to these data are presented in Section IV.B.7.b of today's notice.

Many commenters expressed concerns regarding the extent to which the wastes that will be used for the test phase are representative of the other wastes that DOE wishes to emplace at the WIPP during the operational phase. It was stated by many commenters that, for the test phase, adequate waste characterization is vital to assure that tests will be performed on representative wastes. Commenters pointed out that almost 70 percent of the wastes proposed for storage do not yet exist. They asked what controls and safeguards were in place to ensure that these future wastestreams are adequately represented by existing wastes.

The Agency agrees with commenters' concern that the use of representative wastes in the test phase will be critical to the success of any DOE no-migration petition for the later (operational and post-closure) phases. More specifically, the test-phase wastes must be sufficiently representative of the other wastes that DOE wishes to emplace at the WIPP to allow extrapolation of data from the test-phase experiments to the behavior of the other wastes.²² This issue is, in fact, the basis for the selection of wastes that will be used in the test phase experiments. The selection process will be based upon those parameters that contribute to gas generation and is designed to identify wastes that represent the spectrum of expected values for those parameters. Since waste selection and characterization, as part of the design of the experiments, is the responsibility of DOE, EPA believes that it is DOE's responsibility to establish and implement procedures to demonstrate that the wastes are, in fact, sufficiently representative.

Many commenters also argued that EPA's proposed decision did not clearly establish whether all waste analysis data would be provided to EPA prior to emplacement of any waste or whether the data would be provided incrementally as waste is being emplaced. These commenters stated that they had serious concerns if the Agency is proposing to allow DOE to

provide waste analysis data simultaneously with waste emplacement. They argued that waste analysis should be provided to the Agency not only before the waste is put into the ground, but before EPA can make a decision about a no-migration variance. They believed that this condition would allow EPA independently to assess the quality of the data. In the opinion of some commenters, delivering waste analysis information while the waste was "riding the Carlsbad elevators" would essentially render EPA's independent technical review of the data inconsequential.

EPA is not requiring that DOE submit the analytical data on the test waste for EPA review before the test wastes are emplaced. Much of the analytical work to be conducted by DOE is related to the eventual demonstration of no-migration over the long term. Since EPA will evaluate these data as part of any subsequent petition for the later phases, EPA disagrees with the commenters' statement that this evaluation will be "inconsequential." Rather, it will be a critical element of that evaluation.

EPA, however, is requiring DOE during the test phase to evaluate headspace data before waste is placed in the repository, as described earlier. For example, DOE must evaluate the explosivity-related testing before shipping test wastes to the WIPP. Similarly, DOE must compare the analytical results of newly conducted headspace analyses to the waste characterization data in the no-migration petition before the waste is emplaced in the underground repository. Because the standards for both the flammability and the RCRA constituent analyses are objective and straightforward, EPA does not believe that Agency review of the data before placement is necessary.

The flammability and RCRA constituent requirements, described in detail in section IV.B.7, will address many of the commenters' concerns with the accuracy of the data. These requirements will also ensure that the wastes emplaced during the test phase are, in fact, the wastes characterized by DOE in the petition and evaluated by the Agency and the public.

J. Retrievalability

Commenters also raised concerns about whether waste would ever be retrieved from the WIPP if it were placed in the repository, regardless of the technical feasibility of retrieval. Some questioned DOE's commitment to retrieval, even if the WIPP site proved

unacceptable. Others argued that, even if DOE were willing to remove the waste, no other site would accept it, and therefore the waste would not be retrieved. Several commenters argued that DOE should identify a permitted site ready to receive retrieved waste before any waste should be allowed underground.

EPA believes that it has placed adequate safeguards in today's determination to ensure that DOE in fact removes the hazardous waste from the repository, if it cannot demonstrate the repository's long-term acceptability. Condition 3 in Section VI of today's determination explicitly requires retrieval of wastes if DOE cannot demonstrate compliance with the standards of 40 CFR Part 268 before the expiration of the petition approval. Failure on the part of DOE to remove wastes under these circumstances would constitute a violation of the terms of EPA's determination, leading to possible enforcement action by EPA. In addition, citizens could sue DOE under section 7002 to enforce retrieval of waste from the repository.

Because of this condition, EPA has not found it necessary to require DOE to identify a specific site where waste retrieved from the WIPP would be stored, or to require that a permit be granted for storage of retrieved waste before any waste is placed underground. Furthermore, EPA questions whether any such condition would be useful, given that wastes would probably not be removed (if removal proved necessary) for a five-to-ten year period. Current predictions on the best storage site for the waste up to ten years in the future would be at best open to question, and valuable permitting resources would be expended on a site that might never receive the waste.

K. Human Intrusion

Commenters generally accepted that DOE could maintain institutional controls over the test period to preclude human intrusion. One group of commenters, however, argued that EPA must consider the possible effects of human intrusion in the distant future before allowing the placement of any waste for testing. These commenters expressed particular concern about potential mineral resources at the WIPP site, and the possibility that knowledge of the site would disappear after decommissioning. Other commenters argued that permanent markers should be erected at the WIPP site once the facility is closed, and information regarding the type and location of the markers should be published.

²² It should be noted that, if one or more wastes that are generated at any of the DOE sites are not "represented" by the test wastes, these wastes could not be sent to the WIPP without further evaluation. However, this would not invalidate the testing for all other wastes that are generated at the DOE sites and are represented by the test wastes.

EPA generally believes that the issue of human intrusion is a long-term question, not relevant to the short-term operation of the WIPP during the test and operational phases. In the short-term, DOE management of the site and RCRA permit controls will ensure limited access. Long-term issues would be addressed at the time a petition is considered for permanent disposal. For this reason, EPA disagrees with commenters who argue that it must consider human intrusion in the distant future before allowing any testing at the WIPP.

