RULEMAKING ISSUE
(Affirmation)

April 17, 1989 SECY-89-120

For: The Commissioners

From: Victor Stello, Jr.,
Executive Director for Operations

Subject: 10 CFR 61--LAND DISPOSAL OF RADIOACTIVE WASTE

Category: This paper involves a policy question of interest to other Federal agencies.

Purpose: To obtain Commission approval for a notice of final rulemaking to be published in the Federal Register.

Summary: On May 18, 1988, the Commission published a notice of proposed rulemaking (53 FR 17709) which would require geologic repository disposal of greater-than-Class-C low-level radioactive waste, unless an alternate method of disposal were approved by the Commission. This action was taken in lieu of revision of the definition of high-level radioactive waste. The staff has reviewed the public comments on the proposed amendments to Part 61, and is recommending that the proposed amendments be finalized with no significant change.

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Background: The staff reviewed the desirability of revising the definition of high-level radioactive waste (HLW) in 10 CFR Part 60 in response to a Commission directive. After reviewing public comments on an advance notice of proposed rulemaking (ANPRM) published on February 27, 1987 (52 FR 5922), the staff recommended that no revision be undertaken. Instead, Part 61 should be amended to require that greater-than-Class-C (GTCC) low-level waste (LLW) be disposed of in a deep geologic repository, unless an alternative disposal method was approved by the Commission (SECY-88-51). Major reasons for the staff's recommendation were: (a) the lack of any consensus among the public comments for a numerical method for classifying HLW, and the general concern among the comments over disposal method, rather than classification per se, (b) the technical and legal difficulties involved in any reclassification of what is now considered reprocessing HLW, (c) the lack of any presently available or authorized intermediate disposal facilities, and (d) the relatively small amount of non-reprocessing waste materials that might be candidates for reclassification (GTCC LLW). By requiring geologic repository, or approved alternative disposal for GTCC LLW, regulatory uncertainties about disposal of this class of waste would be reduced. This would address a major concern expressed by the public in its comments, as well as one raised by DOE. In its report to Congress on management of GTCC waste, DOE had cited lack of a regulatory framework for disposal of GTCC waste as a key impediment to DOE plans for management of GTCC waste.[1]

The Commission approved the staff's recommendation, and a notice of proposed rulemaking requiring geologic repository disposal, or approved alternative, was published on May 18, 1988 (53 FR 17709).

Office of Technology Assessment Report

Additional background information comes from a recent report on GTCC waste. Following publication of the proposed amendments, the Congressional Office of Technology Assessment published a report on management of GTCC LLW (Enclosure H). Its recommendations on disposal of GTCC waste generally support the stance taken by the Commission in the proposed amendments.

The OTA report states that "If a decision about the disposal of GTCC wastes were required today, a conservative approach would be to permanently isolate the waste in a deep geologic repository, as has been proposed for commercial spent fuel and defense HLW." The report goes on to acknowledge that further research and

[1]Recommendations for Management of Greater-than-Class-C-Low-Level Radioactive Waste, DOE/NE-0077, 1987.

development could demonstrate the acceptability of intermediate disposal methods, such as deep-augured holes or an intermediate-depth repository. The OTA report agrees with the Commission that the volume of GTCC waste is probably not great enough to justify a separate facility for this waste; costs of geologic repository disposal of GTCC waste would be comparable to, or lower than, developing a special disposal facility solely for GTCC waste.

The overall recommendations of the OTA report are that a Federal off-site interim storage facility for GTCC waste be established, as no permanent disposal facility could be available for at least 15 to 20 years. Until such interim storage facility became operational, the Federal government could provide limited access to an existing DOE storage facility. Within the next year or so, DOE should begin to evaluate the impacts on repository operations and performance of emplacing GTCC waste in the repository. If DOE determines that such impacts are unacceptable, it could then begin to develop an alternative disposal facility.

Discussion:

Public Comments:

Thirty five comment letters were received, broken down as follows: 8 from States, 2 from a State regional compact, 3 from other Federal agencies, 7 from environmental/public interest groups, 5 from electric utility industry organizations or utilities, 2 from national laboratories, 1 from a professional society, and 7 from private individuals.

Most states expressed general support for the proposed amendments, although they did raise some issues. The major comments, and staff responses, are given below. A more detailed analysis of public comments is also enclosed (Enclosure G).

(a) Restricting Alternatives

Many comments, including some by States and a regional State LLW compact, argued for restricting the alternatives to geologic repository disposal. These comments were concerned that GTCC waste would be disposed of in State or State compact operated facilities. NRC was urged to "eliminate the option" of disposal in State or State compact facilities, by limiting alternative disposal methods to Federal facilities.

The Low Level Radioactive Waste Policy Amendments Act, Public Law 99-240 (LLWPAA), clarified Federal and State responsibilities for radioactive waste disposal. States are responsible only for commercial LLW classified as "A", "B", or "C" waste under Part 61; and all HLW and all GTCC LLW is a Federal responsibility. The concerns expressed by

commenters on this point have therefore been addressed, to a large extent, by legislation. No health and safety concerns have been presented that would require the use of Federal facilities, to the exclusion of other facilities licensed under the Atomic Energy Act, for the disposal of all GTCC. Indeed, the LLWPAA appears to recognize the continued authority of a State, subject to the provisions of its compact, or a compact region, to accept GTCC waste for disposal, and in the absence of some compelling reason this option should be preserved.

(b) Applicability of Standards

Both EPA and DOE, among other commenters, were concerned about one aspect of possible geologic repository disposal of GTCC waste. Should GTCC LLW be emplaced in a repository along with HLW, these two categories of waste would be subject to different standards -- EPA's HLW standard, and EPA's LLW standard. In addition, they questioned whether NRC's 10 CFR Part 60, or 10 CFR Part 61 would apply to GTCC waste emplaced in a repository. Commenters cited the potential for confusion in having dual standards apply to waste in the same repository.

The Commission's regulations were developed for specific types of disposal facilities. Thus, Part 60 applies to any geologic repository, regardless of what types of radioactive wastes may be disposed of there. Similarly, Part 61 pertains to land disposal facilities other than geologic repositories. Therefore, only Part 60, and not Part 61, would be relevant for disposal of GTCC wastes in a HLW repository.

If GTCC wastes were to be disposed of in a deep geologic repository, questions might be raised regarding the applicability to those wastes of the waste form and packaging requirements of Part 60. As Part 60 is now structured, the retrievability requirement of §60.111 and the implicit requirement for packaging to permit safe waste handling and emplacement apply to all wastes, including GTCC wastes, that are disposed of in a repository. Applicability of the waste package containment requirement (300-1,000 years) is specifically limited to packages containing HLW or spent nuclear fuel. Since GTCC wastes would not be classified as HLW under these amendments, the waste package requirements of Part 60 would not pertain to GTCC wastes. The performance objectives for the engineered barrier system (release rate of 1 part per 100,000 per year) and for overall system performance are stated so as to be applicable to all wastes emplaced in a repository. The degree to which these performance objectives would affect GTCC waste form

and packaging would depend on the specific radionuclides present in the GTCC wastes and on the physical and chemical forms of those wastes. The staff informed the Commission in SECY-88-285 that it may be necessary to add additional regulatory requirements to Part 60 in the future if DOE should elect to pursue repository disposal of GTCC wastes.

Previous development of EPA's standards has addressed types of wastes rather than types of disposal facilities, as in NRC's regulations. Thus, it is possible that a repository containing both HLW and GTCC LLW would be subject to two EPA standards. The staff does not anticipate that this will cause significant problems for DOE. If it should pose an insurmountable difficulty, DOE would still be able to develop a separate, GTCC only facility. The staff will consult with EPA, as appropriate, to address (and resolve, if possible) potential issues related to differences in regulatory approach.

(c) Effects on Repository Program

There were a number of comments, including those from DOE, that expressed concern over the possible impacts on the geologic repository program of emplacement of GTCC waste along with HLW in the repository. Specific concerns were over the potential for additional costs, GTCC waste taking up valuable repository space, and the burden for DOE of having to include GTCC waste in its performance assessment of the repository.

In the staff's view, these concerns do not warrant changes from the proposed amendments. First, the proposed amendments allow for a range of GTCC disposal methods to be used by DOE. Under present Part 61, GTCC waste is specifically identified as "not generally acceptable" for near-surface disposal. Disposal methods for GTCC waste must generally be "more stringent" than near-surface disposal. The proposed amendments to Part 61 specified that one more stringent method would be geologic repository disposal. Other methods are not specified but are also left open to DOE, subject to Commission approval. The proposed amendments were not what prevented DOE from routinely using near-surface disposal. Thus, relevant cost impacts of the amendments do not involve a comparison between costs of geologic repository disposal vs. costs of near-surface disposal. Cost comparisons involve geologic repository disposal vs. other unspecified Commission-approved "intermediate" methods. However, the proposed amendments did not require one method to be selected over another; either option is permitted. DOE would presumably weigh cost comparisons along with other factors in selecting which

disposal method to use. Even if geologic repository disposal were selected, such disposal should not cause an increase in the present HLW fee charged nuclear utilities. Rather, as suggested by DOE's study of the matter pursuant to §3(b)(3) of the LLWPAA, it is likely that a separate fund, similar to the HLW Nuclear Waste Fund, would be established to provide for payment of disposal costs by the generators of GTCC wastes, either as an advance fee or as a charge upon waste receipt.

The expected volume of GTCC waste is very small relative to volumes of HLW and Class A, B, and C LLW. It is projected that 2,000-4,800 cubic meters of commercially-generated GTCC waste will need disposal through the year 2020. This amount of waste is smaller than the anticipated excavated volume of a single emplacement room of a repository, and would not present a significant burden on the capacity of the repository to receive HLW. It would not be a significant factor underlying the need for a second repository.

