40 CFR Part 191
Environmental Standards for the
Management and Disposal of Spent
Nuclear Fuel, High-Level and
Transuranic Radioactive Wastes

EPA 520/1-85-024-1

RESPONSE TO COMMENTS

FINAL RULE FOR HIGH-LEVEL AND TRANSURANIC RADIOACTIVE WASTES

Volume I--Public Comments

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A - List of Commenters

Chapter 1: INTRODUCTION

The U.S. Environmental Protection Agency (EPA) has the responsibility of developing and issuing environmental standards, guidelines, and criteria to ensure adequate protection of the public and the environment from potential radiation impacts.

This document addresses the comments received on the proposed rulemaking for "Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," (40 CFR Part 191), published in the Federal Register on December 29, 1982 (47 FR 58196-58206)

During the rulemaking, there were two public comment periods based on the proposed rule. During the first comment period, lasting until May 2, 1983, comments were sought on all aspects of the proposed standards. The Agency received replies from a broad spectrum of private citizens, public interest groups, members of the scientific community, representatives of industry, and State and Federal agencies. Two public hearings, held May 12-14, 1983, in Washington, D.C., and May 19-21, 1983, in Denver, Colorado (48 FR 13444) concentrated on seven topics that generated a range of questions. Copies of these questions were also sent to all those who responded to the initial request for comment, and the availability of these questions was announced in the Federal Register (48 FR 21666). A second comment period was then held open until June 20, 1983, to receive responses to these additional questions. The Agency continued to accept comments for docketing until the final rulemaking.

The seven issues were:

(1) A definition of high-level waste.

   (a) Should EPA define "sufficient concentrations" in the high-level waste definition?
   (b) Should EPA prohibit dilution?

(2) Need for the assurance and procedural requirements.

   (a) Retained or deleted.
   (b) Kept in standards or issued as Federal guidance.

(3) Should a long-term monitoring requirement be included?

(4) Definition of accessible environment.

(5) Should applicability of standards be extended beyond 10,000 years?

(6) Should there be some limit on individual exposures in the standard?

(7) Is there a need for quantitative definitions of release probabilities?

Copies of the written comments and transcripts of the hearings are available for inspection and copying at EPA's Central Docket Section, West Tower Lobby, Gallery One, Waterside Mall, 401 M Street, S.W., Washington, D.C. 20460. The docket number is R-82-3. (A fee may be charged for copying.)

The Agency has made every effort to consider all comments submitted. However, because of the time constraint, it is possible that those comments submitted during those months previous to the final rulemaking and after the final comment period closed may not be included in this document.

This document summarizes major concerns and issues arising from written and oral comments on the proposed rulemaking, as well as EPA's response to these. Each commenter is identified by a letter and number after the comment. The response to the comment then follows. In the interest of clarity and economy, some comments are paraphrased, and some closely related comments are combined. A list of the commenters and their identification numbers is given in Appendix A.

In the responses to comments sections of this document, no distinction is made between comments on the proposed standard and special comments concerning the seven issues.

Chapter 2: DEFINITIONS

2.1 Subpart A

Comment 2.1.1: Define "site." (D-58)

Response: The term "site" has been defined in 191.02(n).

Comment 2.1.2a: EPA should adopt the NWPA definition for high-level radioactive waste (HLW). (D-46, D-47, D-48, D-49, D-52, D-62, D-67, D-68, D-71, D-72, D-74, D-76, D-80, D-83, D-91, D-92, F-7-iii, F-7-ix, F-8-ii, F-8-v, H-1, H-4, H-14, K-4, K-5, K-6, K-8, K-9, K-11, K-13, K-14, K-16, K-17, K-20, K-21, K-22, K-24, L-6)

Comment 2.1.2b: EPA should allow NRC to define HLW or use its existing definition. (D-46, D-65, D-70)

Comment 2.1.2c: Definition for HLW should be all inclusive and not allow anything to slip through the cracks. (D-63, D-66)

Comment 2.1.2d: Define HLW in terms of its heat-generating capacity. (D-93)

Comment 2.1.2e: Define HLW in terms of potential hazard to biological systems. (D-77)

Comment 2.1.2f: HLW definition should be reserved for uniquely concentrated primary-raffinate stream rather than be predetermined by Table 1 concentrations. (D-16)

Comment 2.1.2g: Supports the EPA proposed definition of HLW. (D-14, D-42, D-57, D-78, D-90, H-12, H-28, K-7, L-3, L-10)

Comment 2.1.2h: Suggests a HLW classification system based on level of protection necessary. (K-3)

Comment 2.1.2i: Supports definition proposed by DOE. (K-2, K-15, L-1)

Comment 2.1.2j: Supports definition proposed by the Edison Electric Institute. (K-18, K-19)

Comment 2.1.2k: Suggest addition of an intermediate-level waste category to the EPA/NWPA HLW definition. (D-84, K-1, K-11)

Response (Comments 2.1.2a through k): The EPA definition of high-level radioactive waste was revised to be identical with the definition in the NWPA. This was done to prevent varying definitions and will allow EPA to follow the NRC rulemakings in determining a more specific definition for other highly-radioactive material. The Agency will follow-up in determining what appropriate elaborations of the NWPA definition will be incorporated into 40 CFR Part 191.

Comment 2.1.3a: Should use the NWPA definition for HLW, but include spent fuel. (K-12)

Comment 2.1.3b: Spent fuel should not be considered in HLW definition or included for disposal. (D-36, D-59)

Response (Comments 2.1.3a and b): The term "spent fuel" was removed from the HLW definition and defined separately. However, "spent nuclear fuel" was kept under the coverage of the final disposal standards.

Comment 2.1.4a: The background section for Table 1 requires more explanation and documentation. (D-7, D-25, D-84, D-85, F-8-iv)

Comment 2.1.4b: Consideration should be given to the quantity of waste over which concentration limits may be averaged. (D-16)

Comment 2.1.4c: Americium-241 should be given a specific entry with a lower concentration limit in Table 1. (H-21)

Comment 2.1.4d: EPA should retain Table 1 (concentrations) and define the NWPA term "sufficient concentrations." (K-4, K-5, K-6, K-7, K-8, K-12, K-13, K-14, K-16, K-17, K-20, K-21, K-24, L-3, L-6)

Comment 2.1.4e: "Sufficient concentrations" definition (in NWPA) should be defined by the NWPA implementor. (K-2, K-15, L-1, K-18)

Comment 2.1.4f: EPA should not define "sufficient concentrations" for the NWPA HLW definition. (K-9)

Comment 2.1.4g: Should broaden definition to include all radioactive wastes greater than Table 1 concentrations and require geological disposal.
(D-23, D-46, D-8, D-86, H-10)

Comment 2.1.4h: EPA should include a provision to specifically prohibit dilution of wastes to avoid the concentration limits in Table 1. (D-12, D-66, K-4, K-6, K-7, K-8, K-9, K-13, K-17, K-20, L-3, L-6)

Comment 2.1.4i: EPA should not prohibit dilution of wastes. (K-15, K-18, L-1, K-2, L-4)

Comment 2.1.4j: EPA should allow dilution if there is a net health and environmental benefit or cost benefit. (K-14, L-4)

Response (Comments 2.1.4a through j): EPA has incorporated the NWPA definition for HLW without further elaboration of the phrase "sufficient concentrations" and deleted its proposed definition and Table 1 concentrations; thus the subject of waste dilution will be a matter for the implementing agency.

Comment 2.1.5a: The TRU waste definition needs to be clarified in relationship to that for HLW. (D-79)

Comment 2.1.5b: A discrepancy was noted in EPA's definition of TRU wastes. Were they to be considered based on a one-year or 20-year half-life? (D-7, D-25, D-46, D-57, D-59, D-78, D-85, D-86, D-90, H-6, H-10, H-12)

Comment 2.1.5c: EPA's definition of TRU should be the same as NRC's definition in 10 CFR Part 60 and 10 CFR Part 61 or reconciled. (D-7, D-25, D-57, D-65, D-90, F-8-vi)

Response (Comments 2.1.5a through c): The one-year half-life reference was a typographical error. EPA's definition of TRU wastes is applicable to TRU radionuclides with a half-life greater than 20 years. NRC's TRU waste definition in the proposed 10 CFR Part 60 rule was deleted in the final rule, while their definition in the 10 CFR Part 61 rule defines TRU wastes with half-lives greater than 5 years, EPA feels its definition is appropriate for those wastes to be disposed of in a deep geological repository, while NRC's definition is appropriate for shallow land burial considerations.

Comment 2.1.6: Suggest EPA set a *de minimis* level for very small quantities of HLW. (D-47)

Response: As EPA is evaluating the possibility of a Below Regulatory Concern standard along with its standards for the disposal of low-level radioactive wastes (48 FR 39563), it is not appropriate to evaluate such a level in the HLW standards rulemaking.

Comment 2.1.7: EPA should use an environmental bubble approach over the nuclear industry for disposal of nuclear wastes. (D-12)

Response: The environmental bubble would not be an appropriate approach for the disposal of radioactive wastes because of the wide variety of types and radioactivity ranges of the wastes. It is our opinion that the various wastes, high-level, mill tailings, low-level, etc., must be evaluated on their own basis and appropriate standards developed for application to that type of waste.

2.2 Subpart B

Comment 2.2.1: "Disposal" should be defined as it is in the Nuclear Waste Policy Act. (D-58)

Response: The EPA disposal definition (located in Subpart A of the final rulemaking) follows the NWPA definition very closely. The minor differences are related to EPA's standard and the terminology used in the standard.

Comment 2.2.2: Suggest disposal system definition be in terms of physical boundaries during operation and post-closure. (D-48, D-49)

Response: Rather than define the physical boundaries of the disposal system, EPA chose to define the controlled area [in Section 191.12(g)] as it relates to the EPA environmental standard. The definition EPA chose was considered to be the most appropriate within the context of this rule.

Comment 2.2.3: The definition of "heavy metals" is inconsistent with that now legally accepted. (D-75)

Response: The EPA definition is the common definition in use today both in the U.S. and internationally.

Comment 2.2.4: In the "barriers" definition, replace "substantially" with an effectiveness time estimate. (D-75)

Response: The implementing agency will determine whether the barriers are effective to meet the EPA standard.

Comment 2.2.5: The "barriers" definition should add the phrase, "from their original location in the disposal system." (D-47)

Response: The combined definition of barriers and disposal system provides the same meaning.

Comment 2.2.6: What are the "expected processes" in the "reasonably foreseeable" definition? (D-46)

Response: This definition has been deleted in the final rule and permissible probabilities incorporated in the containment requirements. It will be up to the implementing agency to evaluate the significant processes and events that may affect the disposal system. In addition, EPA has added a "Guidance for Implementation of Subpart B" appendix to the final rule.

Comment 2.2.7: "Disturbed zone" should be defined as in 10 CFR Part 60. (D-46)

Response: EPA does not use the term in its standard.

Comment 2.2.8: "Ground water" should be the same as "significant amounts of ground water". (D-46)

Response: Each term refers to a significant definition. Both are needed. Some ground water may not be in an aquifer that is a primary source for a community water system.

Comment 2.2.9a: Define "health effects." (D-46)

Comment 2.2.9b: "Health effects" should include morbidity and genetic effects on humans, flora, and fauna. (D-35).

Comment 2.2.9c: More emphasis should be placed on ionizing radiation damage through alpha and beta emitters to the biota. (D-51)

Response (Comments 2.2.9a through c): The term "health effects" is not used in this standard. The term, where used in the preamble and support documents, is intended to mean fatal cancers for humans only. Agency policy states that when environmental contaminants are radioactive materials and ionizing radiation, the most important impacts are those affecting human health. This policy assumes that, for the same dose, potential radiation effects to other receptors, such as flora and fauna, will be no greater and that such receptors are no more radiosensitive than humans.

Comment 2.2.10: The definition of "active institutional controls" should include monitoring in the list of activities. (D-58)

Response: This was added to the definition in the final rule.

Comment 2.2.11: The "performance assessment" should require all identified events to be evaluated by accountable means rather than dismissed by a "reasonable expectation" since the sentence that contains the term "reasonable expectation" implies that some evaluation needs to be performed to reach that conclusion. (D-58, D-75)

Response: The term "reasonable expectation" is not included in the performance assessment definition in the final rule. The performance assessment is further detailed in the preamble, the containment requirements (Section 191.13), and the appendix on "Guidance for Implementation of Subpart B."

Chapter 3: GENERAL

3.1 Authorities and Implementation

Comment 3.1.1a: EPA may have exceeded its legislative authority by delving into implementation issues. (D-7, D-85)

Comment 3.1.1b: EPA has incorrectly delegated certain standard setting and environmental protection requirements to other Federal agencies through the use of the National Environmental Policy Act. (D-55)

Response (Comments 3.1.1a and b): EPA has not exceeded its legislative authority. The rule is a generally applicable environmental standard issued under the authorities of Reorganization Plan No. 3 of 1970, and the Atomic Energy Act.

Comment 3.1.2: More specific information is needed on which agency implements which activities. (D-46, D-47, D-50, H-25)

Response: This has been done, both in the preamble and in the standard itself. For Subparts A and B, NRC will be the implementing agency for licensed facilities, whereas DOE will be the implementing agency for activities at non-licensed disposal facilities. Other DOE facilities will be covered under the Clean Air Act radionuclide emission regulations (40 CFR Part 61).

Comment 3.1.3: EPA should include the NWPA as part of their authority. (D-48, D-49)

Response: The NWPA (P.L. 97-425) does not give EPA any additional authority. It only directs EPA, under its pre-existing authorities, to promulgate generally applicable standards for protection of the general environment.