More generally, EPA believes that, in the context of RCRA no-migration decisions, it should address the question of human intrusion by considering the likelihood of the intrusion, and imposing controls to make such intrusions unlikely. EPA agrees that permanent markers will be necessary (in fact, they are required under 40 CFR part 191 subpart B) and that information on the markers should be published. These issues will be addressed in any no-migration decision allowing permanent disposal.

In its final determination, EPA has removed one proposed condition related to human intrusion. In the proposal, EPA required that "DOE certify to EPA that it has secured control of the entire surface and subsurface estate at the WIPP site." This condition is now moot, because DOE has now secured control over all oil and gas and mineral leases at the site. EPA has placed documentation of this fact in the record for this rulemaking. Thus, because the condition has been satisfied, EPA has dropped it from its final determination.

VI. Conditions of No-Migration Determination

As a condition of granting DOE's no-migration petition, EPA is requiring that the following conditions be met by DOE:

(1) No wastes subject to this determination may be placed in the WIPP repository for purposes other than testing or experimentation to determine the long-term acceptability of the WIPP. In accordance with 40 CFR 268.6(e), DOE must notify EPA before it conducts any testing or experimentation not within the scope of the "WIPP Test Phase Plan: Performance Assessment," April 1990 (DOE/WIPP 89-011, Revision O), as further explained in Section IV.B.1 of this notice. Placement of waste for the purpose of conducting an operations demonstration is prohibited.

(2) Wastes placed in the repository may not exceed 8,500 drums or 1 percent of the total capacity of the repository, as currently planned.

(3) All wastes placed in the WIPP must be removed if DOE cannot demonstrate compliance with the standards of 40 CFR 268.6, before the expiration of this petition approval, with respect to permanent disposal of mixed waste in the repository. DOE must submit a detailed schedule for retrieval of the waste, including times for completing retrieval as quickly as reasonably feasible, no later than six months after a determination that the repository cannot meet standards for long-term disposal under 40 CFR 268.6 or six months before the expiration of this petition approval, whichever occurs first.

(4) All wastes placed in the WIPP must be placed in a readily retrievable manner, as described in section IV.B.4 of this notice.

(5) DOE must install and operate a carbon adsorption device designed to achieve a control efficiency of 95 percent in the discharge system of the bin experiment rooms. DOE must monitor the control device outlet airstream in accordance with the monitoring plan described in section IV.K of EPA's proposed decision (55 FR 13089) as amended by section IV.B.7 of today's notice, and it must maintain design and operating records as described in section IV.J of EPA's proposed decision, as amended by section IV.B.6 of today's notice. Records must be maintained at the WIPP facility for the term of this determination or for three years after they are created, whichever is longer. Records must also be maintained during the course of any enforcement actions for which they are relevant.

(6) DOE must implement the air monitoring plan described in section IV.K of EPA's proposed decision (55 FR 13089), as amended in section IV.B.7 of today's notice. Records must be maintained at the WIPP facility for the term of this determination or for three years after they are created, whichever is longer. Records must be maintained during the course of any enforcement action for which they are relevant.

(7) Conditions relating to waste analysis:

(a) DOE must ensure that each waste container emplaced underground at the WIPP has no layer of confinement which contains flammable mixtures of gases or mixtures of gases that could become flammable when mixed with air. This prohibition must be implemented by analytical testing of a representative sample of headspace gases from each waste drum or individual container, as described in section IV.B.7.a and V.F.1.a of today's notice.

(b) DOE must analyze representative samples of the headspaces of containers to be used in the bin-scale test and compare these results to the estimated compositions provided in its petition for each waste type, as detailed in IV.B.7.b of today's notice. If the waste is not compositionally similar, as defined in Tables 2 and 3 in IV.B.7.b, that waste cannot be shipped to the WIPP until the waste has been treated or modified such that it is compositionally similar to the estimates provided in the no-migration petition. In addition, as prescribed in IV.B.7.b, DOE must demonstrate the comparability of bin-scale wastes to wastes described in DOE's petition before placing waste in the WIPP for the alcove tests.

(c) Waste analysis records must be maintained for the term of this determination or for three years after generation, whichever is longer. Records must also be maintained during the course of any enforcement action for which they are relevant. The records may be maintained at the generating site or at the WIPP facility.

(8) DOE must provide to the EPA Office of Solid Waste and EPA Region VI annual written reports on the status of DOE's performance assessment during the test phase. These reports must include: A description of the tests to date and their results, modifications to the test plan, a summary of DOE's current understanding of the repository's performance, waste characterization data from pre-test waste characterization, and an annual summary of air monitoring data required in Item 6 above.

Beyond these specific conditions, the wastes placed by DOE in the WIPP and DOE's activities under this variance must be consistent with those described in the petition. Under § 268.6(e), DOE must notify EPA of "any changes in conditions at the unit and/or environment that significantly depart from the conditions described in the variance and affect the potential for migration of hazardous constituents from the unit * * * ." If the change is planned, EPA must be notified in writing 30 days in advance of the change; if it is unplanned, EPA must be notified within ten days.

Under § 268.6(f), if DOE determines that there has been migration of hazardous constituents from the repository in violation of part 268, it must suspend receipt of prohibited wastes at the unit and notify EPA within ten days of the determination. Within 60 days, EPA is required to determine whether DOE may continue to receive prohibited waste in the unit

and whether the variance should be revoked.

Finally, under § 268.6(h), the term of today's petition approval runs for ten years, that is until November 14, 2000.

Dated: October 31, 1990.

Don R. Clay,

*Assistant Administrator for Solid Waste and
Emergency Response.*

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