Regarding DOE's assessment of the performance of the repository, if DOE found that it did pose a major obstacle, these amendments would permit DOE to choose an acceptable alternative disposal method.

(d) Relationship to Defense Wastes

Some comments were concerned with any effects this rulemaking would have on defense wastes.

The proposed amendments apply solely to commercial GTCC LLW. The Commission has no legal authority to license disposal facilities used for defense-generated wastes, unless these wastes are classified as HLW. Defense wastes analogous to commercial GTCC would not be classified as HLW and therefore, DOE plans for disposal of certain defense materials similar to GTCC waste would be unaffected by the proposed amendments.

In the case of facilities authorized for the disposal of HLW, the Commission does have jurisdiction and the Commission's regulations would continue to apply. Accordingly, to the extent that DOE disposes of HLW in facilities other than geologic repositories, a license would be required as before. DOE would not necessarily be precluded from proceeding with such disposal, but as has always been the case DOE would need to obtain the Commission's approval.

The NRC staff has been working with DOE to develop appropriate classifications for defense reprocessing wastes under existing laws and regulations. These efforts have led to

agreement that decontaminated salts at Savannah River and West Valley, generated incidentally in the course of processing, should not be classified as HLW. Additional efforts are now underway to review materials to be produced at Hanford in projected operations, so as to determine whether the disposal therof is subject to Commission licensing.

(e) Restricting DOE Options for GTCC Management

DOE argued that the proposed amendments would limit its statutory authority, under the LLWPAA, to develop a comprehensive policy for management of GTCC waste.

The staff considers the proposed rule to be entirely consistent with the "comprehensive scheme for developing a policy for disposal of GTCC wastes" referred to in this comment. The proposed rule did not constrain DOE's ability to "identify disposal options, financing mechanisms, and the legislation needed to implement them." Nor did the proposed rule require disposal of GTCC wastes prior to submittal of the Department's recommendations to Congress. The proposed rule only recognized that commercial GTCC wastes must be disposed of in a facility licensed by the NRC -- a constraint imposed by the LLWPAA.

(f) Mixed GTCC Waste

EPA commented that some GTCC wastes would also contain hazardous materials subject to RCRA regulations. DOE will indeed need to consider applicable RCRA requirements as well as those arising under the Atomic Energy Act. Should RCRA requirements associated with GTCC waste represent a significant impediment to placing a geologic repository in service, DOE will still have the option to propose the use of a separate facility.

Changes from the Proposed Rule

In §61.55(a)(2)(iv) of the proposed rule, geologic repository disposal is required "unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are submitted to the Commission for approval." In response to a comment, this has been changed to "unless proposals pursuant to this part are approved by the Commission."

NRC resource needs for implementing this rulemaking have already been factored into current budget planning.

The ACNW reviewed the draft final rule at its February, 23, 1989 meeting. In response to ACNW comments, the staff has added

material to the statement of considerations addressing requirements for the waste package for GTCC waste. The ACNW comments and the staff response are contained in Enclosure I.

OGC has reviewed this paper and has no legal objection.

Recommendation: That the Commission:

(1) Approve for publication in the Federal Register the final amendments to 10 CFR 61 which would require repository disposal for GTCC wastes unless an alternative means of disposal has been approved by the Commission.

(2) Certify that this rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. This certification is necessary in order to satisfy the requirements of the Regulatory Flexibility Act, 5 U.S.C. 605(a).

(3) Note:

(a) That the notice of final rulemaking in Enclosure A will be published in the Federal Register .

(b) That the Chief Counsel for Advocacy of the Small Business Administration will be informed of the certification by the Division of Rules and Records.

(c) That the final amendments are corrective or minor, and do not substantially modify existing regulations; and they are accordingly eligible for categorical exclusion from the preparation of an environmental assessment.

(d) The Subcommittee on Energy and the Environment of the House Interior and Insular Affairs Committee, the Subcommittee on Nuclear Regulation of the Senate Committee on the Environment and Public Works, the Subcommittee on Energy, Nuclear Proliferation and Federal Services of the Senate Committee on Government Affairs, and the Subcommittee on Energy and Power of the House Interstate and Foreign Commerce Committee will be informed by a letter similar to Enclosure C.

(e) This rule contains no new or amended recordkeeping, reporting, or application requirement, or any other type of information collection requirement, subject to the Paperwork Reduction Act (Pub. L. 96-511).

(f) A regulatory analysis is presented in Enclosure E.

(g) The Office of Public Affairs has determined that it is necessary to issue a public announcement similar to Enclosure D in connection with these amendments.

(h) The changes to be made in 10 CFR Part 61 are provided in comparative text as Enclosure F.

(i) The draft Federal Register Notice states that provisions of 10 CFR 50.109 on backfitting do not apply to this rulemaking because the rule is not a generic requirement applicable to production and utilization facilities licensed under 10 CFR Part 50.

Victor Stello, Jr.
Executive Director for Operations

Enclosures
A. Federal Register Notice
B. Proposed Amendments (53 FR 17709)
C. Draft Congressional Letter
D. Draft Public Announcement
E. Regulatory Analysis
F. Comparative Text
G. Detailed Analysis of Public Comments
H. OTA Report on Management of GTCC Waste
I. ACNW Comments and Staff Response

Commissioners' comments or consent should be provided directly to the Office of the Secretary by COB Wednesday, May 3, 1989.

Commission Staff Office comments, if any, should be submitted to the Commissioners NLT Tuesday, April 25, 1989, with an information copy to the Office of the Secretary. If the paper is of such a nature that it requires additional time for analytical review and comment, the Commissioners and the Secretariat should be apprised of when comments may be expected.

This paper is tentatively scheduled for affirmation at an Open Meeting during the Week of May 8, 1989. Please refer to the appropriate Weekly Commission Schedule, when published, for a specific date and time.

DISTRIBUTION:

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ENCLOSURE A

(7590-01)

NUCLEAR REGULATORY COMMISSION

10 CFR Part 61

Disposal of Radioactive Wastes

AGENCY: Nuclear Regulatory Commission.

ACTION: Final rule.

SUMMARY: This rule amends 10 CFR Part 61 to require disposal of "greater-than-Class-C" low-level radioactive wastes in a deep geologic repository unless disposal elsewhere has been approved by the Commission. The amendments obviate the need for altering existing classifications of radioactive wastes as high-level or low-level.

EFFECTIVE DATE:

FOR FURTHER INFORMATION CONTACT: W. Clark Prichard, Division of Engineering, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, D. C. 20555, telephone (301) 492-3884.

SUPPLEMENTARY INFORMATION:

Background

On May 18, 1988, the Nuclear Regulatory Commission published proposed amendments to Part 61 to require geologic repository disposal of greater-than-Class-C (GTCC) low level radioactive waste (LLW) unless an alternative means of disposal was approved by the Commission (53 FR 17709). The proposal to require geologic repository disposal, or an approved alternative, was aimed at insuring that GTCC waste would be disposed of in a manner consistent with the protection of public health and safety. This action was taken in lieu of a revision of the definition of high level radioactive waste (HLW). In proposing the amendments the Commission outlined its rationale for not proceeding with a revision of the definition of HLW along the lines proposed in the advance notice of proposed rulemaking (ANPRM) published on February 27, 1987 (51 FR 5992).

It is the Commission's view that intermediate disposal facilities may never be available, in which case a repository would be the only type of facility generally capable of providing safe disposal for GTCC wastes. At the same time, the Commission wishes to avoid foreclosing possible use of intermediate disposal facilities by the Department of Energy (DOE). If DOE chooses to develop one or more intermediate disposal facilities, the Commission anticipates that the acceptability of such facilities would be evaluated in the light of the particular circumstances, considering for example the existing performance objectives of 10 CFR Part 61 and any generally applicable environmental radiation protection standards that might have been established by the U. S. Environmental Protection Agency. Technical criteria to implement the performance objectives and environmental standards would be developed by the Commission after DOE had selected a specific disposal technology and decided to pursue development of an intermediate facility.

The Commission considers that the Part 61 amendments would obviate any need to reclassify certain GTCC wastes as HLW. Many comments on the ANPRM advocated classification of all GTCC wastes as HLW in order to ensure availability of a safe disposal "home" for those wastes, but these amendments achieve the same

purpose while leaving open the prospect that an intermediate disposal facility may prove attractive at some time in the future.

Office of Technology Assessment Report

Following publication of the proposed amendments, the Congressional Office of Technology Assessment published a report on management of GTCC LLW.[1] Its recommendations on disposal of GTCC waste generally support the stance taken by the Commission in the proposed amendments.

The OTA report states that "If a decision about the disposal of GTCC wastes were required today, a conservative approach would be to permanently isolate the waste in a deep geologic repository, as has been proposed for commercial spent fuel and defense HLW."[2] The report goes on to acknowledge that further research and development could demonstrate the acceptability of intermediate disposal methods, such as deep-augured holes or an intermediate-depth repository.

The Commission emphasizes that these amendments preserve DOE's flexibility to pursue either one of these alternatives. The OTA report agrees with the Commission that the volume of GTCC waste is probably not great enough to justify a separate facility for this waste; costs of geologic repository disposal of GTCC waste would be comparable to, or lower than, developing a special disposal facility solely for GTCC waste.

The overall recommendations of the OTA report are that a Federal off-site interim storage facility for GTCC waste be established, as no permanent disposal facility could be available for at least 15 to 20 years. Until such interim storage facilities become operational, the Federal government could

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1 U.S. Congress, Office of Technology Assessment, An Evaluation of Options for Managing Greater than Class C Low Level Radioactive Waste, OTA-BP-O-50, October, 1988.

2 ibid. pp. 2-3.

provide limited access to an existing DOE storage facility. Within the next year or so, DOE should begin to evaluate the impacts on repository operations and performance of emplacing GTCC waste in the repository. If DOE determines that such impacts are unacceptable, it could then begin to develop an alternative disposal facility.