Comment 3.1.4a: Structure standards so that conservatism by EPA, DOE, and NRC on the same item can be avoided. (F-7-ii, F-7-iii)

Comment 3.1.4b: Set standards to allow implementing agencies some flexibility. (K-11)

Comment 3.1.4c: Due to uncertainties, allow more flexibility in reaching licensing decisions. (D-7, D-25)

Response (Comments 3.1.4a through c): In the final rule, the EPA Administrator may allow alternative standards and provisions for both subparts through rulemaking.

Comment 3.1.5: EPA should address its responsibilities under Section 106 of the National Historic Preservation Act and 36 CFR 800. (D-3)

Response: We believe that application of the criteria of the National Historic Preservation Act are appropriate relative to specific site evaluations, but are not appropriate for the promulgation of generally applicable environmental standards under the Atomic Energy Act.

3.2 Transportation

Comment 3.2.1a: EPA should develop and include transportation standards in 40 CFR Part 191. (D-20, D-50, D-70, F-8-iii, H-3, H-19, H-27)

Comment 3.2.1b: Why was transportation not included in the proposed rule? (D-2)

Comment 3.2.1c: Include a transportation assurance requirement. (H-14)

Response (Comments 3.2.1a through c): Transportation is not included in these standards for two reasons. First, the Agency believes the regulations promulgated by DOT and NRC are doing a very good job in limiting impacts from both normal transportation and the number and consequences of accidents. Second, as a consequence of the apparently adequate DOT and NRC regulations and budget and time constraints, the Agency has concentrated its efforts on projects of higher priority such as low-level waste standards and standards under the authority of the Clean Air Act.

3.3 Subpart A

Comment 3.3.1a: Variance section for Subpart A is not within EPA's authority. (H-7)

Comment 3.3.1b: Variance section is too vague. (D-15)

Comment 3.3.1c: Variance procedures need greater State involvement. (D-50, D-58, D-86, H-2)

Comment 3.3.1d: Delete variance section or leave to implementing agency. (H-11)

Comment 3.3.1e: Require a stringent environmental review with variance. (D-22)

Response (Comments 3.3.1a through e): The variance section in the proposed rule was deleted in the final rule. In place of the variance section, an "Alternative Standards" provision has been included in the final rule. The provision allows the EPA Administrator, upon review of an application, to issue alternative standards for waste management and storage operations at particular DOE disposal facilities that are not regulated by NRC.

Comment 3.3.2a: The dose limits are not consistent in Subparts A and B. (D-7, D-25, L-16)

Comment 3.3.2b: The three different dose limits in 40 CFR Part 190 and 40 CFR 191 should correspond to the same level of risk. (D-7)

Comment 3.3.2c: The dose limits should be based on the effective dose equivalent. (D-25)

Comment 3.3.2d: Subpart A dose limits should be no higher than those proposed in the CAA. (D-78)

Comment 3.3.2e: The dose limit approach is not a satisfactory basis for Subpart A standards. (D-47)

Comment 3.3.2f: Subpart A should specifically apply to DOE waste facilities. (F-7-ix, H-38)

Response (Comments 3.3.2a through f): The dose limits set in 40 CFR Part 191 have been arrived at for the specific case of high-level and transuranic radioactive waste disposal. The analyses included consideration of achievability and costs unique to these circumstances. Where the analyses showed it was practicable, we have used limits consistent with other EPA standards in order to simplify implementation. For this same reason, we have expressed the individual exposure limits in units consistent with current EPA radiation standards. The proposed Subpart A limits were based on the outdated "critical organ" approach, while the Subpart B limits used the ICRP's "effective dose equivalent" approach. In the final rule, Subpart A has been divided between NRC-licensed and non-NRC-licensed facilities. The NRC-licensed facilities are considered to be an extension of the uranium fuel cycle and, therefore, fall under 40 CFR Part 190 where dose limits are based on the older method; for consistency purposes, these have been extended to Subpart A. For non-NRC-licensed facilities, the Subpart A dose limits are consistent with the EPA's Clean Air Act standards, which are based on the newer method. The Subpart B dose limits remain based on the newer method. In the future, EPA will consider revising Part 190 and Subpart A of Part 191 to incorporate the effective dose-equivalent concept.

In the final rule, Subpart A standards apply to all NRC-licensed waste management and storage facilities and to the management and storage operations at any non-NRC-licensed disposal facility. For other DOE waste management and storage operations, which are usually conducted on

large reservations with many other potential sources of radionuclide emissions, the Agency believes that coverage under the broader scope of EPA's Clean Air Act Standards, 40 CFR Part 61, is the most effective and practical regulatory approach.

Comment 3.3.3a: The ICRP 500 mrem, annual-committed effective dose equivalent should be an acceptable level. (D-16, D-73)

Comment 3.3.3b: ICRP principles cannot be applied directly to waste disposal. (D-19)

Comment 3.3.3c: Curie release limits for specific radionuclides should also be set for Subpart A, consistent with 40 CFR Part 190. (D-7, D-25)

Comment 3.3.3d: The Subpart A dose limits should correspond to the ICRP and NCRP recommendations of 500 mrem per year. (D-46)

Response (Comments 3.3.3a through d): Upon surveying the expected performance of the technologies planned for the management, storage, and preparation of these wastes for disposal, the Agency found that the likely exposures to members of the public would generally be very small.

Therefore, compatibility with related radiation protection standards (40 CFR Part 190) became a more important perspective for Subpart A. In addition, individual curie release standards, as in 40 CFR Part 190, were not necessary because of the already minimal release and exposure of radionuclides from these activities.

Comment 3.3.4: Guidance should be offered on how technical, social, and economic considerations are factored into the operations planning in order to strive for lower levels of exposure. (D-58)

Response: Such guidance should come from the implementing agencies. The rule does include guidance on the Agency's view of how calculations should be used in determining compliance with the standard.

Comment 3.3.5: The retrieval of waste from storage operations should be addressed. (D-57, D-58, D-74, H-12)

Response: The Agency believes that any radioactive releases from operations such as described would be covered under the existing 40 CFR Part 61 and 40 CFR Part 191 standards. Occupational exposure relating to repository retrievability would be covered by NRC standards.

3.4 Ambiguous Language and Clarification

Comment 3.4.1: The standard contains numerous ambiguities, terms, and definitions which are vague, and many subjective and qualitative words are used. (D-7, D-42, D-85, D-93, L-7)

Response: EPA believes that the final standard has eliminated those terms, definitions, and phrases thought to be vague and ambiguous.

Comment 3.4.2: The preamble (47 FR 58198) and the DEIS gives the impression that a repository could give perfect containment. This is not credible; clarify. (D-46, D-50)

Response: We agree and have reworded to more accurately reflect the projected situations.

3.5 Technical Information

Comment 3.5.1: State number of reactors which currently generate 2000 metric tons per year of spent fuel (47 FR 58196). (D-7)

Response: This number is an average based on the amount of spent fuel generated by all reactors each year over a number of years. Refer to the section on spent nuclear fuel in the Background Information Document.

Comment 3.5.2: EPA should revise its waste inventory to include all wastes and associated radioactivity rather than just those wastes with radionuclide half-lives greater than 20 years. (D-48, D-49)

Response: EPA includes these data in the Background Information Document section on Quantities, Sources, and Characteristics of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes. It is the long half-life elements that will be of concern over the 10,000-year containment requirement. The shorter half-life nuclides will probably be decayed to innocuous levels by the time any amount could travel into the general environment.

Comment 3.5.3: What difference does inclusion of defense or commercial fuel with different burnups and defense wastes have on repository inventory and releases? (D-46, K-3)

Response: The final rule has detailed notes on the application of the release limits table and adjustments for reactor fuels with different burnups or fractionated high-level radioactive waste streams. DOE will calculate an equivalent burnup value (MWd/MTHM) for its defense wastes.

Comment 3.5.4: The repository capacity choice of 100,000 MTHM should be further explained since actual repository capacity may vary; also, a further explanation of the number of reactors producing spent fuel is needed. (D-7, D-31, D-50)

Response: The choice of 100,000 MTHM is a reference base only. It is not meant to define the actual repository, but as a calculational tool to allow one to estimate the releases based on a quantity of waste in the repository. Data on reactor spent fuel generation rates may be found in the Background Information Document.

Comment 3.5.5: Remove all reference to a 500-mrem-per-year dose limit as being acceptable today. (D-66)

Response: This is not possible since the value is an acceptable dose limit under certain circumstances until it is changed by the Federal regulatory agencies.

Comment 3.5.6: More data are necessary to select a site and write standards. (D-86)

Response: The Agency believes it has utilized all available data to prepare the final standards. If further information becomes available in the future that would change the standards, EPA will review such data and make an appropriate judgment as to whether changes are needed. The need to collect more data to select a site is under the authority of the DOE and NRC.

Comment 3.5.7: The standards should insist on "best available technology." (D-50)

Response: In general, the Agency developed the various parts of this rule by balancing several perspectives. One set of considerations was the expected capabilities of the waste management and disposal technologies to reduce both short- and long-term risks to public health and the environment. These capabilities were examined through a number of performance assessments. A second consideration, where applicable, was consistency with related environmental standards for radiation exposure. A third factor was evaluation of various benchmarks to assess the acceptability of the residual risks that might be allowed by the rule. This was particularly important for the disposal standards, where there were few precedents to guide the Agency's judgments. Finally, the Agency placed considerable emphasis on the public concerns expressed during the various phases of this rulemaking, particularly where these concerns involved addressing the substantial uncertainties inherent in the unprecedented time periods of interest.

Because there were other factors to be considered, the Agency believed that the final rule should reflect a blend of all these perspectives, and no single factor, such as a "best" available technology, should predominate to produce a standard.

Comment 3.5.8: Inability to accurately project the future does not allow for reliable results. (D-19)

Response: The Agency has always acknowledged that there is considerable uncertainty in making such long-term predictions. This is a major reason we believe the Assurance Requirements are necessary in the regulatory structure.

Comment 3.5.9: Set an upper limit on the amount of wastes per repository. (D-7)

Response: The NWPA (42 USC 10134) has already set an upper limit on amount of wastes for the first repository until such time as a secondary repository is in operation. In addition, the Agency believes that a proliferation of small repositories is contrary to the policy of best possible protection offered by selecting a small number of well characterized and carefully chosen sites.

3.6 Application of Standards

Comment 3.6.1: There is concern that there is a potential for applying the standards more broadly, or taking them out of context for use in other radiation areas rather than just for the disposal of these particular types of radioactive wastes. (D-42, D-65, F-7-vi)

Response: EPA has emphasized in the preamble to the rule that this standard is for this specific class of wastes and for a given set of conditions. It is EPA's intent that these standards not be used to judge other wastes under other conditions of disposal.

Comment 3.6.2: The special emphasis on high-level radioactive waste management and disposal, causes an inconsistency between other waste management standards and gives the impression that high-level waste disposal presents substantial risks. (H-3, L-9)

Response: The Agency believes that one set of standards is not necessarily appropriate for all classes of wastes. Different wastes may present different levels of risk.

Comment 3.6.3a: Indicate whether DOE's Waste Isolation Pilot Plant or any other test and evaluation disposal facility have to conform to EPA's standards. (D-49, D-50, F-8, K-13, K-25, L-15)

Comment 3.6.3b: Standards should apply to all DOE disposal sites for high-level wastes. (H-14, K-25, L-15)

Response Comments (3.6.3a and b): EPA's disposal and normal operations standard apply to any NRC-licensed or non-NRC-licensed repository where spent nuclear fuel, high-level or transuranic radioactive wastes will be placed for disposal. Test and evaluation facilities are not covered

unless they become a permanent disposal facility in which case they would then have to conform to EPA's standards. However, if a test and evaluation facility is associated with a repository, it too will be covered by the normal operations portion (Subpart A) of EPA's standards.

Comment 3.6.4: EPA should exclude transuranic wastes from standards until NRC and EPA can agree on the degree of control necessary. (K-11)

Response: The Agency believes the standard is appropriate considering the control technology available and that NRC or DOE should be able to implement the standard.

Comment 3.6.5a: Standards should be limited to geologic disposal since that was the basis of the supporting analysis for the rule. (D-66, D-69)

Comment 3.6.5b: EPA has not given proper consideration to seabed disposal as a viable option and is presenting a bias to deep geological disposal. (D-24, D-35, D-69, K-1)

Response (Comments 3.6.5a and b): EPA has specifically excluded ocean or ocean sediment disposal from these standards because ocean dumping of high-level radioactive waste is presently prohibited by both the U.S. Marine Protection, Research, and Sanctuaries Act of 1972 (P.L. 92-532) and the multinational treaty covered by the London Convention of 1972 on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter. In the event ocean disposal were to become a viable alternative, EPA would, if appropriate, prepare standards and regulations under its P.L. 92-532 authority.

EPA's standard is intended to be a generally applicable environmental standard for the disposal, by any method other than the ocean, of high-level wastes, spent nuclear fuel, and specified transuranic wastes.

In developing the standards, EPA concentrated on geologic repositories because more information is available on this approach than on other disposal methods and the U.S. national program is focusing on this method. Also, the Nuclear Waste Policy Act (P.L. 97-425) has directed the Department of Energy to proceed with developing a permanent deep geological repository for disposal of high-level radioactive waste and spent nuclear fuel.

Comment 3.6.6: Why the 12-month delay in the effective date of Subpart A of the proposed standard? (D-86)

Response: In the final rule the effective date for both Subparts A and B will be 60 days after publication in the Federal Register.

Comment 3.6.7: The preamble indicates Subpart B to take effect when the mine is backfilled and sealed, whereas Section 191.16 states Subpart B to be effective immediately upon promulgation. (D-85)

Response: The preamble is referring to the releases and release limits. The time involved with the releases is to begin upon sealing the repository; whereas, the necessary means to implement the containment and assurance requirements should begin soon after promulgation and during the design and construction phases.