Public Comments

The Commission received 35 comment letters in response to its request for public comment. Among the responses were comments from the Department of Energy (DOE), the Environmental Protection Agency (EPA), the States of Indiana, New York, Pennsylvania, South Carolina, Vermont, Michigan, Washington, Tennessee, and the Midwest Interstate Low Level Radioactive Waste Commission. Remaining comments came from industry, professional, and environmental groups, as well as private citizens. The following is a summary of major comments and Commission responses. A detailed analysis of public comments is available at the Commission's Public Document Room, 2120 L St., NW, Washington, DC.

(a) Restricting Alternatives

Many comments, including some by States and a regional state LLW compact, argued for restricting the alternatives to geologic repository disposal. These comments were concerned that GTCC waste would be disposed of in State or State compact operated facilities. NRC was urged to "eliminate the option" of disposal in State or State compact facilities, by limiting alternative disposal methods to Federal facilities.

This concern must be examined in the light of the Low Level Radioactive Waste Policy Amendments Act of 1985, Public Law 99-240, 42 U.S.C. 2021b et seq. (LLWPAA) which clarified Federal and State responsibilities for radioactive waste disposal. States are responsible only for commercial LLW defined as "A", "B", or "C" waste by Part 61. All HLW, and all GTCC LLW is a Federal responsibility. The concerns expressed by commenters on this point have therefore been addressed, to a large extent, by legislation. No health and

safety concerns have been presented that would persuade the Commission to require the use of Federal facilities, to the exclusion of other facilities licensed under the Atomic Energy Act, for the disposal of all GTCC. Indeed, the LLWPAA appears to recognize the continued authority of a State, subject to the provisions of its compact, or a compact region, to accept GTCC waste for disposal, and in the absence of some compelling reason the Commission's judgment is that this option should be preserved.

(b) Applicability of Standards

Both EPA and DOE, among other commenters, were concerned about one aspect of possible geologic repository disposal of GTCC waste. Should GTCC LLW be emplaced in a repository along with HLW, these two categories of waste would be subject to different standards -- EPA's HLW standard, and EPA's LLW standard. In addition, they questioned whether NRC's 10 CFR Part 60, or 10 CFR Part 61 would apply to GTCC waste in a repository. Commenters cited the potential for confusion in having dual standards apply to waste in the same repository.

The Commission notes that its regulations were developed for specific types of disposal facilities. Thus, Part 60 applies to any geologic repository for HLW, regardless of what other types of radioactive wastes may be disposed of there. Similarly, Part 61 pertains to land disposal facilities other than repositories. Therefore, only Part 60, and not Part 61, would be relevant for disposal of GTCC wastes in a HLW repository.

If GTCC wastes were to be disposed of in a deep geologic repository, questions might be raised regarding the applicability to those wastes of the waste form and packaging requirements of Part 60. As Part 60 is now structured, the retrievability requirement of §60.111 and the implicit requirement for packaging to permit safe handling and emplacement apply to all wastes, including GTCC wastes, that are disposed of in a repository. Applicability of the waste package containment requirement (300-1,000 years) is specifically limited to packages containing HLW or spent nuclear fuel. Since GTCC wastes would not be classified as HLW under these amendments, the waste package

requirements of Part 60 would not pertain to GTCC wastes. The performance objectives for the engineered barrier system (release rate of 1 part per 100,000 per year) and for overall system performance are stated so as to be applicable to all wastes emplaced in a repository. The degree to which these performance objectives would affect GTCC waste form and packaging would depend on the specific radionuclides present in the GTCC wastes and on the physical and chemical forms of those wastes.

For all wastes disposed of in a repository, Part 60 now requires:

(1) waste disposal operations shall be conducted in compliance with the radiation protection requirements of Part 20 of the NRC's regulations (§60.111(a)),

(2) the option of waste retrieval shall be maintained for a period up to 50 years after the start of waste emplacement operations (§60.111(b)), and

(3) "... any release of radionuclides from the engineered barrier system shall be a gradual process which results in small fractional releases to the geologic setting over long times ... The release rate of any radionuclide from the engineered barrier system following the containment period shall not exceed one part in 100,000 per year of the inventory of that radionuclide calculated to be present at 1,000 years following permanent closure ... (§60.113).

Also implicit in Part 60 is a requirement that any GTCC wastes disposed of in a repository not prevent HLW or spent fuel from meeting the specific performance objectives for those types of wastes.

These general objectives can be achieved in various ways for different wastes. For example, containment within a durable waste canister might be appropriate for short-lived wastes (half-lives about 30 years or less), while processing of wastes to reduce leachability or use of retardant backfill materials might be more appropriate for longer-lived wastes. The NRC is initiating an effort, as contemplated by §60.135(d) of Part 60, to specify in more detail the waste form

and packaging criteria appropriate for specific types of GTCC wastes. The Commission anticipates that DOE will develop specific waste form and packaging alternatives for consideration by the NRC in that rulemaking, and the Commission would welcome similar suggestions from other interested parties.

Previous development of EPA's standards has addressed types of wastes rather than types of disposal facilities as in NRC's regulations. Thus, it is possible that a repository containing both HLW and GTCC LLW would be subject to two EPA standards. The NRC does not anticipate that this will cause significant problems for DOE, since the LLW standard has not yet been proposed and this situation can be taken into account as the standard is developed.

(c) Effects on Repository Program

There were a number of comments, including those of DOE, that expressed concern over the possible impacts on the geologic repository program of emplacement of GTCC waste along with HLW in the repository. Specific concerns were over the potential for additional costs, GTCC waste taking up valuable repository space, and the burden for DOE of having to include GTCC waste in its performance assessment of the repository.

In the Commission's view, these concerns do not warrant changes from the proposed amendments. First, the proposed amendments allow for a range of GTCC disposal methods to be used by DOE. Under present regulations on land disposal of LLW (10 CFR Part 61), GTCC waste is specifically identified as "not generally acceptable" for near-surface disposal. Disposal methods for GTCC waste must generally be "more stringent" than near-surface disposal. The proposed amendments to Part 61 specified that one "more stringent" method would be geologic repository disposal. Other methods are not specified but are also left open to DOE, subject to Commission approval. The proposed amendments were not what prevented DOE from routinely using near-surface disposal; that is already prohibited by 10 CFR Part 61. Thus, relevant cost impacts of the amendments do not involve a comparison between costs of geologic repository disposal vs. costs of near-surface disposal. Cost comparisons involve geologic

repository disposal vs. other unspecified Commission-approved "intermediate" methods. However, the proposed amendments did not require one method to be selected over another; either option is permitted. DOE would presumably weigh cost comparisons along with other factors in selecting which disposal method to use.

Even if geologic repository disposal were selected, such disposal should not cause an increase in the present HLW fee charged nuclear utilities-- a specific concern raised on behalf of industry. Rather, as suggested by DOE's study of the matter pursuant to §3(b)(3) of the LLWPAA, it is likely that a separate fund, similar to the HLW Nuclear Waste Fund, would be established to provide for payment of disposal costs by the generators of GTCC wastes, either as an advance fee or as a charge upon waste receipt (Recommendations for Management of Greater-than-Class C Low Level Radioactive Waste., U.S. Department of Energy, DOE/NE-0077, 1987.) The Commission anticipates that new legislation would be enacted if required so that the current situation does not represent a major impediment to disposal of GTCC wastes.

The fact that the expected volume of GTCC waste is very low was an important factor in the Commission's decision to propose the Part 61 amendments. Current evidence shows that the expected volume of GTCC waste is very small relative to volumes of HLW and Class A, B, and C LLW. It is projected that 2,000-4,800 cubic meters of commercially-generated GTCC waste will need disposal through the year 2020[3]. This amount of waste is smaller than the anticipated excavated volume of a single emplacement room of a repository, and would not present a significant burden on the capacity of the repository to receive HLW. It would not be a significant factor underlying the need for a second repository.

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3 U.S. Department of Energy estimates

Regarding DOE's assessment of the performance of the repository, if DOE found that it did pose a major obstacle, these amendments would permit DOE to choose an acceptable alternative disposal method.

(d) Relationship to Defense Wastes

Some comments were concerned with any effects this rulemaking would have on defense wastes.

The proposed amendments apply solely to commercial GTCC LLW, and have no bearing on facilities for defense LLW. NRC has licensing authority only over commercially generated LLW; it has no licensing authority over defense LLW, including defense LLW that might be analogous to GTCC waste. And, since Part 61 by its terms would only apply to DOE activities subject to NRC jurisdiction, and such jurisdiction is lacking for defense LLW facilities, these efforts would have no effect on defense LLW disposal.

In the case of facilities authorized for the disposal of HLW, the Commission does have jurisdiction and the Commission's regulations would continue to apply. Accordingly, to the extent that DOE disposes of HLW in facilities other than geologic repositories, a license under Part 61 would be required as before. DOE would not necessarily be precluded from proceeding with such disposal, but as has always been the case DOE would need to obtain the Commission's approval. The NRC staff has been working with DOE to develop appropriate classifications for defense reprocessing wastes under existing laws and regulations. These efforts have led to agreement that certain decontaminated salts at Savannah River and West Valley, generated incidentally in the course of processing, should not be classified as HLW. Additional efforts are now underway to review materials to be produced at Hanford in projected operations, so as to determine whether the disposal thereof is subject to Commission licensing.

(e) Restricting DOE Options for GTCC Management

DOE argued that the proposed amendments would limit its statutory authority, under the LLWPAA, to develop a comprehensive policy for management of GTCC waste.

The Commission considered the proposed rule to be entirely consistent with the "comprehensive scheme for developing a policy for disposal of GTCC wastes" referred to in this comment. The proposed rule did not constrain DOE's ability to "identify disposal options, financing mechanisms, and the legislation needed to implement them." Nor did the proposed rule require disposal of GTCC wastes prior to submittal of the Department's recommendations to Congress. The proposed rule only recognized that GTCC wastes must be disposed of in a facility licensed by the NRC -- a constraint imposed by the LLWPAA.