Comment 3.6.8: EPA should delay the final rule until the National Academy of Sciences releases its final report on the isolation system for geologic disposal. (D-79)

Response: The NAS report was released in April 1983 and made available to EPA's Science Advisory Board's High-Level Radioactive Waste Disposal Subcommittee prior to their report to EPA and prior to EPA's final rule.

Comment 3.6.9: Let DOE and NRC set acceptable practices to meet EPA's standards. (K-2)

Response: It is intended that NRC and DOE will set acceptable practices to meet EPA's 40 CFR Part 191 through appropriate modification and application of their regulations and guidelines, 10 CFR Part 60 and 10 CFR Part 960, respectively.

Comment 3.6.10: Allow case-by-case risk-benefit analysis for disposing of certain defense wastes in-situ. (D-46)

Response: The Agency does not now have sufficient information and analysis to formulate and propose provisions for subcategories or subclasses of wastes. However, it may turn out that the disposal requirements of Subpart B are not completely appropriate for all classes of wastes. Therefore, a Section (191.17) has been added to the final rule which sets forth procedures to be followed if further rulemaking is needed to modify Subpart B for such situations when more information becomes available.

Comment 3.6.11: Provide funding and expertise for intervenor groups and require compensation and consent of local populace. (L-7)

Response: EPA's authority only extends to providing generally applicable environmental standards.

3.7 Intrusion

Comment 3.7.1a: The human intrusion scenario taking place after 100 years is too conservative. (D-7)

Comment 3.7.1b: EPA should include human error in its analysis. (D-50)

Comment 3.7.1c: Quantitative demonstration of compliance for the human intrusion scenario and other human activities should be restricted to no greater than 100 meters, whereas deeper human intrusions should be discouraged by the assurance requirements. (D-19)

Comment 3.7.1d: It seems inconsistent that water well drilling is considered a likely source of intrusion, while estimates of waste migration in groundwater assume that there is an openly flowing stream at the surface only 1600 meters from the repository site. (D-36)

Response (Comments 3.7.1a through d): The most potential disruptions of a mined geologic repository are those that are hardest to predict and associated with inadvertent human intrusion. Some types of intrusion would have virtually no effect on a repository's containment of waste. On the other hand, it is possible to conceive of intrusions that could result in major disruptions that no reasonable repository selection or design precautions could alleviate. The Agency believes that the most productive consideration of inadvertent intrusion concerns those realistic possibilities that may be usefully mitigated by repository design, site selection, or use of passive controls (although passive institutional controls should not be assumed to completely rule out the possibility of intrusion). Therefore, inadvertent and intermittent intrusion by exploratory drilling for resources should be the most severe intrusion scenario considered by the implementing agencies. For further details, see Appendix B of the final rule, "Guidance for Implementation of Subpart B." The Agency interprets inadvertent to mean any unplanned and unintended intrusion.

The implementing agencies should consider the effects of each particular disposal system's site, design, and passive institutional controls in judging the likelihood and consequences of such inadvertent exploratory drilling. Furthermore, the Agency assumed that the consequences of such inadvertent drilling need not be assumed to be more severe than: 1) direct release to the land surface of all the ground water in the repository horizon that would promptly flow through the newly-created borehole to the surface due to natural lithostatic pressure--or (if pumping would be required to raise water to the surface) release of 200 cubic meters of ground water pumped to the surface if that much water is readily available to be pumped; and 2) creation of a ground water flow path with a permeability typical of a borehole filled by the soil or gravel that would normally settle into an open hole over time--not the permeability of a carefully-sealed borehole.

The Agency assumes that, as long as such passive institutional controls endure and are understood, they: 1) can be effective to cause societal action to deter systematic or persistent exploitation of these disposal sites; and 2) can reduce the likelihood of inadvertent, intermittent human intrusion to a degree to be determined by the implementing agency. However, the Agency believes that passive institutional controls can never be assumed to eliminate the chance of inadvertent and intermittent human intrusion into these disposal sites.

3.8 Miscellaneous

Comment 3.8.1: EPA should select an advisory board of technical experts to review the comments and response documents. (D-62, F-7-ix)

Response: The Agency did convene a group of internal experts to review the comments and responses. This was not considered an appropriate task for a group outside the Agency since the EPA Administrator must be responsible for the decisions.

Comment 3.8.2: EPA's interpretation that the National Academy of Science study supports EPA's standards as an effective rulemaking is questionable. (D-7, D-25)

Response: EPA's statement in the proposed rule was not meant to imply that EPA believed the NAS study supported EPA's standards. The NAS study on the compliance aspects assisted EPA in concluding that our standard could be implemented.

Comment 3.8.3: EPA should allow for several decades of dry storage of solidified wastes to reduce the thermal output. (D-93)

Response: The assurance requirement calling for prompt disposal has been deleted; there is now nothing in the final rules which prohibits DOE from cooling the waste over some time period to reduce the thermal load.

Comment 3.8.4: A variance section should be included for Subpart B. (D-7, F-7-iii)

Response: An "Alternative Provisions for Disposal" section (191.17) has been included in the final rule establishing minimum procedural requirements that the EPA Administrator must follow if additional information indicates that it might be appropriate to consider modifying the disposal standards (Subpart B).

Comment 3.8.5: The standard should state that 1000 health effects over 10,000 years from 100,000 metric tons of waste is the basis of Table 2. (H-10)

Response: We do not see the need to include that information in the standard, as its inclusion in the Preamble and the Background Information Document is sufficient to properly inform the public of the table's basis.

Comment 3.8.6a: When and where will nonradiological impacts, such as socioeconomics, land use, and air quality, be analyzed? (D-70)

Comment 3.8.6b: EPA should consider and include nonradiological risks. (D-25, D-75, D-56, D-86, H-10)

Response (Comments 3.8.6a and b): These subjects will be addressed in the environmental impact statements issued by the Department of Energy in the course of its site selection and repository licensing programs. This rulemaking establishes generally applicable environmental standards only for radiation exposure. The standard being promulgated by EPA does not take nonradiological impacts or risks into consideration because they were outside the scope of the standard.

Comment 3.8.7: The DEIS does not consider other HLW such as demineralized resins. (H-13)

Response: The final rule has used the NWPA definition for high-level radioactive waste which allows the NRC to further define other highly-radioactive material that requires permanent isolation.

Comment 3.8.8: Why are extraterrestrial and transmutation discussed in the DEIS as viable disposal alternatives? (D-69)

Response: The DEIS section discussed extraterrestrial disposal and transmutation in the context of describing various waste management operations for various disposal options and not necessarily as viable disposal options. See Section 4.6 of the BID for further information on alternative disposal methods.

Comment 3.8.9a: Vaults created by underground nuclear weapons tests should be used for the storage of radioactive wastes until they can be recycled into safe by-products. (H-24)

Comment 3.8.9b: Consider use of salt domes for storing liquid radioactive wastes. (F-84)

Response (Comments 3.8.9a and b): It is the Department of Energy's responsibility to determine storage policy for high-level radioactive wastes.

Comment 3.8.10: The Agency should include a general discussion of the relative chemical toxicity of HLW and consider it in the standard. (D-7, D-25, D-50, D-59, F-7-vii, H-2, K-3, K-9)

Response: The standards being promulgated by EPA do not take into consideration the chemical toxicity of the HLW. For high-level radioactive wastes and spent nuclear fuel, it is felt that the radiation concern is greater than the problem of chemical toxicity.

Comment 3.8.11: The Agency should consider and/or require a 1000-year canister. (D-50, F-7-vii, F-7-viii).

Response: It is within NRC's authority to designate the technical criteria for the disposal of high-level radioactive wastes (10 CFR Part 60), e.g., a specific type of engineering control, of which canisters would be a part.

Comment 3.8.12: EPA should set rules to discourage further reprocessing and encourage disposal of all existing and spent fuel in unaltered form. (D-54, L-9)

Response: EPA can discern no basis for such a rule. Our basic concern is to assure that the development of all energy sources be accomplished in a manner compatible with generally acceptable public health and environmental quality goals.

Chapter 4: ASSURANCE REQUIREMENTS

4.1 General

Comment 4.1.1a: The assurance requirements should be retained in the rule. (D-50, D-66, D-80, D-81, F-7-iv, F-7-v, F-7-vii, F-7-viii, F-7-ix, F-8-iv, F-8-v, H-6, H-37, H-38, K-1, K-4, K-5, K-6, K-7, K-8, K-9, K-10, K-12, K-13, K-16, K-17, K-20, K-21, K-24, K-25, L-3, L-6, L-8, L-10, L-11, L-12, L-13, L-14, L-15)

Comment 4.1.1b: Retain assurance requirements, especially for facilities not subject to NRC licensing. (K-13)

Comment 4.1.1c: Changes should be made and additional requirements included to describe uncertainties, state assumptions, and document models. (D-7, D-36, D-41, D-53, D-55, D-57, K-5, K-24)

Comment 4.1.1d: The assurance requirements should be deleted from the rule. (D-46, D-47, D-79, F-7-ii, F-7-iii, F-11, H-7, H-11, H-33, K-2, K-15, K-18, K-19, L-1)

Comment 4.1.1e: Should require the implementing agencies to issue assurance requirements. (K-18)

Comment 4.1.1f: NRC only should be allowed to waive the assurance requirements if a particular site meets the performance standard. (K-13)

Comment 4.1.1g: The assurance requirements should be retained and issued as Federal Radiation Protection Guidance. (D-65, D-84, D-90, F-7-vi, K-2, K-14, K-15, K-19)

Response (Comments 4.1.1a through g): EPA believes that an important complement to the disposal containment requirements is the assurance requirements and that they are needed to provide adequate confidence that the long-term release limits will be met. The Agency believes that the assurance requirements are an important part of the generally applicable standards because of the major uncertainties involved. The NRC has agreed to modify 10 CFR Part 60 where necessary to incorporate the intent of the assurance requirements, rather than have them included in 40 CFR Part 191 for NRC-licensed disposal facilities. In the final rule, the assurance requirements are retained for non-NRC-licensed disposal facilities only.

Comment 4.1.2: What enforcement measures are in place to ensure compliance by DOE and NRC? (K-9)

Response: The DOE's 10 CFR Part 960 incorporates the standards the Agency is promulgating as the overall siting requirements for a geologic repository. See response to Comment 4.1.1a through g for NRC's compliance with the standards.

4.2 Prompt Disposal Requirement

Comment 4.2.1a: Quantify the time before disposal. (D-50, D-53, D-75, D-81, H-6, L-7)

Comment 4.2.1b: Define prompt disposal in terms of inventory or radioactivity, and how it applies to storage or test facilities. (D-50, D-75, D-84, K-9)

Comment 4.2.1c: Preclude reprocessing. (D-54)

Comment 4.2.1d: Requirement too vague and not germane to purpose of assurance requirements. (D-7, D-25, D-46, D-47, D-65, F-7-iii, F-11)

Comment 4.2.1e: The requirement should be deleted. (D-46, D-65, D-90, F-7-iii, F-11, H-14, K-7)

Comment 4.2.1f: Retain the prompt disposal requirement. (D-50, K-9, L-9)

Response (Comments 4.2.1a through f): The assurance requirement discussing prompt disposal was deleted from the final rulemaking. There is a requirement in the NWPA for DOE to assess the advantages of long-term storage for ease of computation, lesser disturbance of the geologic environment, etc. The prompt disposal requirement in the proposed standards, therefore, appears to be inconsistent with these considerations. With the NWPA in force clarifying the nation's commitment to develop disposal facilities, while allowing for some temporary storage, the Agency believes the requirement calling for prompt disposal is no longer necessary.

4.3 ALARA Requirement

Comment 4.3.1a: Include the ALARA requirement. (D-50, D-52, D-60, D-70, D-80, D-81, D-90, F-7-viii, H-38, K-7, L-7)

Comment 4.3.1b: Include the ALARA requirement as appropriate to site selection process. (D-53, D-62, D-66, F-7-viii, F-7-ix, H-12)

Comment 4.3.1c: ALARA not appropriate for repositories or repository siting. (D-93, F-7-ii, F-7-vi, H-3, K-19)

Comment 4.3.1d: The ALARA concept should be applied in new ways or that alternative concepts might be preferable. (D-7, D-19, D-25, D-58, H-6)

Comment 4.3.1e: The ALARA requirement should be deleted. (D-46, D-47, D-56, D-59, D-84, D-90)

Response (Comments 4.3.1a through e): The ALARA assurance requirement was deleted from the final rulemaking because of two aspects of the related rules subsequently promulgated by the NRC and DOE for disposal of spent fuel and high-level wastes. First, NRC's 10 CFR Part 60 implemented the multiple barrier principle by requiring very good performance from two types of engineered components: a 300- to 1000-year lifetime for waste packages during which there would be essentially no expected release of waste, and a long-term release rate from the waste form of no more than one part in 100,000 per year. The Agency fully endorses this approach. Second, the DOE has included a provision in its site selection guidelines (10 CFR Part 960) that calls for significant emphasis to be placed on selecting sites that demonstrate the lowest releases over 100,000 years compared with the other alternatives available. Particularly because of the longer time frame involved in this comparison, the Agency believes that this provides adequate encouragement to choose sites that provide the best isolation capabilities available. Therefore, the concept of keeping long-term releases as small as reasonably achievable has been embodied by other agencies' regulations for both the engineered and natural components of disposal systems.

4.4 Multiple Barrier Requirement

Comment 4.4.1a: Keep the assurance requirement concerning use of multiple barriers. (D-7, D-22, D-24, D-50, F-7-ix, F-8-v, H-4, H-36, K-7, K-9, K-12)

Comment 4.4.1b: The multiple barrier assurance requirement should be deleted. (D-46, D-47, D-84)

Response (Comments 4.4.1a and b): Because of the inherent uncertainties associated with these long time periods, the Agency believes that the principles embodied in this assurance requirement are essential complements to the containment requirements to ensure that the level of protection desired is likely to be achieved. Designing disposal systems to include multiple types of barriers, both engineered and natural, reduces the risks if one type of barrier performs more poorly than current knowledge indicates.

Comment 4.4.2a: Quantify barrier performance requirements. (D-58, D-85, L-7)

Comment 4.4.2b: Clarify the multiple barrier concept, define types of barriers, and define "substantial isolation". (D-69, D-75, D-84, D-85, F-8-iv, H-4, L-7)

Comment 4.4.2c: Do not use limited resources in constructing barriers. (D-59)

Comment 4.4.2d: Rely on total system performance. (D-24, D-47)

Response (Comments 4.4.2a through d): The multiple barrier assurance requirement in the final standard was modified from that in the proposed standard. Barriers are defined and examples given in the definitions section of Subpart B [Section 191.12(d)]. EPA does not believe that it is necessary to quantify or define system performance because of the two related rules by NRC and DOE.

See Response to Comments 4.3.1a through e.

Comment 4.4.3: The multiple barrier assurance requirement might need to be different for TRU waste. (D-47, F-8-iv, L-16)

Response: The assurance requirement calling for both engineered barriers and natural barriers in the final rule does not distinguish between high-level and transuranic radioactive wastes. Although the wording of the assurance requirement has changed from the proposed rule, the Agency does not believe the requirement has been significantly changed. EPA believes that the definition is broad enough that it is not necessary to differentiate between HLW and TRU wastes.

4.5 Active Institutional Controls Requirement

Comment 4.5.1a: Agree with EPA's philosophy of active institutional controls, but believe the authority belongs to NRC. (D-46, D-47, D-90)

Comment 4.5.1b: The primary consideration for any control requirements at a specific site should be need. (D-90)

Response (Comments 4.5.1a and b): See response to Comments 4.1.1a through g.

Comment 4.5.2a: Need either a specific time period or a limit of 0 to 100 years after closure. (D-12, D-48, D-49, D-50, D-52, D-53, D-61, D-62, D-67, D-68, D-71, D-72, D-76, D-79, D-80, D-81, D-83, D-92, H-1, K-21, L-7)

Comment 4.5.2b: Need several hundred years if the implementing agency could give assurance that they can maintain control beyond the 100 years. (K-7)

Comment 4.5.2c: Limiting active institutional controls is unrealistic. (D-19)

Comment 4.5.2d: Need a longer period and a monitoring program. (F-8-iii)

Response (Comments 4.5.2a through d): In the final rule, a time period of 100 years was decided to be the maximum time that repository performance assessments could assume for relying on any active institutional controls to isolate the wastes, although it is stated that the controls should be maintained for as long a period of time as is reasonable after disposal [191.14(a)]. Also, a monitoring assurance requirement [191.14(b)] was included in the final rule and included in the definition of active institutional controls. See also response to Comments 4.1.1a through g.

The phrase "several hundred years" lacks the specificity necessary upon which to base assessments with confidence and may be unrealistically long, whereas less than 100 years is deemed to be unrealistically conservative.

Comment 4.5.3: Under no circumstances should active institutional controls be used as a reason to relax the requirement regarding siting near resources. (D-63)

Response: The resource assurance requirement was revised so that it now permits compensating factors to be considered rather than automatically ruling out a site because of the proximity of potential resources. However, this change was not prompted by any changes in the length of the active institutional control period; in fact, rather than lengthening the active institutional control period, it has been reduced from "several hundred years" to 100 years.

4.6 Permanent Markers Requirement

Comment 4.6.1: This requirement is better addressed by NRC and DOE and should be deleted from EPA standards. (D-47)

Response: This requirement has been retained. See response to Comments 4.1.1a through g.

Comment 4.6.2a: Feasibility of permanent marking systems has not been shown beyond a relatively short time. (D-50, F-7-viii)

Comment 4.6.2b: Passive controls should not be tied to a particular government structure. (D-65)

Comment 4.6.2c: Passive controls in perpetuity are unrealistic without Congressional action to prohibit drilling. (L-7)

Comment 4.6.2d: Passive controls might increase the probability of future intrusions. (D-48, D-49, D-50, D-55)

Response (Comments 4.6.2a through d): While long-term markers of modern design have not shown their durability over long periods of time, we believe that some method of warning future generations is better than not attempting to communicate the dangers involved. Prior to this rulemaking (in the public hearings held in 1977-1978), the question was raised as to whether it would be wiser to mark the site or to essentially "hide" the site. Public comments led us to the conclusion that marking the site would likely be the safer of the two alternatives since markings give a notion of the dangers; whereas, given the natural curiosity of people, they would probably find a "hidden" site anyway and then have no idea of what was there, with potentially very dangerous results.

Comment 4.6.3: There needs to be continued maintenance of the markers to counteract effects of erosion, vandalism, and vegetative growth. (D-57)

Response: While this suggestion would be the ideal and needs to be considered very seriously by designers, the stated position of nonreliance on active institutional controls prevents us from requiring long-term maintenance. Requiring "the most permanent markers, records and other passive institutional controls practicable" is as far as we can reasonably go toward the stated ideal.

Comment 4.6.4: EPA needs to be more specific concerning the legal and physical requirements, such as "a massive stone pyramid cap," for records and markers (D-50, D-77, D-81, D-84).

Response: This is the role of NRC and DOE.

Comment 4.6.5: Reliance on passive institutional controls should not allow selection of a site which would otherwise be more vulnerable to human intrusion. (F-7-ix)

Response: Permitting reliance on passive institutional controls is not intended to be used as a trade off in selecting sites with an increased likelihood of human intrusion.

4.7 Resource Conflict Requirement

Comment 4.7.1a: Keep this assurance requirement. (D-12, D-16, D-22, D-36, D-53, D-70, D-78, D-81, D-93, H-2, H-10, H-12, L-4)

Comment 4.7.1b: Delete this assurance requirement. (D-46, D-47, D-65, D-90)

Comment 4.7.1c: Replace this requirement with its counterpart in NRC's 10 CFR Part 60. (D-65)

Comment 4.7.1d: Many terms are ambiguous. (D-7, D-14)

Response (Comments 4.7.1a through d): The requirement was maintained, but modified in the final rule [191.14(c)] to identify resource potential as a disincentive but not as an outright prohibition for site selection, because other attributes of the site might overcome the relative disadvantages presented by resource potential. The new wording implies a qualitative comparison rather than quantitative formulas to provide adequate comparisons. The Agency intends that the sites with resources should only be used if it is reasonably certain that they would provide better overall protection than the practical alternatives that are available. See response to Comments 4.1.1a through g.

Comment 4.7.2: Change the word "easily" to "potentially" or "perceived" which would allow the requirement to account for improved resource extraction technology and the changing economics of resources and their extraction. (D-48, D-49, D-61, D-62, D-67, D-68, D-71, D-72, D-76, D-80, D-92, L-7)

Response: The word "easily" has been retained because it expresses what is intended. "Easily" is a relative term and its interpretation could change depending on the circumstances but is still exclusive; whereas, "potentially" or "perceived" could be interpreted to mean any material anywhere without regard to where it is located and/or the difficulty of reaching it.

Comment 4.7.3: Requirement is too strict in that resource potential should be considered unfavorable but not prohibitive, depending on sufficient compensatory factors. (D-1, D-41, D-42, D-47, D-57, D-78, D-79, D-84, D-85, F-8-v, H-4)

Response: The Agency believes that potential resources should not automatically eliminate a site and that any favorable characteristics for such a site must compensate for their greater likelihood of being disturbed in the future.

Comment 4.7.4: Include a prohibition against salt domes. (D-32, D-66)

Response: It is DOE's responsibility to select the disposal media. However, any media or method chosen will have to meet EPA standards.

Comment 4.7.5: Include groundwater as a potential resource. (D-48, D-49, D-50, D-58, D-62, D-70, D-74, D-80, D-91, L-7)

Response: In the final rule, resources to be considered included ground waters that are irreplaceable either because there is no reasonable alternative source of drinking water available for substantial populations or that they are vital to the preservation of unique and sensitive ecosystems.

Comment 4.7.6: Spent nuclear fuel is a potential resource and, therefore, the standard is inconsistent within itself. (D-36)

Response: Spent nuclear fuel is a waste once it has been disposed of with no intent to retrieve it in a routine manner. See NWPA. The EPA rule is not internally inconsistent.

Comment 4.7.7: Include a prohibition against an area with major tectonic activity within the past 100 years. (D-86)

Response: Tectonic activity is factored into the siting process during the performance assessment phase. Here the probability of activity is estimated along with the potential enhancement of the radionuclide release rate. These outcomes are then factored into the other scenarios for comparison with 40 CFR Part 191. In addition, tectonic activity is a major consideration in the DOE siting guidelines, 10 CFR Part 960.4-2-7.

4.8 Retrievability Requirement

Comment 4.8.1a: Supports the retrievability assurance requirement. (D-12, D-14, D-15, D-16, D-50, D-53, D-57, D-78, D-85, H-2, H-4, H-6, K-5, K-7, K-24, F-8-v)

Comment 4.8.1b: The retrievability assurance requirement is inappropriate and should be deleted. (D-46, D-47, D-71, D-87, D-92, F-7-x)

Response (Comments 4.8.1a and b): This requirement has been retained [191.14(f)]. See response to Comments 4.1.1a through g.

Comment 4.8.2: The retrievability assurance requirement appears to be inconsistent with the definition of disposal where there is no intent to recover. (D-7, D-16, D-23, D-25, D-58, D-62, D-77, D-80, D-83, D-86, D-93)

Response: This assurance requirement would permit corrective action if development of technical and scientific knowledge should indicate that a disposal system poses much greater risks than had originally been expected. Future generations may find it necessary or desirable to recover the wastes in order to better dispose of them (not because they are a resource) and change the disposal site or methodology in light of new knowledge. This would be possible using the other assurance requirements of institutional controls. This is not intended to be a required concept of retrievable storage; this criterion merely requires that the option of retrievability be left open to our successors. Also, it will prevent methods of irreversible disposal such as deep-hole placement. In addition, the NWPA has specified an appropriate period of retrievability for disposal of spent nuclear fuel (42 USC 10142).

Comment 4.8.3a: Should specify a period of time for retrievability option. (D-36, D-50, D-52, D-62, D-65, D-67, D-68, D-71, D-76, D-79, D-80, D-81, D-91, F-7-vi, F-7-vii, F-7-ix)

Comment 4.8.3b: Clarify meaning of retrievability. (D-42, D-50, K-9)

Comment 4.8.3c: Include additional restraints to the retrievability requirement. (D-54, H-10, H-12, H-28, H-31, L-4, L-7, F-7-vii)

Response (Comments 4.8.3a through c): The requirement in the final rule is the same as that in the proposed rule. The Agency does not believe that a specified time or additional restraints would provide added assurance. Other requirements or further restraints may be added by the implementing agencies at any time. For further discussion on this requirement, refer to the proposed rule preamble (47 FR 58201) and the Draft Environmental Impact Statement for 40 CFR 191 (EPA-520/1-82-025).

4.9 Long-Term Monitoring Requirement

Comment 4.9.1a: Should require long-term monitoring as long as active institutional controls are in place or as long as possible. (D-6, D-15, D-58, D-81, K-7, K-12, K-14, K-16, K-20, L-5, L-6)

Comment 4.9.1b: Keep a long-term monitoring assurance requirement. (K-8, K-13, K-17, K-21, K-22, L-3)

Comment 4.9.1c: Establish an institution for long-term monitoring in perpetuity. (D-77)

Comment 4.9.1d: Make long-term monitoring a siting factor. (D-5)

Comment 4.9.1e: Do not support a long-term monitoring program because of possible technical problems and uncertainties such as additional escape pathways, and increased costs. (K-2, K-10, K-15, K-18, K-19)

Comment 4.9.1f: Such a program should be left to implementing agencies. (L-1)

Response (Comments 4.9.1a through f): The proposed rule did not include a long-term monitoring requirement; however, from the comments received and further study of the issue, the Agency decided to include long-term monitoring as an assurance requirement [191.14(b)] while taking into consideration the comments against the proposal. The assurance requirement stipulates that monitoring techniques be used which could not create escape pathways for the radionuclides. This stipulation together with the requirement to detect "substantial and detrimental deviations from expected performance" negates the need for the more expensive "close-in" monitoring systems and allows reliance on less expensive and more reliable systems to monitor only large-scale parameters such as ground uplift, groundwater flow, and seismicity. The Agency further understands that the technology exists and is available at reasonable cost to fulfill

this requirement and, therefore, concludes that this requirement is a prudent addition to the rule. The details of the monitoring are left up to the implementing agencies.

Chapter 5: CONTAINMENT REQUIREMENTS

5.1 Time Period

Comment 5.1.1a: Retain the 10,000-year time period for containment requirements. (D-90, F-7-iii, F-7-vii, F-8-vi, F-11, K-7, K-9, K-12, K-15, K-18, K-19, K-21, L-1, L-3)

Comment 5.1.1b: Adopt a time period of 1000 years for containment requirements. (D-14, D-44, H-16, K-2)

Comment 5.1.1c: Adopt a time period greater than 10,000 years for containment requirements. (D-6, D-19, D-35, D-41, D-52, D-55, D-62, D-66, D-70, D-71, D-72, D-75, D-76, D-77, D-78, D-80, D-83, D-87, D-91, D-92, F-7-iv, F-7-viii, F-7, F-7-x, K-20, K-24, F-8-ii, F-8-iii, F-8-v, H-10, H-14, H-28, L-5, K-5, K-6, K-8, K-10, K-13, K-14, K-16, K-17)

Comment 5.1.1d: Need further comparison or additional qualitative statement for containment requirements beyond 10,000 years. (D-47, D-62, D-66, F-7-iii, F-7-ix, F-8-vi, F-11, K-6, K-7, K-9, K-12, K-13, K-15, K-20, K-21, L-1, L-3, L-6)

Comment 5.1.1e: Explain basis for 10,000 years in greater detail. (D-6, D-7, D-16, D-25, D-50, F-8-v)

Response (Comments 5.1.1a through e): To develop the containment requirements, it was assumed that some aspects of the future can be predicted well enough to guide the selection and development of disposal systems for these wastes. A period of 10,000 years was considered because that appears to be long enough to distinguish geologic repositories with relatively good capabilities to isolate wastes from those with relatively poor capabilities. On the other hand, this period is short enough so that major geologic changes are unlikely and repository performance might be reasonably projected.