In DOE's 1987 report to Congress regarding management of GTCC wastes (DOE/NE-0077), DOE stated that certain regulatory actions were needed before DOE could proceed with identification of disposal options and costs. One of these actions was a decision by NRC whether or not to proceed with development of a concentration based definition of high-level waste. The Commission has decided not to develop such a definition for the reasons previously discussed. Thus, one of the regulatory impediments previously identified by DOE will be removed by this rulemaking.

(f) Reference to Analyses of Kocher and Croff

In the proposed rule, the Commission cited a technical report which had recently been published (Kocher, D. C. and A. G. Croff, A Proposed Classification System for High-Level and Other Radioactive Wastes, ORNL/TM-10289, Oak Ridge National Laboratory, 1987). The Commission cited this report to support its view that evaluations of the waste isolation capabilities of "intermediate" disposal facilities would be so speculative and site-specific that such analyses would not provide a technically defensible basis for classifying wastes as HLW or non-HLW. The Commission further stated that it could not accept an alternative classification approach presented in that report because that approach was based solely on the short-term storage and

handling risks associated with the heat and external radiation levels generated by a waste rather than on the degree of waste isolation required following disposal. The authors of the cited report (Kocher and Croff) commented on the proposed rule alleging that the Commission had misrepresented the content and conclusions of their report.

As discussed in the detailed analysis of public comments, the Commission acknowledges that its statements could have been misunderstood. The Commission's purpose in referring to Kocher and Croff's report was solely to support its view that the proposal presented in the ANPRM, i.e., classification of wastes based on analyses of the projected performance of "intermediate" disposal facilities, should not be pursued because of the limited development of these facilities and because their performance is likely to be highly site-specific. The Commission continues to believe that Kocher and Croff's report supports this view. Other references to Kocher and Croff's work are withdrawn.

(g) Licensing Under Part 61

Concerning alternatives to geologic repository disposal, some comments argued that the licensing of any alternative disposal method should not necessarily be under the framework of Part 61, as was proposed in §61.55. This would be too restrictive in their view.

The Commission's regulations for licensing of radioactive waste disposal consist solely of 10 CFR Part 60, which applies to disposal in a geologic repository, and 10 CFR Part 61, which applies to land disposal other than in a geologic repository. A wide variety of disposal methods, including all of those currently proposed as "intermediate" disposal methods, could be licensed under Part 61. Thus, the Commission does not believe that §61.55 places any unnecessary restrictions on DOE.

On the contrary, as provided in §61.1, Part 61 establishes procedures, criteria, and terms and conditions with respect to "land disposal of

radioactive waste". In implementing this objective, §61.3 requires that the disposal of low-level waste at any "land disposal facility" must be authorized under Part 61. §61.7 notes that additional technical criteria might be needed for licensing of disposal facilities other than "near-surface" disposal. If needed, such criteria would be added to Part 61 before licensing an "intermediate" disposal facility. Since "land disposal facility" is defined broadly (so as to include any facility other than a geologic repository), the reference to licensing under Part 61 is proper and in conformance with the existing regulatory structure.

(h) Mixed GTCC Waste

EPA raised the possibility that some GTCC wastes would also contain hazardous materials subject to RCRA (Resource Conservation and Recovery Act) regulations. The Commission acknowleges this possibility as well as the importance of steps to insure that "mixed" GTCC wastes are managed appropriately. DOE will need to consider applicable RCRA requirements as well as those arising under the Atomic Energy Act. Should RCRA requirements associated with GTCC waste represent a significant impediment to placing a geologic repository in service, DOE will still have the option to propose the use of a separate facility.

(i) Limiting State Responsibility

A number of comments wanted the Commission to promulgate regulations making all radioactive waste which is hazardous for over 100 years a Federal responsibility. Congress clarified Federal/State responsibilities for radioactive waste in the LLWPAA. States are responsible for all commercially-generated Class A, B, and C LLW. The Federal government is responsible for the disposal of HLW and defense LLW. In view of this statutory framework, which the Commission considers to be compatible with protection of public health and safety, there would be no basis for any Commission action at this time.

Changes From the Proposed Rule

Only one change from the proposed rule has been made in these final amendments. Proposed §61.55(a)(2)(iv) required geologic repository disposal of GTCC waste "unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are submitted to the Commission for approval." A comment pointed out that the mere submittal of proposals was quite different than approval of proposals by the Commission. The Commission agrees that its intent is better expressed by requiring proposals to be approved. Accordingly, the wording in this section has been changed to read "proposals.... are approved by the Commission."

Final Rule

Following its review and analysis of the public comments, the Commission believes that the course of action it had proposed --requiring geologic repository disposal of GTCC waste, or approved alternative-- should be adopted. Therefore, these final amendments to Part 61 deviate little from those proposed. By them, the Commission is providing DOE with the regulatory framework DOE needs to proceed with plans for management of GTCC waste. The rule identifies one approved method of disposal for GTCC waste, but allows DOE to plan and develop an alternative method if DOE so desires, subject to Commission approval. It is now up to DOE to evaluate its options for GTCC waste disposal, and to proceed with GTCC disposal.

In line with the foregoing discussion, therefore, the Commission is promulgating two changes to its existing rules. First, by amending 10 CFR §61.55, it would henceforth require all greater-than-Class-C waste to be disposed of in a geologic repository unless an alternative proposal is approved by the Commission. Second, the jurisdictional reach of 10 CFR Part 61 would be extended to cover all activities of the Department of Energy that may be subject to the licensing and regulatory authority of the Commission. This is intended to reflect the policy of the Low-Level Radioactive Waste Policy Amendments Act, which provides that all commercially-generated waste with concentrations exceeding Class C limits shall be disposed of in a facility licensed by the Commission that the Commission determines is adequate to

protect the public health and safety. This change would take the form of eliminating the more restrictive language regarding the Department of Energy that appears in §61.2.

Environmental Impact

The amendments to Part 61 contained herein are corrective or of a minor nature and do not substantially modify existing regulations. Accordingly, under 10 CFR §§51.22(a) and 51.22(c)(2), they are eligible for categorical exclusion from the preparation of an environmental assessment.

The first change, pertaining to the definition of "person," is corrective in that it merely reflects the broader jurisdiction of the Commission under the Low-Level Radioactive Waste Policy Amendments Act. The modification is not substantial.

The second change, pertaining to the disposal of greater-than-Class-C radioactive wastes in a geologic repository, is minor. The existing regulations in 10 CFR Part 61 already preclude disposal of GTCC in a Part 61 licensed disposal facility without further review and approval. This amendment does no more than state the Commission's conclusion that, in the absence of such an approved alternative, a geologic repository is the only currently authorized facility acceptable for GTCC disposal without further review by the Commission. It is thus a minor change to specify that the "more stringent" methods are to include disposal in a repository, where it is also expressly provided that, as before, proposals for other methods of disposal may still be submitted to the Commission for approval. No substantial modification of existing regulations is involved.

Paperwork Reduction Act Statement

This rule does not contain a new or amended information collection requirement subject to the Paperwork Reduction Act of 1980 (44 U.S.C. 3501 et seq.). Existing requirements were approved by the Office of Management and Budget approval number 3150-0135.

Regulatory Analysis

The Commission has prepared a regulatory analysis for this final regulation. The analysis examines the costs and benefits of the alternatives considered by the Commission. The analysis is available for inspection in the NRC Public Document Room, 2120 L Street NW, Washington, DC. Single copies of the analysis may be obtained from W. Clark Prichard, Division of Engineering, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC, 20555, telephone (301) 492-3884.

Regulatory Flexibility Act Certification

In accordance with the Regulatory Flexibility Act of 1980 (5 U.S.C. 605(b)) and NRC Size Standards (December 9, 1985, 50 FR 50241), the Commission certifies that this rule will not have a significant economic impact on a substantial number of small entities. The only entity subject to regulation under this rule would be the U.S. Department of Energy, which does not fall within the scope of the definition of "small entities" set forth in the Regulatory Flexibility Act. All waste generators, some of which might be classified as small entities, must pay the costs associated with management and disposal of the wastes they generate. This rule would not affect those costs since it preserves all options currently available for waste disposal. Only DOE's selection of a specific disposal technology from the full range of alternatives available would potentially have an economic impact on small entities.

List of Subjects in 10 CFR Part 61

Low-level waste, Nuclear materials, Penalty, Radioactive waste, Reporting and recordkeeping requirements, Waste classification, Waste treatment and disposal.

Backfitting Analysis

The NRC has determined that the backfit rule, 10 CFR 50.109, does not apply to this rule, and therefore, that a backfit analysis is not required for this rule, because these amendments do not involve any provisions which would impose backfits as defined in 10 CFR 50.109(a)(1).

For the reasons set out in the preamble and under the authority of the Atomic Energy Act of 1954, as amended, and 5 U.S.C. 553, Part 61 of Title 10, Code of Federal Regulations is amended as follows:

PART 61 -- LICENSING REQUIREMENTS

FOR LAND DISPOSAL OF RADIOACTIVE WASTE

1. The authority citation for Part 61 continues to read as follows: Secs. 53, 57, 62, 63, 65, 81, 161, 182, 183, 68 Stat. 930, 932, 933, 935, 948, 953, 954, as amended (42 U.S.C. 2073, 2077, 2092, 2093, 2095, 2111, 2201, 2232, 2233); secs. 202, 206, 88 Stat. 1244, 1246, (42 U.S.C. 5842, 5846); secs. 10 and 14, Pub.L. 95-601, 92 Stat. 2951 (42 U.S.C. 2021a and 5851).

For the purposes of Sec. 223, 68 Stat. 958, as amended, (42 U.S.C. 2273): Tables 1 and 2, §§61.3, 61.24, 61.25, 61.27(a) 61.41 through 61.43, 61.52, 61.53, 61.55, 61.56, and 61.61 through 61.63 issued under Sec. 161b, 68 Stat. 948 as amended (42 U.S.C. 2201(b)); §§61.10 through 61.16, 61.24, and 61.80 issued under Sec. 161o, 68 Stat. 950, as amended (42 U.S.C. 2201(o)).

2. In §61.2, the definition of "person" is revised in the alphabetical sequence to read as follows:

§ 61.2 Definitions.

As used in this part:

* * * * *

"Person" means (1) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, government agency other than the Commission or the Department of Energy (except that the Department of Energy is considered a person within the meaning of the regulations in this part to the extent that its facilities and activities are subject to the licensing and related regulatory authority of the Commission pursuant to law), any State or any political subdivision of or any political entity within a State, any foreign government or nation or any political

subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent, or agency of the foregoing.

* * * * *

3. In §61.55, paragraph (a) is amended by revising paragraph (a)(2)(iv) to read as follows:

§ 61.55 Waste classification.

(a) * * *

(2) * * *

(iv) Waste that is not generally acceptable for near-surface disposal is waste for which waste form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository as defined in Part 60 of this chapter unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are approved by the Commission.

* * * * *

Dated at Rockville, Md. this _____ day of _____, 1989.

For the Nuclear Regulatory Commission.

_____

Samuel J. Chilk,

Secretary of the Commission.

ENCLOSURE B

Proposed Rules

Federal Register
Vol. 53, No. 95
Wednesday, May 18, 1988

This section of the FEDERAL REGISTER contains notices to the public of the proposed issuance of rules and regulations. The purpose of these notices is to give interested persons an opportunity to participate in the rule making prior to the adoption of the final rules.

NUCLEAR REGULATORY COMMISSION

10 CFR Part 61

Disposal of Radioactive Wastes

AGENCY: Nuclear Regulatory Commission.

ACTION: Proposed rule.

SUMMARY: The NRC is publishing proposed amendments which require disposal of "greater-than-Class-C" low-level radioactive wastes in a deep geologic repository unless disposal elsewhere has been approved by the Commission. The proposed amendments obviate the need for altering existing classifications of radioactive wastes as high-level or low-level.

DATE: Comment period expires July 18, 1988. Comments received after this date will be considered if it is practical to do so, but the Commission is able to assure consideration only for comments received on or before this date.

ADDRESS: Mail written comments to: Secretary, U.S. Nuclear Regulatory Commission, Washington, DC 20555, Attention: Docketing and Service Branch. Deliver comments to: 1 White Flint North, 11555 Rockville Pike, Rockville, Md. between 7:30 a.m. and 4:15 p.m. Federal workdays, or to the NRC Public Document Room at the address and times below. Copies of the regulatory analysis and comments received may be examined at the NRC Public Document Room, 1717 H Street NW., Washington, DC, between 7:30 a.m. and 4:15 p.m.

FOR FURTHER INFORMATION CONTACT: W. Clark Prichard, Division of Engineering, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC 20555, telephone (301) 492-3884.

SUPPLEMENTARY INFORMATION:

Background

On February 27, 1987, the Nuclear Regulatory Commission published an Advance Notice of Proposed Rulemaking (ANPRM) (51FR 5992) announcing its intent to revise the definition of the term "high-level radioactive waste" (HLW) that appears in 10 CFR Part 60. In the ANPRM, the Commission reviewed the previous statutory and regulatory uses of the term "high-level radioactive waste," the NRC's current regulations related to waste classification and disposal, and the pertinent provisions of the Nuclear Waste Policy Act of 1982, Pub. L. 97-425, 42 U.S.C. 10101 et seq. (NWPA). As indicated in the ANPRM, the NWPA includes a specific definition of "high-level radioactive waste" and the Commission was considering a change to its own rules to conform to that definition.

In the ANPRM, the Commission proposed to define HLW in a manner that in general would apply the term "high-level radioactive waste" to materials in amounts and concentrations exceeding numerical values that would be stated explicitly in the form of a table. Thus, HLW would be characterized by the kind of hazard that could only be guarded against by disposal in a geologic repository or equivalent facility. Those wastes that could be disposed of safely in an "intermediate" disposal facility would continue to be classified as low-level radioactive waste rather than as HLW.

Comments

The Commission solicited comments on several specified issues and received letters from nearly 100 public agencies, private organizations, and individuals. Virtually all comments on the ANPRM agreed with the Commission on one point: use of the term "high-level radioactive waste," at least under Clause (B) of the NWPA definition, serves to identify those wastes which require the degree of isolation afforded by a deep geologic repository. However, comments differed widely regarding the specific wastes perceived to require that degree of isolation. Some comments advocated classification of all radioactive wastes, other than the most innocuous, as HLW while other comments would prefer to reclassify as low-level large quantities of defense reprocessing wastes long regarded as HLW. Conspicuously absent from the comments was any consensus regarding the means to be used by the Commission to distinguish HLW from non-HLW. For example, even the basic concept of a numerical definition of HLW, as suggested in the ANPRM, was criticized as an invitation to dilute or fractionate wastes solely to alter their classification. In light of the comments received, the Commission's own review of available technical information related to waste classification and "intermediate" disposal facilities, and review of relevant statutory purposes, the Commission has determined that it would be best to proceed quite differently from its original suggestion put forth in the ANPRM.

Reprocessing Wastes

The NWPA first labels as HLW, under Clause (A), the "highly radioactive material" resulting from the reprocessing of spent fuel, including not only the liquid wastes but also any solid material derived from such liquid waste that contains fission products "in sufficient concentrations." Clause (A) wastes have little significance for purposes of NWPA, since the Federal Government was already responsible for the disposal of all reprocessing wastes at the time the statute was passed. (The only commercially-generated reprocessing wastes were made a Federal Government responsibility in 1980 pursuant to the West Valley Demonstration Project Act, Pub. L. 96-368, 42 U.S.C. 2021a note.) In light of this fact, the Commission believes that the preferable construction of the statue is to conform to the traditional definition. Under this approach, materials that are HLW for purposes of the licensing-jurisdiction provisions of the Energy Reorganization Act of 1974 (ERA) will also be regarded as HLW under NWPA. This would include the primary reprocessing waste streams at DOE facilities, though not the incidental wastes produced in reprocessing.

Other Wastes

In the ANPRM the Commission proposed to classify wastes as HLW or non-HLW by examining the disposal capability of hypothetical, "intermediate" disposal facilities less secure than a deep geologic repository. Wastes which could not be safely disposed of in such facilities would be classified as HLW.

Following publication of the ANPRM, a technical report (Kocher, D. C. and A. G. Croff, *A Proposed Classification System for High-Level and Other Radioactive Wastes*, ORNL/TM-10288, Oak Ridge National Laboratory, 1987) was published which attempted to provide a technical basis for classification of wastes as HLW or non-HLW. This report described a number of conceptual "intermediate" disposal facilities which would use either engineered barriers or deeper burial to provide a degree of waste isolation intermediate between that of shallow land burial and a deep geologic repository. The authors attempted an analysis of the waste isolation capability of such facilities but, emphasizing the site-specific nature of such analyses and the very large uncertainties involved, concluded that "[a]t the present time . . . [such facilities are] not sufficiently developed to provide a basis for defining waste classes, and disposal of any wastes using [such facilities] must be considered on a case-by-case basis." Kocher and Croff then presented an alternative approach for defining HLW which, in essence, is based solely on the short-term storage and handling risks associated with the heat and external radiation levels generated by a waste. The Commission could not accept this alternative approach since it bears no correlation to the degree of waste isolation required following disposal.

The Commission's review of Kocher and Croff's study leads it to the same conclusion regarding the impracticability of waste classification based on analyses of the performance of intermediate disposal facilities. If waste classification is to be at all realistic, additional disposal facility development must be completed which will provide a supportable basis for such classification. Such disposal facility development is more properly the responsibility of DOE rather than NRC. However, the very small volume (about 2,000 m^3 through the year 2020) of commercially-generated, greater-than-Class-C (GTCC) wastes may make an intermediate disposal facility economically unattractive. Because no such facility now exists for disposal of commercially-generated wastes, and because there is no assurane that one will ever be constructed, the Commission believes that an alernative, technically conservative approach should be taken.

The Commission proposes to require disposal of all GTCC wastes in a deep geologic repository unless disposal elsewhere has been explicitly approved by the Commission. This proposal reflects the Commission's view that intermediate disposal facilities may never be available, in which case a repository would be the only type of facility generally capable of providing safe disposal for GTCC wastes. At the same time, the Commission wishes to avoid foreclosing possible use of intermediate disposal facilities by the Department of Energy (DOE). If DOE chooses to develop one or more intermediate disposal facilities, the Commission anticiptes that the acceptability of such facilities would be evaluated in the light of the particular circumstances, considering for example the existing performance objectives of 10 CFR Part 61 and any generally applicable environment radiation protection standards that might have been established by the U.S. Environmental Protection Agency. Technical criteria to implement the performance objectives and environmental standards would be developed by the Commission after DOE had completed its conceptual design and selected a site for a specific type of facility.

The Commission considers that the proposal presented in the notice would obviate any need to reclassify certain GTCC wastes as HLW. The proposal follows the alternative approach alluded to in the ANPRM, that the Commission "need not exercise NWPA Clause (B) authority in order to assure that radioacative wastes from licensed activities are disposed of properly" (52 FR 5998). Many comments on the ANPRM adocated classification of all GTCC wastes as HLW in order to ensure availability of a safe disposal "home" for those wastes, but this proposal achieves the same purpose while leaving open the prospect that an intermediate disposal facility may prove attractive at some time in the future. (Since the possibility of using such a facility is left open, the Commission is not now determining that the wastes, even if highly radioactive, do in fact "require permanent isolation"; accordingly, the NWPA definition of HLW does not apply). Moreover, this proposal avoids the problem of trying to distinguish HLW from non-HLW without an adequate technical basis for doing so. And the legal and administrative complications identified in the ANPRM, as well as questions as to the retroactive application of any new classification, would be avoided or reduced. However, additional legislation may be needed by DOE to provide for payment of disposal costs for above Class C wastes, or to authorize receipt of such wastes for disposal at a repository.