In the proposed rule, the Agency indicated that 10,000 years was chosen, in part, because compliance with quantitative standards for a substantially longer period would have entailed considerably more uncertain calculations. There was no intention to indicate that times beyond 10,000 years were unimportant, but the Agency felt that a disposal system

capable of meeting the proposed containment requirements for 10,000 years would continue to protect people and the environment well beyond 10,000 years. The SAB Subcommittee reviewed and supported these technical arguments for limiting the containment requirements to a 10,000-year period.

Many of the commenters and the SAB Subcommittee suggested that more qualitative or comparative assessments beyond 10,000 years might be appropriate. The Agency agreed with these comments and worked with the DOE to formulate comparative assessment provisions that have been incorporated into the final version of the Department's site selection guidelines (10 CFR Part 960). These provisions call for comparisons of the projected releases from undisturbed performance of alternative repository sites over 100,000 years to be a significant consideration in site selection. Since natural barriers are expected to provide the primary protection for such long time frames, this provision should allow for appropriate consideration of longer time periods without requiring the absolute values of these very uncertain calculations to meet a specific quantitative test. With the inclusion of this comparative test in 10 CFR Part 960, the Agency believes that no modification is needed in 40 CFR Part 191.

5.2 Definitions

Comment 5.2.1: Define the term "reasonable expectation." (D-7, D-58, L-16)

Response: This phrase reflects the fact that unequivocal numerical proof of compliance is neither necessary nor likely to be obtained. It should not be associated with a level of confidence that may not be appropriate for the very long-term analytical projections that are called for. The use of this test of judgment is meant to acknowledge the unique considerations likely to be encountered upon implementation.

Comment 5.2.2a: The definitions of "reasonably foreseeable" and "very unlikely" seem excessively conservative. (D-7)

Comment 5.2.2b: Explain difference between "normal" and "accidental" occurrences. (H-6)

Comment 5.2.2c: Change definition of "very unlikely releases" to "less than one chance of 100" of occurring in 10,000 years. (D-86)

Response (Comments 5.2.2a through c): These terms are not used in the final rule; therefore, the comments are no longer applicable.

5.3 Release Probabilities

Comment 5.3.1a: Should have only one set of release probabilities. (D-7, K-2, K-15, K-17, K-18)

Comment 5.3.1b: Should have only the lowest of the two proposed probabilities. (K-13)

Comment 5.3.1c: Should have two sets of release probabilities. (H-31, K-6, K-8, K-9, K-12, K-20, L-1)

Comment 5.3.1d: Increase the "very unlikely" release probability by a factor of 100. (D-65)

Comment 5.3.1e: The release probabilities should be stated quantitatively. (F-8-iv, F-8-v, K-4, K-5, K-6, K-9, K-10, K-13, K-14, K-16, K-17, K-20, K-22, K-24, L-3)

Comment 5.3.1f: The release probabilities should be stated quantitatively with uncertainty limits or high uncertainty noted. (K-7, K-12, K-21)

Comment 5.3.1g: The release probabilities should be stated qualitatively with some numerical guidance. (K-2, K-15, K-18, K-19, L-1, L-6)

Comment 5.3.1h: Qualitative relative probabilities should be set through an adjudicatory hearing using expert witnesses after EPA sets a list of possible events to examine. (F-7-ix)

Comment 5.3.1i: The probability classes discussion in the Preamble is not consistent with their definitions and the standard. (H-10)

Comment 5.3.1j: Use terms such as Category A and Category B for probability classes to preclude connotative misinterpretation. (D-36, H-12)

Comment 5.3.1k: Release definitions are unworkable; release categories should be stated qualitatively. (H-7)

Comment 5.3.1l: Prefer subjective definitions of release probability classes. (D-7, D-25, D-47)

Comment 5.3.1m: Delete numerical probability definitions from rule in favor of qualitative descriptions. (D-19)

Response (Comments 5.3.1a through m): The containment requirement in the proposed rule applied to two categories of potential releases ("reasonably foreseeable" and "very unlikely") based upon their projected probabilities of occurrence over the first 10,000 years after disposal. The Agency has revised the structure of the containment requirements in several ways that will retain quantitative objectives for long-term containment while allowing the implementing agencies enough flexibility to make qualitative judgments when necessary.

First, the final rule does not use the terms "reasonably foreseeable" and "very unlikely" releases. Instead, the permissible probabilities for two different levels of cumulative releases (over 10,000 years after disposal) are now incorporated directly into the containment requirements.

Second, the numerical probabilities associated with the two release categories have been increased by an order of magnitude to reflect further assessments of the uncertainties associated with projecting the probabilities of geologic events such as fault movement.

Third, the final rule clearly indicates that comprehensive performance assessments, including estimates of the probabilities of various potential releases whenever meaningful estimates are practicable, are needed to determine compliance with the containment requirements.

Fourth, a paragraph has been added to the final containment requirements to emphasize that unequivocal proof of compliance is neither expected nor required because of the substantial uncertainties inherent in such long-term projections. Instead, the appropriate test is a reasonable expectation of compliance based upon practically obtainable information and analysis.

Finally, a "Guidance for Implementation of Subpart B" appendix has been added. This part of the rule describes the Agency's intentions regarding performance assessments and uncertainties and should discourage overly restrictive or inappropriate implementation of the containment requirements.

The Agency believes that these revisions to the proposed rule preserve an objective framework for application of the containment requirements that requires very stringent isolation, while allowing the implementing agencies adequate flexibility to handle specific uncertainties that may be encountered.

Comment 5.3.2: Some release "events" are not "events" but are continuous physical processes, in which case one should attempt to bracket uncertainties in process rates and not predict yes/no probabilities. (D-7)

Response: The Agency agrees. The final rule makes it clear that performance assessments must address both "processes" and "events", including uncertainties in the rates of processes.

Chapter 6: ACCESSIBLE ENVIRONMENT

Comment 6.1: Change the general definition. (D-19, D-59, D-62, D-71, D-78, F-7-ix, H-3, K-2, K-5, K-7, K-8, K-12, K-15, K-16, K-18, K-19, K-20, K-24, L-3, L-6)

Comment 6.2: Provide for long-term monitoring in the definition. (K-5, H-38)

Comment 6.3: The distance to the accessible environment should be less than 10 kilometers. (D-48, D-49, D-52, D-53, D-67, D-71, D-75, D-83, F-8-ii, F-8-iii, F-8-vi, H-38, K-4, K-6, K-10, K-13, K-14, K-22, L-7)

Comment 6.4: There should be no exclusion zone. (D-58, K-9)

Comment 6.5: Exclude or distinguish unusable water. (D-46, D-48, D-49, D-58, D-70, D-79, K-14, L-1)

Comment 6.6: Define accessible environment to be site-specific. (D-7, D-25, F-7-ii, H-6)

Comment 6.7: Delete accessible environment concept. (D-55, F-7-v)

Comment 6.8: Provide protection for all surface or ground water within the accessible environment area (D-7, D-48, D-49, D-50, D-52, D-58, D-65, D-66, D-74, D-76, D-91, F-8-ii, F-8-v, H-2, H-3, H-4, K-6, K-10, K-13, K-17, K-21)

Comment 6.9: Define qualitative terms or allow NRC and DOE to define using EPA guidance. (D-90, K-6, K-12, K-13, K-15, K-18, K-20)

Comment 6.10: Use NRC's accessible environment and controlled area definitions. (D-19, D-62, D-65, D-71, F-7-ix)

Comment 6.11: Explain the change from 1 mile to 10 kilometers. (K-3, L-3)

Response (Comments 6.1 through 6.11): In the proposed rule, ground water within 10 kilometers of a disposal system was excluded from the definition of accessible environment. This definition was intended to reflect the concept that the geologic media surrounding a mined repository are

part of the long-term containment system, with disposal sites being selected so that the surrounding media prevent or retard transport of radionuclides through ground water.

Such surrounding media would be dedicated for this purpose, with the assumption that steps will be taken to prohibit any incompatible activities (either those that might disrupt the disposal system or those that could cause significant radiation exposures) in perpetuity. Applying standards to ground water in the immediate vicinity of the site within the definition of "accessible environment" would ignore the role of this natural barrier, and it could remove the incentive to search for sites with properties that would enhance long-term containment of these wastes. The Agency also recognizes that the institutional controls designed to reserve this area around a disposal system cannot be considered infallible.

The Agency made several changes in the definition of the "accessible environment". First, the concept of a "controlled area" has been adopted from NRC's 10 CFR Part 60. This establishes an area around a disposal system that is to be identified by markers, records, and other passive institutional controls intended to prohibit incompatible activities from the area. Consistent with the proposed 40 CFR Part 191, the current NRC definition of "controlled area" limits its distance from the edge of a repository to no more than 10 kilometers. The final 40 CFR Part 191 defines "accessible environment" to include: 1) the atmosphere, land surfaces, surface waters, and the oceans, wherever they are located; and 2) portions of the lithosphere--and the ground water within it--that are beyond the controlled area.

Second, the Agency has made the definition of the "controlled area" more restrictive than that currently incorporated in 10 CFR Part 60. This revised definition limits the controlled area to a distance no greater than 5 kilometers from the original emplacement of wastes in a disposal system, rather than 10 kilometers. Furthermore, the revised definition limits the area encompassed by the controlled area to no more than 100 square kilometers, which is approximately the area that would be encompassed by a controlled area at a distance of 3 kilometers from all sides of a typical repository configuration. This revised definition substantially reduces the area of the lithosphere that would have been removed from the "accessible environment" defined in the proposed rule, and it somewhat reduces the distance used in the proposed rule. The 5-kilometer distance was chosen to retain reasonable compatibility with the NRC's requirement for a preemplacement ground water travel time of 1,000 years to the accessible environment while still providing for greater isolation than called for by the proposed rule. This definition of the accessible environment will allow a controlled area to be established asymmetrically around a repository based upon the particular characteristics of a site.

Chapter 7: PROCEDURAL REQUIREMENTS

Comment 7.1: Define various terms and phrases. (D-7, D-19, D-50, L-7)

Comment 7.2: Probabilistic analyses are NRC's responsibility and should be deleted from the rule. (D-90, H-7, H-11)

Comment 7.3: Concept of procedural requirements is fine, but standards should be health-based, not performance-assessment-based. (F-11)

Comment 7.4: Screening models should be used for evaluations. (D-7, D-25)

Comment 7.5: Require use of nominal values for parameters. (D-65)

Comment 7.6: EPA should set minimal assessment criteria and not leave performance assessment criteria to discretion of implementing agencies. (D-83)

Response (Comments 7.1 through 7.6): The procedural requirements as presented in the proposed rule have been deleted from the final rule. In their place is a new definition of "performance assessment" and a "Guidance for Implementation of Subpart B" appendix, which although not an integral part of the standard, will be included in the Code of Federal Regulations.

The appendix to the final rule is based upon the analytical assumptions that the Agency made in developing the technical basis used for formulating the numerical disposal standards. In particular, the appendix discusses: 1) the consideration of all barriers of a disposal system in performance assessments; 2) reasonable limitations on the scope of performance assessments; 3) the use of average or "mean" values in expressing the results of performance assessments; 4) the types of assumptions regarding the effectiveness of institutional controls; and 5) our limiting assumptions regarding the frequency and severity of inadvertent human intrusion into geologic repositories.

The implementing agencies are responsible for selecting the specific information to be used in these and other aspects of performance assessments to determine compliance with 40 CFR Part 191. However, the Agency believes it is important that the underlying reasoning and approach used

by the implementing agencies are compatible with those used by EPA in developing this rule. Otherwise, implementation of the disposal standards may have effects quite different than those anticipated by EPA. Although the other agencies are not bound to follow this guidance, EPA recommends that it be carefully considered in planning for the application of 40 CFR Part 191. The Agency will monitor implementation of the disposal standards as it develops over the next several years to determine whether any changes to the rule are called for to meet the Agency's objectives for these standards.

Chapter 8: STANDARDS

8.1 Individual Dose Standards

Comment 8.1.1a: There is a need for some form of individual protection criteria. (D-24, D-41, D-50, D-70, D-78, D-79, D-91, D-93, F-7-iv, F-7-v, F-7-vii, F-7-ix, F-8-ii, F-8-iii, K-1, K-2, K-6, K-9, K-10, K-12, K-13, K-14, K-16, K-17, K-20, K-21, H-2, H-28, L-3, L-6, L-8)

Comment 8.1.1b: There is no need for individual protection requirements. (K-4, K-7, K-8, K-15, K-18, K-19, K-22, L-1)

Comment 8.1.1c: Individual protection limits should apply to ground water in the vicinity of a disposal site. (D-19, D-24, D-41, D-71, K-6, K-10, K-12, K-13, K-14, K-20)

Comment 8.1.1d: Individual protection limits are not needed for ground waters in vicinity of a disposal site. (K-2, K-15, K-17, K-18)

Comment 8.1.1e: Individual dose limits should apply to all ground waters in the area. (K-6, K-12, K-14, K-17, K-20)

Comment 8.1.1f: Individual dose limits should apply to ground waters only in the accessible environment. (K-9, K-15, K-18, L-6)

Comment 8.1.1g: Use ALARA to keep individual doses low. (L-1)

Comment 8.1.1h: Qualitative requirements such as ALARA are not needed or too vague. (K-13, K-14, K-15, K-17, K-18, K-20)

Comment 8.1.1i: Qualitative requirements would need quantitative augmentation. (K-6, K-9, K-12, K-13, K-20)

Comment 8.1.1j: Use the individual protection approach of B. Ross (comment letter II-D-19, available in EPA's Public Docket Room). (D-19, K-2, K-9, K-13, K-17)

Comment 8.1.1k: Reject the proposed B. Ross approach to individual protection. (K-6, K-15, K-18)

Comment 8.1.1l: Existing standards, either 10 CFR Part 20 or 40 CFR Part 141, are adequate for individual dose standards. (K-2, K-5, K-9, K-12, K-15, K-18, K-17, K-24)

Comment 8.1.1m: Existing standards, either 10 CFR Part 20 or 40 CFR Part 141, are not adequate for individual dose standards. (K-6)

Response (Comments 8.1.1a through m): The Agency believes that the containment requirements in Section 191.13 will ensure that the overall population risks to future generations from disposal of these wastes will be acceptably small. However, the situation with regard to potential individual doses is more complicated. Even with good engineering controls, some waste may eventually (i.e., several hundreds or thousands of years after disposal) be released into any ground water that might be in the immediate vicinity of a geologic repository. Since ground water generally provides relatively little dilution, anyone using such contaminated ground water in the future may receive a substantial radiation exposure. This possibility is inherent in the decision to isolate a very large amount of radioactivity in a small area.

On the other hand, analyses of repository systems with good engineering controls show that they should be able to prevent significant doses from ground water use for several hundred to a thousand years after disposal. Such protection would be compatible with both containment and assurance requirements.

After considering all the available information, the Agency has decided to include two new sections in the final rule. The first (Section 191.15) limits annual exposures in the first 1000 years to members of the public from all pathways after disposal, while the second (Section 191.16) limits concentrations in water withdrawn from certain important sources of ground water after disposal during the same time period.

Comment 8.1.2: Should require zero accessibility of radioactivity to ground water. (D-92)

Response: Considering the long time spans involved (10,000 years) and the limited technical and financial capabilities available, it was not feasible to require an absolute zero accessibility of radioactivity to ground water.

8.2 Release Limits (Population Dose Approach)

Comment 8.2.1a: Keep EPA release limit approach (proposed rule - Table 2). (D-7, D-62, D-65, D-68, D-71, D-76, D-77, D-78, D-80, D-85, D-92, F-7-vi, F-8-iv, F-8-v, H-4, H-7, H-12)

Comment 8.2.1b: Use a release rate standard, too. (D-86, F-7-vi)

Comment 8.2.1c: Release limits are too stringent; more flexibility is needed. (D-36, D-44, D-47, D-90, D-93, F-7-ii, F-7-iii, F-7-vi, K-3)

Comment 8.2.1d: Release limits not conservative enough. (D-31, D-48, D-49, D-91, F-7-iv, F-7-viii)

Comment 8.2.1e: Basis for release limits has technical shortcomings. (D-6, D-41, D-44, D-46, D-75, D-78, F-7-v, F-7-ix)

Comment 8.2.1f: Release rates for the TRU wastes too high. (H-4, F-8-iv)

Response (Comments 8.2.1a through f): The Agency and its Science Advisory Board both reviewed the release limit concept and its basis and concurred that this was the best way to influence the design of high-level radioactive waste repositories. The final standards augment the release limits with individual protection requirements that establish annual limits for individual exposures. The issue of the stringency of the release limits was thoroughly evaluated by the Agency management and determined to be appropriate for this specific circumstance.

8.3 General

Comment 8.3.1: Provide individual standards for construction, operation, and closure. (F-8-iii)

Response: This is accomplished by the Subpart A portion of the final rule.

Comment 8.3.2: Standard should not be proportioned to amount of waste in respository. (D-86, L-4, F-8-vi)

Response: To have made the release limits independent of the amount of waste in the repository, i.e., only related to releases from a site, could have provided impetus to have more sites. The Agency believed that it was desirable to concentrate the waste in a minimum number of repositories.

Comment 8.3.3: What about people living in the area of a repository who already have, or are exposed to, radiation from other sources including fallout or weapons testing? (D-60, F-8-iii)

Response: Other sources of radiation exposure were taken into consideration in Subpart A of the standards. This subpart limits the combined exposure from the repository's operational phase and other NRC-licensed fuel cycle facilities. It also limits the combined exposure from DOE high-level waste management and storage operations and other DOE activities through application of the Clean Air Act Radionuclide Standards. Protection from background radiation, including fallout, is not part of this standard.

Comment 8.3.4a: EPA should not use the linear dose hypothesis. (D-44)

Comment 8.3.4b: EPA should use a geometric relationship between radiation and cancer incidence. (F-8-iii)

Response (Comments 8.3.4a and b): The Agency and its Science Advisory Board both reviewed the basis for the radiation dose vs. effects assumptions. It was determined that the most prudent relationship to use was the linear. However, the Background Information Document does discuss the differences resulting from other dose-effect relationships.

Chapter 9: REGULATORY (COST) IMPACT ANALYSIS

Comment 9.1: Clarify the assumptions used in the Draft Regulatory Impact Analysis (RIA) document that pertain to delay-induced costs. (F-11)

Response: Neither the Draft RIA nor the Final RIA considers delay-induced costs.

Comment 9.2: Life cycle cost should be considered for implementing the standards and state the range of cost for a single year. (F-11)

Response: The Final RIA demonstrates that the standards are not expected to cause significant additional costs for most of the repository sites being considered by DOE. Only for one site would there be additional costs of 6 to 12 million dollars per year, and only if the requirements of 10 CFR Part 60 were relaxed.

Comment 9.3: Include cost impacts on defense waste disposal programs (both high-level and transuranic radioactive wastes) and from Subpart A. (D-47, F-11)

Response: The Agency does not have enough information on the plans and engineering designs for the disposal of defense high-level and transuranic radioactive wastes to perform meaningful estimates of possible cost impacts of Subpart B. With regards to Subpart A, studies performed in support of the proposed rule indicate that Subpart A should not have any cost impacts (see Item 8, Section 1.5 in the BID) since the estimated radionuclide releases during normal operations of typical facilities and the resulting radiation doses are less than the limits in the proposed rule.

Comment 9.4: Clarify what operations (i.e., siting, construction, operation, decommissioning, monitoring) are covered in the cost estimates. (D-50, D-59, L-16)

Response: The cost estimates for waste disposal in the Final RIA include transportation; encapsulation; the waste form; siting, design, construction, operation, and decommissioning of the repository; research and development

needed for the various components of the disposal system (including site evaluations); and miscellaneous government overhead. Monitoring of the disposal system would be included within these costs. However, unlike the Draft RIA, waste storage before transportation to the disposal site is not included in the Final RIA.

Comment 9.5: Repository costs should be borne by nuclear power plant customers only. (D-50)

Response: The NWPA accomplishes this by setting up a fund to pay for repository costs that is financed through a fee levied on electricity generated by nuclear power plants.

Comment 9.6: EPA should also consider costs of additional containment beyond 10,000 years. (F-7-iv)

Response: Disposal systems that meet the 10,000-year containment requirements will almost certainly provide substantial containment for much longer periods of time. Furthermore, enhancing the very long term containment capability appears to be best addressed by picking sites which provide good isolation (which does not necessarily cost more) than by using more expensive engineering controls.

Comment 9.7a: The standards may result in greater costs with no added benefits. (D-47, F-11)

Comment 9.7b: Overconservatism could make licensing difficult and increase costs. (F-7-iii, F-7-vi)

Comment 9.7c: Costs should not be in conflict with finding a suitable disposal site. (D-50)

Comment 9.7d: Demonstrable safety increases should be the only reason for cost increases. (D-36)

Response (Comments 9.7a through d): The Final RIA indicates that the levels of protection sought by the final rule generally do not appear to cause cost increases over the costs already anticipated for mined geologic repositories. Section 191.13(b) and Appendix B of the final rule have been added to ensure that unwarranted difficulties or conservatisms do not hamper licensing of adequate disposal systems.

Chapter 10: MODELS AND MODELING

Comment 10.1: Too many model uncertainties exist over the long time spans simulated. (D-7, D-25, D-36, D-50, D-86, F-7-iii, F-7-viii, H-6, L-7)

Comment 10.2: The generic site data are too uncertain. (D-70, F-7-ii, F-8-iii)

Comment 10.3: Models are not conservative enough. (D-55, D-66, F-7-v, F-8-iii, H-6, H-15, L-7)

Comment 10.4: Models are too conservative. (D-7, D-36, F-11, H-4)

Comment 10.5: More adequate input data and more detail concerning assumptions and how calculations were made are needed. (D-31, D-46, D-50, D-70, F-8-vi, H-2)

Comment 10.6: Should include new or additional modeling considerations for climate changes, repository thermal effects, atmospheric transport, and other environmental effects. (D-50, D-56, D-60, D-69, F-8-v)

Response (Comments 10.1 through 10.6): The Agency recognizes that there are great uncertainties in models that attempt to estimate risks over these very long time periods. in the Preamble to 40 CFR Part 191, there is a footnote that specifically points out that this is "a speculative calculation that is primarily intended as a tool for comparing risk levels; it should not be considered a reliable projecton of the 'real' number of health effects resulting from compliance with the disposal standards." Also in the supporting Regulatory Impact Analysis for the standard, the Agency has presented its estimates of cost effectiveness as ranges, rather than points, to illustrate the uncertainty involved.

Even with the realization of uncertainty, it was necessary to make some modeling estimates of risks to establish a perspective for making decisions. It was this context that justified the type of modeling used. Since we never intended to typify specific sites, and since our standards must be generally applicable, we used generic single-dimension models.

The many assumptions and input factors that were used in developing the proposed standard were reviewed by the Agency's Science Advisory Board. Numerous changes were made on the basis of this review and comments received.

Comment 10.7: The ground water transport and radionuclide sorption portions of the transport model has a built-in bias against salt; consider differences among rock types. (D-42)

Response: The Agency could not discern that its transport models had "built-in bias" relative to any specific geology. Rather, the model seemed to adequately differentiate among geological media.

Comment 10.8: Modeling should include rapid dissolution of salt bodies or ground water flow directly into a major river. (D-75)

Response: Even with reasonable siting criteria, the Agency did not believe that rapid dissolution of salt or ground water flow directly into a major river was sufficiently probable to predominate the risk assessment.

Comment 10.9: Need model verification. (D-3)

Response: The models used predict releases over thousands of years. Although various subelements have been checked against available data, there is no way to "validate" the totality of such long-term predictions. It is because of these inherent uncertainties that the Agency believes the assurance requirements are a necessary part of the standards.

Chapter 11: LEVEL OF RISK

11.1 Comparison to Other Risks

Comment 11.1.1a: Risks posed by mined uranium ore bodies are not necessarily acceptable. (D-55, D-75, F-7-v, F-8-vii, K-10)

Comment 11.1.1b: Differences between a uranium ore body and a repository are too great for a basis of comparison. (D-31, D-55, D-75, D-86, F-7-v, F-8-iii)

Comment 11.1.1c: Supports the uranium ore body comparison as an approach to a long-term acceptable risk. (D-16, D-61, D-62, D-63, D-67, D-68, D-76, D-77, D-78, D-80, D-81, D-86, D-92, F-7-vii, H-2, H-6, H-15, L-4)

Response (Comments 11.1.1a through c): In developing the disposal standards, the Agency has carefully evaluated the capabilities of mined geologic repositories to isolate the high-level radioactive wastes from the environment, because it is believed that these repositories are capable of providing exceptionally good protection to current and future generations for at least 10,000 years after disposal. EPA's analyses indicate that the residual risks allowed by the disposal standards would be comparable to the risks to which future generations would have been exposed if the uranium ore used to produce the high-level wastes had not been mined to begin with.

Specifically, the Agency estimates that compliance with the disposal standards would allow no more than 1,000 premature deaths from cancer in the first 10,000 years after disposal of the high-level radioactive wastes from 100,000 metric tons of reactor fuel: an average of no more than one premature death every ten years. This residual risk level is a speculative calculation that is primarily intended as a tool for comparing risk levels; it should not be considered a reliable projection of the "real" number of health effects resulting from compliance with the disposal standards.

The Agency also evaluated the health risks to which future generations would be exposed from the amount of uranium ore needed to produce 100,000 metric tons of reactor fuel, if this ore had not been mined to begin with. Population risks ranging between 10 and 100,000 premature cancer deaths over 10,000 years were associated with this much unmined uranium ore, depending upon the analytical assumptions made.

These analyses, which have been updated from those prepared for the proposed standards, reinforce the Agency's conclusion that limiting radionuclide releases to levels associated with no more than 1,000 premature cancer deaths over 10,000 years from disposal of the wastes from 100,000 metric tons of reactor fuel satisfies two important objectives. First, it provides an objective that appears readily achievable by the various options being considered within the national program. Second, it limits risks from disposal to no more than the midpoint of the range of estimated risks that future generations would have been exposed to if the uranium ore used to create the wastes had never been mined. The Agency believes that such a limitation is adequately small and has decided to establish containment requirements that meet these two objectives.

We have never stated that the risks from a uranium ore body are necessarily acceptable. The level of risk was chosen based upon the projected performances of generic repositories in various geologic media not upon the range of projected risks from ore bodies. The ore body risk levels were compared to the chosen risk level because of the many similarities between an ore body and a repository.