The Commission also observes that the satutory framework for nuclear waste matters has changed greatly since enactment of NWPA. When that law was passed, it placed a responsibility on the Federal government to receive, manage and disposal of certain wastes (HLW as well as spent nuclear fuel) in geologic repositories. In that context, the definition of the term "high-level radioactive waste" assumed importance because it provided a basis for differentiating between State and Federal responsibilities. This concern was subsequently mooted by adoption of the Low-Level Radioactive Waste Policy Amendments Act of 1985, Pub. L. 99-240, 42 U.S.C. 2021b et seq. This later statute established a Federal Government responsibility for the disposal of commercially generated wastes with radionuclide concentrations exceeding the limits established in 10 CFR Part 61 for Class C radioactive waste. In view of this development, the Commission perceives little practical importance or significance in proceeding with a precise definition of HLW. To do so would not advance the objectives of NWPA.

Proposed Amendments

In line with the foregoing discussion, therefore, the Commission is proposing two changes to its existing rules. First, by amending 10 CFR 61.55, it would henceforth require all greater-than-Class-C waste to be disposed of in a geologic repository unless an alternative proposal is approved by the Commission. Second, the jurisdictional reach of 10 CFR Part 61 would be extended to cover all activities of the Department of Energy that may be subject to the licensing and regulatory authority of the Commission. This is intended to reflect the policy of the Low-Level Radioactive Waste Policy Amendments Act, which provides that all commercially-generated waste with concentrations exceeding Class C limits shall be disposed of in a facility licensed by the Commission that the Commission determines is adequate to protect the public health and safety. This change would take the form of eliminating the more restrictive language regarding the Deparatment of Energy that appears in the definition of the term "Person" in § 61.2.

Environmental Impact: Categorical Exclusion

The NRC has determined that this proposed regulation is the type of action described in categorical exclusion 10 CFR 51.22(c)(2). Therefore neither an enviornmental impact statement nor an

environmental assessment has been prepared for this proposed regulation.

The first change, pertaining to the definition of "person," is corrective in that it merely reflects the broader jurisdiction of the Commission under the Low-Level Radioactive Waste Policy Amendments Act. The modification is not substantial.

The second change, pertaining to the disposal of greater-than-Class-C radioactive wastes in a geological repository, is minor. The existing regulations in 10 CFR Part 61 already preclude disposal of GTCC in a Part 61 licensed disposal facility without further review and approval. This amendment does no more than state the Commission's conclusion that, in the absence of such an approved alternative, a geologic repository is the only currently authorized facility acceptable for GTCC disposal without further review by the Commission. Thus, it is a minor change to specify that the "more stringent" methods are to include disposal in a repository, where it is also expressly provided that, as before, proposals for other methods of disposal may still be submitted to the Commission for approval. No substantial modification of existing regulations is involved.

Paperwork Reduction Act Statement

This proposed rule does not contain a new or amended information collection requirement subject to the Paperwork Reduction Act of 1980 (44 U.S.C. 3501 et seq.). Existing requirements were approved by the Office of Management and Budget approval number 3150-0135.

Regulatory Analysis

The Commission has prepared a draft regulatory analysis for this proposed regulation. The analysis examines the costs and benefits of the alternatives considered by the Commission. The draft analysis is available for inspection in the NRC Document Room, 1717 H street NW., Washington DC. Single copies of the draft analysis may be obtained from W. Clark Prichard, Division of Engineering, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC 20555, telephone (301) 492-3884.

The Commission requests public comment on the draft regulatory analysis. Comments on the draft analysis may be submitted to the NRC as indicated under the ADDRESSES heading.

Regulatory Flexibility Act Certification

In accordance with the Regulatory Flexibility Act of 1980 (5 U.S.C. 605(b)) and NRC Size Standards (December 9, 1985, 50 FR 50241), the Commission certifies that this proposed rule will not have a significant economic impact on a substantial number of small entities. The only entity subject to regulation under this proposed rule would be the U.S. Department of Energy, which does not fall within the scope of the definition of small entities" set forth in the Regulatory Flexibility Act. All waste generators, some of which might be classified as small entities, must pay the costs associated with management and disposal of the wastes they generate. This proposed rule would not affect those costs since it preserves all options currently available for waste disposal. Only DOE's selection of a specific disposal technology from the full range of alternatives available would potentially have an economic impact on small entities.

Backfitting Analysis

The NRC has determined that the backfit rule, 10 CFR 50.109, does not apply to this proposed rule, and therefore, that a backfit analysis is not required for this proposed rule, because these amendments do not invovle any provisions which would impose backfits as defined in 10 CFR 50.109(a)(1).

List of Subjects in 10 CFR Part 61

Low-level waste, Nuclear materials, Penalty, Radioactive, waste, Reporting and recordkeeping requirements, Waste classification, Waste treatment and disposal.

For the reasons set out in the preamble and under the authority of the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, and 5 U.S.C. 553, the NRC is proposing to adopt the following amendments to 10 CFR Part 61.

PART 61—LICENSING REQUIREMENTS FOR LAND DISPOSAL OF RADIOACTIVE WASTE

1. The authority citation for Part 61 continues to read as follows:

Authority: Secs. 53, 57, 62, 63, 65, 81, 161, 182, 183, 68 Stat. 930, 932, 933, 935, 948, 953, 954, as amended (42 U.S.C. 2073, 2077, 2092, 2093, 2095, 2111, 2201, 2232, 2233); secs. 202, 206, 88 Stat. 1244, 1246 (42 U.S.C. 5842, 5846); secs. 10 and 14, Pub. L. 95-601, 92 Stat. 2951 (42 U.S.C. 2021a and 5851).

For the purposes of Sec. 223, 68 Stat. 958, as amended (42 U.S.C. 2273); Tables 1 and 2, §§ 61.5, 61.24, 61.25, 61.27(a), 61.41 through 61.43, 61.52, 61.53, 61.55, 61.56, and 61.61 through 61.63 are issued under Sec. 161b, 68 Stat. 948 as amended (42 U.S.C. 2201(b)); §§ 61.10 through 61.20, 61.24, and 61.80 are issued under Sec. 161o, 68 Stat. 950, as amended (42 U.S.C. 2201(o)).

2. In § 61.2, the definition of "person" is revised in the alphabetical sequence to read as follows:

§ 61.2 Definitions.

As used in this part:

* * * * *

"Person" means (1) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, government agency other than the Commission or the Department of Energy (except that the Department of Energy is considered a person within the meaning of the regulations in this part to the extent that its facilities and activities are subject to the licensing and related regulatory authority of the Commission pursuant to law), any State or any political subdivision of or any political entity within a State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent, or agency of the foregoing.

* * * * *

3. In § 61.55, paragraph (a) is amended by revising paragraph (a)(2)(iv) to read as follows:

§ 61.55 Waste classification.

(a) * * *

(2) * * *

(iv) Waste that is not generally acceptable for near-surface disposal is waste for which waste form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository as defined in Part 60 of this chapter unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are submitted to the Commission for approval.

* * * * *

Dated at Rockville, MD, this 12th day of May, 1988.

For the Nuclear Regulatory Commission.

Samuel J. Chilk,

Secretary of the Commission.

[FR Doc. 88-11130 Filed 5-16-88; 8:45 am]

BILLING CODE 7590-01-M

DRAFT CONGRESSIONAL LETTER

Dear Mr. Chairman:

Enclosed for your information is a copy of a notice of final rulemaking to be published in the Federal Register.

This action would require geologic repository disposal of greater-than-Class-C low level radioactive waste, unless an alternative method of disposal were approved by the Commission. It would give DOE the regulatory framework it needs to proceed with management of greater-than-Class-C waste. The Commission gave careful consideration to public comments on the notice of proposed rulemaking, published on May 18, 1988 (53 FR 17709), in preparing this final rulemaking.

Sincerely,

Eric S. Beckjord, Director

Office of Nuclear Regulatory Research

COMPARATIVE TEXT

Changes From the Proposed Rule

61.55 Waste classification

(a) * * *

(2) * * *

(iv) waste that is not generally acceptable for near-surface disposal is waste for which waste form and disposal methods must be different, and in general more stringent, than those specified for Class c waste. In the absence of specific requirements in this Part, such waste must be disposed of in a geologic repository as defined in Part 60 of this chapter unless proposals for disposal of such waste in a disposal site licensed pursuant to this Part ~~are submitted to the Commission for approval~~ are approved by the Commission.

ENCLOSURE C

DRAFT CONGRESSIONAL LETTER

Dear Mr. Chairman:

Enclosed for your information is a copy of a notice of final rulemaking to be published in the Federal Register.

This action would require geologic repository disposal of greater-than-Class-C low level radioactive waste, unless an alternative method of disposal were approved by the Commission. It would give DOE the regulatory framework it needs to proceed with management of greater-than-Class-C waste. The Commission gave careful consideration to public comments on the notice of proposed rulemaking, published on May 18, 1988 (53 FR 17709), in preparing this final rulemaking.

Sincerely,

Eric S. Beckjord, Director
Office of Nuclear Regulatory Research

ENCLOSURE D

DRAFT

NRC CHANGES REGULATIONS ON DISPOSAL OF RADIOACTIVE WASTE

The Nuclear Regulatory Commission is amending its regulations to provide for additional types of radioactive waste to be disposed of in a high-level waste repository.

The amendments state that wastes "greater than Class C," as defined in the Commission's current regulations, must be disposed of in a deep, excavated repository to be built by the Department of Energy, unless disposal elsewhere has been approved by the Commission.