Comment 11.1.2: Use natural background as a basis for risk comparison. (D-36, D-59, D-65, D-75, F-7-ii, F-7-iii, F-7-vi, F-8-ii, F-11, K-19)

Response: In the draft EIS, the uranium ore body was only one of four bases for comparisons given; there were also nuclear power generation, nuclear weapons fallout, and natural background radiation. However, in the Preamble to the proposed rule, only the uranium ore body was mentioned. It was not our intention to stress the ore body comparison in favor of the other bases. Therefore, while we will continue to refer to the uranium ore body analysis because we believe it provides a usable, if not perfect, long-term risk reference point, we will also refer to natural background radiation exposure risks because it provides a long-term risk reference as well.

Comment 11.1.3: Should consider radiation risks from medical applications in assessment of comparative levels. (D-36)

Response: The perspectives of medical exposure are quite different from exposure from environmental sources. In medical exposure, the physician must weigh the potential hazards of increased radiation exposure against the risk of improper diagnosis or treatment.

11.2 General

Comment 11.2.1a: Level of risk is lower than necessary or too conservative. (D-44, D-46, D-47, D-79, D-85, D-90, H-12, H-35, K-19)

Comment 11.2.1b: Risk level is too high. (D-52, D-66, D-72, H-34)

Comment 11.2.1c: Include all the fuel cycle activity risks in setting a level or making comparison. (D-7, D-75, L-9)

Comment 11.2.1d: Oppose any long-term risk, incremental or otherwise. (D-52, D-59, D-72, D-87, D-90, D-91, F-8-ii)

Comment 11.2.1e: Supports the standards' long-term acceptable risk approach. (D-7, D-25, D-50, D-57, D-59, D-65, D-78, D-85, H-4)

Response (Comment 11.2.1a through e): Intergenerational risks are an issue because the consequence of the fundamental decisions to have nuclear power and nuclear weapons is the production of radioactive wastes, some of which will exist for generations. It now becomes necessary to isolate, as long as possible, these wastes from people and the environment in the safest and most economically reasonable method possible. The Congress assumed, in the Nuclear Waste Policy Act of 1982 (NWPA), that deep geologic disposal would be the method used for high-level waste disposal in the foreseeable future. Prior to passage of NWPA, EPA had decided to center its studies to develop high-level waste standards on deep geologic disposal since it was the most advanced disposal technology then, and still is now. Using current technology, it is neither economically, nor technically possible, to reduce releases to zero for the lifetime of all the nuclides in the wastes. Therefore, given those constraints, a level of risk somewhere between zero and several million potential cancer fatalities must be found and judged acceptable.

In the proposed rule, the containment requirements for disposal systems limited the residual risks to no more than an estimated 1,000 premature cancer deaths over the first 10,000 years after disposal of the wastes from 100,000 metric tons of heavy metal (MTHM) used as fuel in a nuclear reactor, or its equivalent. The Agency pointed out that a variety of mined repository designs using different combinations of geologic media and engineered controls were expected to readily meet these requirements. It was also estimated that the residual risks to future generations appeared to be no greater than if the uranium ore used to create the wastes had not been mined.

The Agency has retained the proposed level of protection as the basis for the long-term containment requirements in the final rule, even though it is true that long-term assessments of repository performance will encounter substantial uncertainties, as the SAB Subcommittee pointed out. Three reasons support this decision.

First, revising the performance assessments in accordance with many of the technical recommendations of the SAB has reinforced the Agency's conclusion that the proposed level of protection can readily be achieved by a variety of combinations of repository sites and designs, and EPA's Regulatory Impact Analyses indicate that this level of protection can be achieved without significant effects on the cost of disposing of these wastes.

Second, comparing this level of protection with the same type risks from equivalent amounts of unmined uranium ore lends perspective that the standard does not allow a significant increase in the risk to future generations. Therefore, the Agency believes that this level of protection represents a reasonable basis for these disposal standards.

Third, rather than relax the level of protection, the Agency has chosen to address the uncertainties that concerned the SAB Subcommittee by providing a more detailed "Guidance for Implementation" of Subpart B appendix to replace the proposed "Procedural Requirements." For example, this guidance points out that the entire range of possible projections of releases need not meet the containment requirements. Rather, compliance should be based upon the projections that the implementing agencies believe are more realistic. Furthermore, this guidance acknowledges that the quantitative calculations needed may have to be supplemented by reasonable qualitative judgments in order to appropriately determine compliance with the disposal standards.

In retaining the proposed level of protection, the Agency emphasizes that it is making a decision applicable only to the circumstances involving disposal of spent nuclear fuel and high-level and transuranic radioactive wastes. This rule cannot be used to establish precedents such as "no incremental risk to future generations" for extrapolation to other disposal problems.

Comment 11.2.2: Defer setting a U.S. standard on long-term risks until an international consensus has been agreed upon. (D-93)

Response: The Agency's consideration of the appropriate risk level included several factors, such as the capabilities of geological disposal systems, the risks from unmined uranium ore, and the need for public acceptance. The time period within which the standards were required did not accommodate an international consensus.

Chapter 12: SITING

12.1 Water Resources

Comment 12.1.1a: Repository sites should avoid surface water resources. (D-52)

Comment 12.1.1b: Disqualify site if a waterway is a major water supply within a set distance from the repository. (F-8-iii)

Comment 12.1.1c: Sites with limited quantities of water should be avoided. (F-8-v)

Response (Comments 12.1.1a through c): In considering all nearby water resources, the Agency concluded that its primary role was the protection of public health and that protection of potable water should be required in that context (Section 191.16). In addition, Individual Protection Requirements (Section 191.15) were included to protect the public in the accessible environment.

12.2 General

Comment 12.2.1: Evaluate site location considering both short-term and long-term problems; however, the long-term problems should be more judiciously considered. (D-63)

Response: The Agency's containment requirements (Section 191.13) serve as the primary protection aspect of the standard in its influence of design of a repository. This provision does consider the potential releases over a 10,000-year period. The provisions for Individual Protection and Ground Water Protection (Sections 191.15 and 191.16) consider the shorter term problems for a 1,000-year period.

Comment 12.2.2: Site repository away from other nuclear areas for disbursal of risk for health and safety. (F-8-ii)

Response: Rather than establish any siting requirements with specific relation to other nuclear facilities, the Agency has prescribed its Subpart A requirements so that the combined exposure from NRC-licensed repositories and other fuel-cycle facilities are limited.

Comment 12.2.3: Cultural resources, such as archaeological areas should be considered as mitigating measures for not siting a repository nearby. (H-19)

Response: The Department of Energy guidelines, 10 CFR Part 960, provide for such considerations as other land uses.

Comment 12.2.4: Opposed to disposal of materials in agriculture-producing areas. (H-20)

Response: The Agency's risk assessment and the assessment necessary to show compliance with the EPA standards both consider contamination of agricultural products to the extent that the commenter's intent was to protect the consumer of agricultural products.

12.3 Geology

Comment 12.3.1a: Risk of intrusion into salt domes should be a factor in siting. (F-7-iii)

Comment 12.3.1b: Risk of intrusion into salt domes should be a factor in siting, but not rule out salt domes. (D-37, D-47, L-5)

Comment 12.3.1c: Resource potential of salt domes should be considered in site selection. (F-11)

Comment 12.3.1d: EPA did not adequately consider many factors concerning salt domes, e.g., salt tectonism, dome dissolution processes, dome uplift and movement, past geologic history of salt areas, and potential for gas exploration. (F-8-v, H-13, H-17, H-30)

Response (Comments 12.3.1a through d): Assurance Requirement 191.14(e) provides that resource potential and intrusion probability will be taken into consideration in the site selection process. The site-specific aspects of a salt dome will be considered in the site assessment and selection process. A further discussion of intrusion is included in the response to comments 3.7.1a through d.

APPENDIX A

LIST OF COMMENTERS

APPENDIX A

LIST OF COMMENTERS

A.1 Introduction

The following is a list of the commenters whose comments were responded to in this document. The identification number used in this document is the same number used by the EPA Docket Section (except that the number II is deleted from each number). Where there are missing sequential numbers, it means that the document material was not a letter of comment but some other reference material.

A.2 Commenter Listing

	Section D	Date docketed
D-1	Linda K. McClain, Westerville, Ohio.	1/12/83
D-2	The U.S. Department of Transportation, Washington, D.C., signed by Joseph Canny, Deputy Director for Environment and Policy Review.	2/24/83
D-3	The State of Montana Historical Society signed by Marcella Sherfy, Deputy SHPO of the Historic Preservation Office.	2/28/83
D-7	Package of comments, letters, and memos from David C. Kocher, Oak Ridge National Laboratory, Oak Ridge, Tennessee.	3/8/83
D-10	D.G. Andrews, Professor of Nuclear Engineering, University of Toronto (Canada).	3/16/83
D-11	The State of Kansas, signed by Lynn Muchmore, Director of the Budget, Division of the Budget, Department of Administration.	3/16/83
D-12	John Bergamini, Windham, New York.	3/17/83
D-14	Dennis R. Arter, Kennewick, Washington.	3/23/83
D-15	The Suffolk Nuclear Study Group, Mastic, New York, signed by Bill Hafner.	3/25/83
D-16	The British Embassy, Washington, D.C., on behalf of the United Kingdom Atomic Energy Authority.	3/25/83

D-19	Benjamin Ross of GeoTrans, Inc. of Reston, VA, but submitted as a private citizen.	4/15/83
D-20	The State of Oklahoma Grant-in-Aid Clearinghouse signed by Don N. Strain, Director.	4/15/83
D-22	The South Carolina Department of Health and Environmental Control, signed by Heyward G. Shealy, Chief, Bureau of Radiological Health.	4/20/83
D-23	Dr. Charles Forsberg, Kingston, Tennessee.	4/20/83
D-24	John M. Matuszek of the State of New York Radiological Sciences Laboratory.	4/26/83
D-25	David C. Kocher, Oak Ridge, Tennessee.	4/21/83
D-28	D.E. Wood of Rockwell International, Richland, Washington.	4/26/83
D-29	Steve Frishman of the Texas Energy and Natural Resources Advisory Council.	4/26/83
D-30	Copy of testimony given by Bill Vincent, southern coordinator of Citizen Alert, at a DOE public hearing in Las Vegas, Nevada on March 30, 1983.	4/22/83
D-31	John L. Geesman, Executive Director of the State of California Energy Commission, to Gordon F. Snow, Assistant Secretary of the California Resources Agency.	4/22/83
D-32	Theodore M. Edison, West Orange, NJ.	4/26/83
D-34	Packerland Packing Company, Inc., Green Bay, Wisconsin, signed by Norval Dvorak, Vice-President of Market Growth & Development.	4/27/83
D-35	Douglas E. Denninger, Somerville, MA.	4/27/83
D-36	San Diego Gas & Electric, San Diego, California, signed by L. Bernath, Manager, Nuclear Department.	4/27/83
D-41	John M. Matuszek of the State of New York Radiological Sciences Laboratory.	4/29/83
D-42	RE/SPEC Inc. of Rapid City, South Dakota, signed by William C. McClain, Executive Vice President.	4/29/83
D-44	Memo from Kay Wilcox, State of Oregon A-95 Coordinator, forwarding a comment memo from Dr. Max Bader, Oregon Health Division.	4/29/83

D-46	The Atomic Industrial Forum, Bethesda, Maryland, signed by Carl Walske.	4/29/83
D-47	The U.S. Department of Energy, Washington, D.C., signed by William A. Vaughn, Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness.	5/2/83
D-48	Serious Texans Against Nuclear Dumping, Tulia, Texas, signed by Don Hancock, a consultant for that group.	5/2/83
D-49	The Southwest Research and Information Center, Albuquerque, New Mexico, signed by Don Hancock, Information Coordinator.	5/2/83
D-50	The Wisconsin Radioactive Waste Review Board signed by Patrick J. Walsh, Executive Director.	5/2/83
D-51	Louis G. Williams, Ph.D., Northport, Alabama.	5/2/83
D-52	The Yakima Indian Nation, Toppenish, Washington, signed by Melvin R. Sampson, Chairman of the Legislative Committee.	5/2/83
D-53	The Sierra Club signed by Brooks B. Yeager, Washington Representative.	5/2/83
D-54	Paul Leventhal, President of the Nuclear Control Institute (Washington, D.C.), Ted Harris, President of the Energy Research Foundation (Columbia, South Carolina), and John Buell, staff member of Nuclear Control Institute.	5/2/83
D-55	The Environmental Policy Institute, Washington, D.C., signed by David M. Berick, Director of the Nuclear Waste Project.	5/2/83
D-56	Sandra Edwards, Champaign, Illinois.	5/3/83
D-57	The Tennessee Valley Authority, signed by Alvan Bruch for Dr. Mohamed T. El-Ashry, Director of Environmental Quality, Knoxville, Tennessee.	5/3/83
D-58	The State of Texas Energy and Natural Resources Advisory Council, Austin, Texas, signed by Bill Carter, Acting Executive Director.	5/3/83
D-59	GA Technologies, San Diego, California, signed by R.A. Dean, Vice President, Power Reactors Program.	5/3/83
D-60	Citizen Alert, Las Vegas, Nevada, signed by Abby Johnson, Program Director.	5/3/83

D-61	Upper Valley Energy Coalition, Lebanon, New Hampshire, signed by Dr. Douglas V. Smith.	5/3/83
D-62	The Nuclear Information and Resource Service, Washington, D.C., signed by Laura Worby.	5/3/83
D-63	Angela Iadavaia-Cox, New York, New York.	5/3/83
D-65	The Edison Electric Institute, Washington, D.C., signed by John J. Kearney, Senior Vice President.	5/3/83
D-66	The Natural Resources Defense Council, Washington, D.C., signed by Thomas B. Cochran.	5/3/83
D-67	Katherine P. Kitchell, Logan, Utah.	5/3/83
D-68	Groundwater Alliance, Ketchum, Idaho, signed by Elizabeth Paul.	5/3/83
D-69	The National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Washington, D.C., signed by Joyce M. Wood, Chief, Ecology and Conservation Division.	5/3/83
D-70	The U.S. Department of the Interior, Washington, D.C., signed by Tom Loomis for Bruce Blanchard, Director, Environmental Project Review.	5/3/83
D-71	Joseph H. Gross, El Paso, Texas.	5/3/83
D-72	Carolinians for Safe Energy, Asheville, North Carolina, signed by Rubin Falk, President.	5/3/83
D-73	Kerr-McGee Nuclear Corporation, Oklahoma City, Oklahoma, signed by W.J. Shelley, Vice-President, Nuclear Licensing & Regulation.	5/3/83
D-74	The State of Nevada Department of Energy, signed by James I. Barnes, Director.	5/4/83
D-75	The State of Utah signed by Randy Moon, State Science Advisor.	5/4/83
D-76	The Redwood Alliance, Arcata, California, signed by James S. Adams.	5/4/83
D-77	The Natural Rights Center, Summertown, Tennessee, signed by Albert Bates, Director.	5/4/83

D-78	The New York State Department of Environmental Conservation, signed by Louis M. Concra, Jr., Director, Division of Regulatory Affairs.	5/4/83
D-79	The American Nuclear Society, LaGrange Park, Illinois, signed by L. Manning Muntzing.	5/4/83
D-80	The Minnesota Project, Minneapolis, Minnesota, signed by Barbara J. Johnson, Radioactive Waste Project.	5/5/83
D-81	The U.S. Department of Health & Human Services, signed by John C. Villforth, Director, National Center for Devices and Radiological Health.	5/5/83
D-82	Deborah Wilkinson, Bayfield, Wisconsin.	5/5/83
D-83	The Hanford Oversight Committee, Richland, Washington, signed by Larry L. Caldwell.	5/5/83
D-84	Middle South Services, Inc., New Orleans, Louisiana, signed by Joel D. Patterson.	5/5/83
D-85	Marshall S. Little, Santa Fe, New Mexico.	5/5/83
D-86	The Michigan Department of Public Health, signed by Gloria R. Smith.	5/5/83
D-87	R. Eileen Buller, Kennewick, Washington.	5/5/83
D-88	The California Resources Agency, signed by Gordon F. Snow, Assistant Secretary for Resources.	5/5/83
D-89	Gayle Houston, Alta, Utah.	5/6/83
D-90	The American Institute of Chemical Engineers signed by J.A. Buckham, Chairman, Nuclear Waste Task Force, Government Programs Steering Committee.	5/6/83
D-91	Hovis, Cockrill, Weaver, & Bjur, Yakima, Washington, signed by James B. Hovis, Attorney for the Yakima Indian Nation.	5/9/83
D-92	Roscoe and Evelyn Churchill, Ladysmith, Wisconsin.	5/9/83
D-93	The United Kingdom's Department of the Environment, signed by F.S. Feates, Director, Nuclear Waste Management.	5/9/83

Section F		Date docketed
F-7	TRANSCRIPT FOM THE MAY 12-14, 1983 PUBLIC HEARING HELD IN WASHINGTON, D.C.	5/24/83
F-7-ii and F-7-iii	Michael J. Lawrence, Director, Office of Storage and Acting Director, Nuclear Waste Policy Act project Office. U.S. Department of Energy, Washington, D.C.	
F-7-iv and F-7-v	David M. Berick, Director, Nuclear Waste Project, Environmental Policy Institute, Washington, D.C.	
F-7-vi	Russell E.L. Stanford, Program Director, Utility Nuclear Waste Management Group, Representing the Edison Electric Institute and the Utility Nuclear Waste Management Group, Washington, D.C.	
F-7-vii	Duwayne F. Gebken, Chief, Environmental Analysis Section and Chairman, Radioactive Waste Review Board Technical Advisory Council, Department of Natural Resources, State of Wisconsin.	
F-7-viii	Brooks B. Yeager, Washington Representative, Sierra Club, Washington, D.C.	
F-7-ix	Laura Worby, Nuclear Waste Specialist, Nuclear Information and Resource Service, Washington, D.C.	
F-7-x	Louis G. Williams, Aquatic ecologist and Emeritus professor, University of Alabama, Northport, Alabama.	
F-8	TRANSCRIPT FROM THE MAY 20, 1983, PUBLIC HEARING HELD IN DENVER, COLORADO.	5/31/83
F-8-ii	Mr. Melvin Sampson, Yakima Indian Nation, Toppenish, Washington.	
F-8-iii	Dr. Randy G. Moon, State of Utah.	
F-8-iv	Dr. James K. Channell, Environmental Evaluation Group, State of Mexico.	
F-8-v	Mr. Steve Frishman, Energy and Natural Resources Advisory Council, State of Texas.	
F-8-vi	William Jacobi, Department of Health, State of Colorado.	

F-11	Letter from the U.S. Department of Energy, signed by the John O. McElroy for Michael J. Lawrence, Acting Director, Nuclear Waste Policy Act Project Office, forwarding a package entitled "Responce to Questions Raised by EPA during M. Lawrence's Testimony, May 12, 1983."	7/19/83

	Section H	Date docketed
H-1	Pacific Gas and Electric Company, San Francisco, California, signed by Philip A. Crane.	5/4/83
H-2	The Texas Department of Health, signed by David M. Cochran, Associate Commissioner for Environmental and Consumer Health Protection.	5/6/83
H-3	Numerous Mississippi State Offices, forwarded by the Mississippi Department of Energy & Transportation and signed by Ronald J. Forsythe, Manager, Nuclear Energy/ Nuclear Waste.	5/6/83
H-4	The New Mexico Environmental Evaluation Group.	5/6/83
H-5	Raymond S. Burton, Executive Councilor, District One, State of New Hampshire.	5/9/83
H-6	The State of Minnesota, signed by Michael O'Donnell, Executive Secretary of the Cabinet, Office of the Governor.	5/9/83
H-7	The U.S. Nuclear Regulatory Commission, signed by Donald S. Mausshardt for John G. Davis, Office of Nuclear Materials Safety and Safeguards.	5/10/83
H-8	Pacific Gas and Electric Company, San Francisco, California, signed by Philip A. Crane.	5/11/83
H-10	The Commonwealth of Pennsylvania, Department of Environmental Resources, signed by Nicholas DeBenedictis, Secretary, Department of Environmental Resources.	5/13/83
H-11	The U.S. Nuclear Regulatory Commission, signed by Nunzio J. Palladino, Chairman, U.S. Nuclear Regulatory Commission.	5/16/83
H-12	Georgia Power Company, Atlanta, Georgia, signed by L.T. Gucwa, Chief Nuclear Engineer, Power Generation Department.	5/17/83
H-13	The Manhattan Group (Oil and Gas Consultants), Natchez, Mississippi, signed by Donald F.X. Finn, Managing Director.	5/13/83

H-14	The Birmingham Audubon Society, Birmingham, Alabama, signed by John Northrop, Member, Conservation Committee.	5/18/83
H-15	The New Jersey Department of Environmental Protection, signed by George J. Tyler, Assistant Commissioner.	5/18/83
H-16	The Virginia Council on the Environment, signed for Sheila M. Prindiville.	5/18/83
H-18	The Mississippi State Clearinghouse and Ronald J. Forsythe, Mississippi Department of Energy & Transportation referring their comments to the Mississippi Nuclear Waste Technical Review Committee.	5/31/83
H-19	The New Mexico State Clearinghouse and various New Mexico State Agencies.	5/31/83
H-20	Position statements from the Texas Corn Growers Association and the High Plains Gas Users Association.	3/31/83
H-21	The Bethlehem Steel Corporation, Bethlehem, Pennsylvania, signed by A.E. Moffitt, Jr., Manager of Environmental Health.	6/03/83
H-24	Richard Packey, Oakdale, New York.	6/14/83
H-25	The Maryland State Clearinghouse, signed by Guy W. Hager, Director.	6/14/83
H-26	The Manhattan Group, Natchez, Mississippi, signed by Donald F.X. Finn, Managing Director.	6/15/83
H-27	Gary Tannahill, Houston, Texas.	6/16/83
H-28	The New York State Department of Health, signed by David Axelrod, Commissioner of Health.	6/20/83
H-30	The Manhattan Group, signed by Donald F.X. Finn.	7/19/83
H-31	The National Radiological Protection Board.	7/19/83
H-33	Thomas M. Roberts, Acting Chairman, U.S. Nuclear Regulatory Commission.	8/10/84
H-34	William Thompson, M.D., Hattiesburg, Mississippi.	8/10/84
H-35	David Okrent, University of California at Los Angeles.	5/22/85
H-37	Robert H. Neill,, Director, New Mexico Environmental Evaluation Group.	5/22/85

H-38	Russell Jim, Manager, Nuclear Waste Program, Yakima Indian Nation, Toppenish, Washington.	6/4/85

	Section K	Date docketed
K-1	Louis G. Williams, Ph.D., Northport, Alabama.	6/3/83
K-2	San Diego Gas & Electric, San Diego, California, signed by L. Bernath, Manager, Nuclear Department.	6/7/83
K-3	The Georgia Department of Natural Resources signed by James C. Hardeman, Manager, Environmental Radiation Program.	6/14/83
K-4	The Suffolk Nuclear Study Group, Mastic, New York, signed by Bill Hafner, Director.	6/15/83
K-5	The Washington State Department of Ecology, signed by Donald W. Moos, Director, Department of Ecology, and Susan E. Gould, Chair, Nuclear Waste Policy and Review Board, and Chair, Nuclear Waste Advisory Council.	6/20/83
K-6	Harmon & Weiss, Washington, D.C., signed by Dean R. Tousley on behalf of the Yakima Indian Nation.	6/20/83
K-7	The New Mexico Environmental Evaluation Group, signed by Robert H. Neill, Director.	6/20/83
K-8	Joseph H. Gross, El Paso, Texas.	6/20/83
K-9	The Wisconsin Radioactive Waste Review Board, signed by DuWayne R. Gebken for Patrick J. Walsh, Executive Director.	6/20/83
K-10	The Environmental Policy Institute, Washington, D.C., signed by David Berick, Director, Nuclear Waste Project.	6/20/83
K-11	Kerr-McGee Corporation, Oklahoma City, Oklahoma, signed by W.J. Shelley, Vice-President, Nuclear Licensing and Regulation.	6/20/83
K-12	The Natural Resources Defense Council, Inc., Washington, D.C., signed by Thomas B. Cochran, Senior Staff Scientist, and Barbara A. Finamore, Project Attorney.	6/21/83
K-13	The Southwest Research and Information Center, Albuquerque, New Mexico, signed by Don Hancock, Information Coordinator.	6/21/83

K-14	The Colorado Department of Health, signed for Albert J. Hazle, Director, Radiation Control Division.	6/21/83
K-15	The American Institute of Chemical Engineers, signed by J.A. Buckham, Chairman, Nuclear Waste Task Force, Government Programs Steering Committee.	6/21/83
K-16	The Groundwater Alliance, Ketchum, Idaho, signed by Elizabeth Paul.	6/21/83
K-17	Mary Green, Hattiesburg, Mississippi.	6/21/83
K-18	The Atomic Industrial Forum, Inc., Bethesda, Maryland, signed by Carl Walske.	6/21/83
K-19	The Edison Electric Institute, Washington, D.C., signed by John J. Kearney, Senior Vice-President.	6/22/83
K-20	The Minnesota Project, Minneapolis, Minnesota, signed by Barbara J. Johnson, Coordinator, Radioactive Waste Project.	6/23/83
K-21	The Nuclear Information and Resource Service, Washington, D.C., signed by Laura Worby, Nuclear Waste Specialist.	6/23/83
K-22	The Nevada Department of Energy, signed by James I. Barnes, Director.	6/28/83
K-23	The U.S. Nuclear Regulatory Commission, signed by Robert E. Browning, Acting Director, Division of Waste Management.	7/14/83
K-24	The Washington State Department of Ecology, signed by Donald M. Moos, Director, and Susan E. Gould, Chair, Nuclear Waste Policy and Review Board, and Chair, Nuclear Waste Advisory Council.	7/15/83
K-25	The Governor of New Mexico.	9/8/83

	Section L	Date docketed
L-1	The U.S. Department of Energy, signed by William A. Vaughan, Assistant Secretary, Environmental Protection, Safety, and Emergency Preparedness.	6/22/83
L-3	The Michigan Department of Health, signed by James Harmon for Gloria R. Smith, Director.	7/5/83
L-4	The New Jersey Department of Environmental Protection, signed by George J. Tyler, Assistant Commissioner.	7/14/83

L-5	The Texas Governor's Office, signed by Steve Frishman, Director, Nuclear Waste Programs Office.	7/18/83
L-6	The U.S. Department of the Interior, signed by Bruce Blanchard, Director, Environmental Project Review.	7/22/83
L-7	The Sierra Club National Energy Committee, signed by Marvin Resnikoff.	8/16/83
L-8	Governor Earl of Wisconsin.	9/2/83
L-9	William D. Wiley, Phoenix, Arizona.	10/18/83
L-10	Governor Bryan of Nevada.	2/10/84
L-11	Thomas Kalitowski, Chairman of the Minnesota Governor's High-Level Radioactive Waste Task Force.	2/10/84
L-12	David C. Treen, Governor of Louisiana.	2/10/84
L-13	Mark White, Governor of Texas.	3/12/84
L-14	Thomas F. Hartnett, Congressman from South Carolina.	4/26/84
L-15	Joseph Goldberg, New Mexico Secretary for Health & Environment.	5/25/84
L-16	Tom Kalitowski, Chairman, Minnesota Governor's Task Force on High-Level Radioactive Waste.	5/29/84