Generally speaking, greater-than-Class-C waste is radioactive waste that is less toxic than high-level waste, but more toxic than ordinary low-level waste.

More specifically, radioactive waste is greater than Class C if it contains more than 8 curies per cubic meter of Carbon-14; 80 curies per cubic meter of Carbon-14 in activated metal; 220 curies per cubic meter of Nickel-59 in activated metal; 0.2 curies per cubic meter of Niobium-94 in activated metal; 3 curies per cubic meter of Technetium-99; 0.08 curies per cubic meter of Iodine-129; 100 nanocuries per gram of alpha-emitting transuranics with a half-life greater than five years; 3,500 nanocuries per gram of Plutonium-241; or 20,000 nanocuries per gram of Curium-242.

Waste is also greater than Class C if it contains more than 700 curies per cubic meter of Nickel-63; 7000 curies per cubic meter of Nickel-63 in activated metal; 7000 curies per cubic meter of Strontium-90; or 4600 curies per cubic meter of Cesium-137.

If waste contains a mixture of these radioactive materials, the determination as to whether it is greater than Class C is made by use of a formula, as described in Part 61 of the Commission's regulations.

Most of the greater-than-Class-C wastes are expected to come from the decommissioning of nuclear power plants. Examples are certain instruments, metal components and reactor internals such as control rods.

The Low-Level Radioactive Waste Policy Amendments Act of 1985 gave the federal government responsibility for disposal of greater-than-Class-C radioactive waste. Commercially generated wastes that are Class C or lower, which are not a Federal responsibility, may be disposed of in commercially operated low-level waste facilities.

If DOE decides in the future to build an intermediate disposal facility for greater-than-Class-C wastes, the Commission would evaluate its acceptability at that time. However, the very small volume (about 2,000 cubic meters through the year 2020) of commercially generated, greater-than-Class-C wastes may make an intermediate disposal facility unattractive. Providing that these wastes be disposed of in a high-level waste repository ensures that they will have a safe disposal "home," while leaving open the prospect than an intermediate disposal facility may prove attractive at some time in the future.

A proposed rule on this subject was published in the Federal Register on May 18, 1988. As a result of the comments received, the wording of the regulation has been changed to clarify the Commission's intent that proposals for alternative disposal methods be "approved" by the Commission, rather than just "submitted to the Commission for approval."

The amendments will be effective on _____ (_____ days after publication in the Federal Register on _____.

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ENCLOSURE E

REGULATORY IMPACT ANALYSIS

I. BACKGROUND

On May 18, 1988, the Nuclear Regulatory Commission published a notice of proposed rulemaking which would require the disposal of Greater-than-Class C (GTCC) low-level radioactive waste (LLW) in a deep geologic repository, unless an alternative disposal method was approved by the Commission (53 FR 17709). This proposed rulemaking was an outgrowth of a review by NRC of the need to revise the definition of high-level radioactive waste (HLW) in 10 CFR Part 60. This review examined the implications for the radioactive waste management system of such revision. The issues involved were discussed by the Commission in a February 27, 1987 advance notice of proposed rulemaking (51 FR 5992). The Commission received a large number of comments on the advance notice and these comments, along with other information, led the Commission to set aside any revision of the definition of HLW. A detailed analysis of the comments is available in the Commission's Public Document Room. However, to address a gap in the regulatory framework for waste disposal which concerned disposal alternatives for GTCC LLW, the Commission proposed the amendments to 10 CFR Part 61 which would require geologic repository, or approved alternative, disposal of GTCC waste. The need to reduce uncertainty about the licensing of disposal methods for radioactive waste was an important issue brought out by the public comments on the advance notice.

This was particularly true for GTCC LLW. This category of wastes is LLW which contains concentrations of radionuclides which exceed the upper limits of Class C LLW. Part 61 classifies LLW into three categories, Class A, B, and C -- with C being the most hazardous. The significance of GTCC LLW is that Part 61 makes waste exceeding the upper limits of Class C generally not eligible for near surface disposal. According to DOE, approximately 2,000-4,800 cubic meters of commercial GTCC will need disposal through the year, 2020. At present, there is no alternative disposal facility available for disposal of GTCC waste. Uncertainty about licensing the disposal of GTCC was therefore a major issue.

The Low Level Radioactive Waste Policy Amendments Act of 1985 (LLWPAA) clarified Federal/State responsibility for waste disposal. States are only responsible for Classes A, B, and C LLW. The Federal government is responsible for GTCC waste. The Federal government is also responsible for HLW. The LLWPAA contained a provision which directed DOE to prepare a report for Congress on management of GTCC waste. This report, entitled Recommendations for Management of Greater-than-Class C Low Level Radioactive Waste, DOE/NE-0077, 1987, cited lack of NRC regulatory guidance on GTCC waste as a major impediment to DOE planning for GTCC disposal. It called for prompt NRC action to remedy this situation.

Following publication of the proposed amendments, the Congressional Office of Technology Assessment published a report on management of GTCC LLW ("An Evaluation of Options for Managing Greater than Class C Low Level Radioactive Waste", US Congress, Office of Technology assessment, OTA-BP-O-50, 1988). Its recommendations on disposal of GTCC waste generally support the stance taken by the Commission in the proposed amendments.

The report estimates that deep geologic repository disposal of GTCC waste would cost $90 per cubic ft. vs. $140 per cubic ft. for a separate near surface GTCC facility. Based on 2,000 cubic meters of GTCC waste, this would indicate total costs of $6.36 million for repository disposal vs. $9.89 million for an alternative facility.

The OTA report states that "If a decision about the disposal of GTCC wastes were required today, a conservative approach would be to permanently isolate the waste in a deep geologic repository, as has been proposed for commercial spent fuel and defense HLW." The report goes on to acknowledge that further research and development could demonstrate the acceptability of intermediate disposal methods, such as deep-augured holes or an intermediate-depth repository. The OTA report agrees with the Commission that the volume of GTCC waste is probably not great enough to justify a separate facility for this waste; costs of geologic repository disposal of GTCC waste would be comparable to, or lower than, developing a special disposal facility solely for GTCC waste.

The overall recommendations of the OTA report are that a Federal off-site interim storage facility for GTCC waste be established, as no permanent disposal facility could be available for at least 15 to 20 years. Until such interim storage facilities become operational, the Federal government could provide limited access to an existing DOE storage facility. Within the next year or so, DOE should begin to evaluate the impact on repository operations and performance of emplacing GTCC waste in the repository. If DOE determines that such impacts are unacceptable, it could then begin to develop an alternative disposal facility.

Mention should be made here of the statutory regulatory authority of NRC over DOE waste disposal. The Energy Reorganization Act of 1974 established NRC licensing authority over facilities for disposal of HLW; and under the LLWPAA commercially generated LLW must be disposed of in an NRC licensed facility. Defense LLW may be disposed of by DOE without NRC licensing. There may be some defense waste materials managed by DOE analogous to commercial GTCC waste. The disposal of these materials would not be subject to Commission licensing.

II. OBJECTIVE

Establish a regulatory framework for disposal of GTCC waste. Ensure that regulations exist for disposal of GTCC waste which will protect public health and safety. Insofar as consistent with protection of health and safety, reduce uncertainty regarding licensing of disposal of GTCC waste.

What is not affected by this rulemaking and not an objective, is State reponsibility for radioactive waste disposal. This is set forth in the LLWPAA. NRC licensing authority, established by the Energy Reorganization Act, is also unchanged.

III. ALTERNATIVES

1. [Selected] Require Disposal of all GTCC waste in a Geologic Repository or Approved Alternative.

   The selected alternative keeps GTCC LLW classified as LLW. No change is made in the definitions of HLW or LLW. However, geologic repository disposal of GTCC waste is required, unless an alternative disposal method has been approved by the Commission. This action is but a minor change to the status quo. Currently, Part 61 prohibits the routine disposal of GTCC waste by near surface disposal. Part 61 specifies that disposal methods for GTCC must be "more stringent", but does not identify acceptable disposal methods. These amendments to Part 61 would identify one acceptable method, geologic repository disposal, but would also permit Commission-approved alternatives. The amendments thus provide the needed regulatory framework for GTCC disposal by; (a) continuing to classify GTCC as LLW, and (b) reducing uncertainty about licensing of GTCC disposal. It would also provide DOE with a wide range of flexibility in managing GTCC. DOE may choose geologic repository disposal, or it may choose some alternative intermediate type of disposal, so long as it meets Commission approval. DOE can weigh the costs and benefits of the two approaches, and make its decision.

2. Proceed with a Numerical Reclassification of HLW along the lines suggested in the Advance Notice

In the advance notice, the Commission suggested the following steps to establish a waste classification system. Waste would be classified as HLW if it was both highly radioactive and required permanent isolation. "Highly radioactive" waste would be defined as any waste with radionuclide concentrations above those listed for Class C waste in Table 2 of 10 CFR Part 61. To determine which of this highly radioactive waste required permanent isolation, the Commission would carry out technical studies on waste types and a variety of different waste disposal technologies. These studies would make use of performance assessment models of each type of reference case disposal facility. Waste classifications would be established by determination, through modeling, of what types of waste could be safely isolated in each type of facility. For example, a certain type of waste might be found to exceed release limits in all types of disposal facilities except a geologic repository. This type of waste would require the "permanent isolation" afforded by a geologic repository, and be defined as HLW.

The case against this alternative was made in detail in the supplementary information to the proposed Part 61 amendments. Briefly, there is no consensus underlying any specific method to classify radioactive waste by concentration. To develop such a method would be costly, time-consuming, and controversial. The technical studies referred to above would be quite expensive to carry out and, since "intermediate" disposal facilities are not available to serve as the basis for classification analyses, hypothetical facilities would have to be postulated based on somewhat arbitrary assumptions.

More importantly, as discussed in the advance notice and in the proposed amendments, reprocessing waste now classified as HLW, such as some Hanford tanks waste, does not appear to be a good candidate for reclassification for several reasons:

(a) Even if radionuclide concentrations of some wastes are not high, total radionuclide inventory in these wastes is very large, making them unsuitable for disposal in shallow land burial facilities.

(b) The historic legislative and administrative treatment of reprocessing wastes has been as HLW. The Energy Reorganization Act of 1974 recognizes this waste as HLW, and extends NRC licensing authority over it. Therefore, reclassification of some reprocessing waste to the LLW category under Nuclear Waste Policy Act (NWPA) authority, would not exempt it from Commission licensing authority. Disposal of this reprocessing waste would remain under Commission licensing authority.

The NRC staff is working with DOE to develop appropriate classification for defense reprocessing wastes under existing laws and regulations. These efforts have led to agreement that certain decontaminated salts at Savannah River and West Valley, generated incidentally in the course of processing, should not be classified as HLW. Additional efforts are now underway to review materials to be produced at Hanford in projected operations, so as to determine whether the disposal thereof is subject to Commission licensing.

For non-reprocessing waste not now classified as A, B, or C LLW (essentially GTCC LLW), only a small amount is generated. DOE estimates that approximately 2,000 cubic meters will need disposal through 2020 (DOE/NE-0077, 1987). A more recent DOE estimate, cited by the Congressional Office of Technology Assessment (OTA-BP-O-50, 1988), suggests that the GTCC volume may be twice this large. This relatively small amount of waste suitable for reclassification does not justify a major technical effort to establish a numerical classification system. The only benefit of such a classification system would be to ensure a disposal "home" for those GTCC wastes requiring disposal in a repository. However, the remainder would still not be routinely eligible for near surface disposal, and would not be a State responsibility. The problem would still exist as to where to dispose of this GTCC waste. The Commission can accomplish much more by simply requiring repository

disposal of all GTCC wastes, unless DOE has developed an approved "intermediate" disposal facility.

3. Classify All GTCC Waste as HLW

This option would redefine GTCC LLW as HLW. Numerous public comments on the ANPRM published by the Commission in 1987 advocated that all waste with concentration limits above the upper limits of Class C should be classified as HLW. Under this alternative only non-reprocessing waste material with concentrations lower than the upper limits of Class C would be LLW. As the NWPA contemplates only geologic repository disposal for material classified thereunder as HLW, this redefinition would result in GTCC waste going to the repository.

The disadvantages of this option, compared to the selected one, is the limitation it places on DOE's flexibility to dispose of GTCC. It would disallow the option, held open by the selected alternative, of permitting DOE to select Commission-approved alternatives to geologic repository disposal.

Should future developments result in the availability of more cost-effective intermediate methods, DOE would be prevented from taking advantage of them. This could result in excessive costs for the waste management system and waste generators.

IV. IMPACTS OF THE PROPOSED ALTERNATIVE

As DOE is responsible for disposal of GTCC waste, direct impacts would fall on it. The impacts of the proposed rulemaking should not be major, as it does not change the status quo. DOE may select either geologic repository disposal for GTCC waste, or another alternative, so long as it is approved by the Commission. GTCC waste is not now generally eligible for near surface disposal by the provisions of 10 CFR Part 61. These amendments to Part 61 are not what prevents DOE from routinely using near surface disposal-- it is already prohibited by existing regulation. Cost impacts do not involve a com-

parison of shallow land burial with either geologic repository, or intermediate disposal techniques.

The fact that geologic repository disposal was suggested in the supplementary information to the proposed amendments causes no impact. Cost comparisons already presented in this regulatory analysis indicate that geologic repository disposal would be as cost-effective as an intermediate disposal method which would require DOE to develop a new disposal site solely for GTCC waste.

There would be no adverse radiological impacts from this alternative. No performance requirement for any type of disposal facility is being changed. On the contrary, as this rulemaking reduces uncertainty as to the regulatory framework for disposal of GTCC waste, it allows the development of plans for disposal to proceed at a more rapid pace. It should result in more timely disposal of GTCC waste, rather than an indefinite period of interim storage.

GTCC waste is relatively small by volume. It could be disposed of in a geologic repository with little impact on the capacity of the repository to receive spent fuel and HLW. There should be no significant costs imposed upon generators of spent fuel and HLW from adding GTCC to the repository. Moreover, the rule imposes no requirement for geologic repository disposal. DOE should be able to establish a method for recovering costs of GTCC disposal from generators. The LLWPAA directs DOE to identify such a method, even if this would require legislative changes.

There would be no impacts on States or State LLW Compacts. This rulemaking has no effect on Federal/State responsibilities for radioactive waste disposal. States already are not responsible for GTCC waste disposal by the provisions of the LLWPAA.

For NRC, there would be no adverse impacts on costs/resource needs for licensing. It is quite possible that the licensing of GTCC disposal by means of the geologic repository would be less of a burdensome licensing responsibility than that of licensing a separate GTCC-only facility. However, NRC must license whatever disposal method is selected by DOE.

ENCLOSURE F

COMPARATIVE TEXT

Changes From the Proposed Rule

61.55 Waste classification

(a) * * *

(2) * * *

(iv) waste that is not generally acceptable for near-surface disposal is waste for which waste form and disposal methods must be different, and in general more stringent, than those specified for Class c waste. In the absence of specific requirements in this Part, such waste must be disposed of in a geologic repository as defined in Part 60 of this chapter unless proposals for disposal of such waste in a disposal site licensed pursuant to this Part ~~are submitted to the Commission for approval~~ are approved by the Commission.

ENCLOSURE G

PART 61 AMENDMENTS

ANALYSIS OF PUBLIC COMMENTS

DRAFT

IMPACTS ON COMMERCIAL LLW FACILITIES

A comment wanted NRC to assess any impacts that the proposed rule would have on commercial low-level waste (LLW) facilities.

Response:

The proposed Part 61 amendments would have no adverse effect on commercial LLW facilities since the amendments deal only with Greater-than-Class C (GTCC) waste. The Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLWPAA) clearly identifies disposal of GTCC waste as a Federal, not State responsibility. States which operate LLW disposal facilities, either solely or as part of a State compact, are not required to accept GTCC waste for disposal. The proposed amendments were developed in recognition of this reality.

Some States commented that the proposed amendments would have a beneficial effect on State efforts to manage LLW by reducing uncertainty about disposal of GTCC waste.

IMPACTS ON UTILITIES AND RATEPAYERS

A comment wanted NRC to assess any impacts on utilities and ratepayers.

Response:

The Commission believes that impacts on utilities and ratepayers would be negligible. Firstly, the proposed amendments allow for a range of GTCC disposal methods to be used by DOE. Under present regulations on land disposal of LLW (10 CFR Part 61), GTCC waste is specifically identified as "not generally acceptable" for near-surface disposal. Disposal methods for GTCC waste must generally be "more stringent" than near-surface disposal. The amendments to Part 61 proposed here specify that one "more stringent" method would be geologic repository disposal. Other methods are not specified but are also left open to DOE, subject to Commission approval. The present amendments are not what prevents DOE from routinely using near-surface disposal; that is already prohibited by 10 CFR Part 61 without a special technical analysis. Thus, relevant cost impacts of the amendments do not involve a comparison between costs of geologic repository disposal vs. costs of shallow land burial. Cost comparisons involve geologic repository disposal vs. other unspecified Commission-approved "intermediate" methods. However, the present amendments do not require one method to be selected over another; either option is permitted. DOE will presumably weigh cost comparisons along with other factors in selecting which disposal method to use. Even if geologic repository disposal is selected, it is not likely that the disposal of GTCC waste in the repository would cause an increase in the present HLW fee charged nuclear utilities. Rather, as suggested by DOE's study of the matter pursuant to §3(b)(3) of the LWPAA, it is likely that a separate fund, similar to the HLW Nuclear Waste Fund, would be established to provide for payment of disposal costs by the generators of GTCC wastes.

Finally, the Commission notes that a recent study by the Congressional Office of Technology Assessment[1] suggests that disposal of GTCC waste in a HLW repository may be less expensive than developing an alternative, intermediate type of disposal facility. In any case, the amendments proposed by the Commission allow DOE to select any disposal option that is safe, so no adverse cost impacts will result from these amendments.

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1 U.S. Congress, Office of Technology Assessment, An Evaluation of Options for Managing Greater than Class C Low Level Radioactive Was OTA-BP-O-50, October, 1988.

BURDEN ON CAPACITY OF REPOSITORY

Several comments expressed concern that requiring geologic repository disposal of GTCC wastes would be a burden on the capacity of the geologic repository. Some noted that this could be a factor leading to the need to develop a second geologic repository. One comment noted that fractionation of HLW may be adopted in the future, and that this would result in larger volumes of GTCC waste than projected.

Response:

The fact that the expected volume of GTCC waste is very low was an important factor in the Commission's decision to promulgate the proposed Part 61 amendments. Current evidence shows that the expected volume of GTCC waste is very small relative to volumes of HLW and Class A, B, C LLW. It is projected that less than 4,800 cubic meters of commercially-generated GTCC waste will need disposal through the year 2020. This amount of waste is smaller than the anticipated excavated volume of a single emplacement room of a repository, and would not present a significant burden on the capacity of the repository to receive HLW. It would not be a significant factor underlying the need for a second repository.

The Commission does not consider that fractionation would affect the proposed amendments for three reasons: (1) Proposals for fractionation of defense HLW are not expected to produce GTCC wastes, and even if they do, Part 61 would not be applicable to disposal of defense wastes, (2) Fractionation of spent fuel (rod consolidation) produces a waste (fuel hardware) which should continue to be classified as spent fuel rather than as GTCC waste, and (3) Reprocessing of commercial spent fuel is unlikely to occur in the U.S. Nevertheless, if the projected volumes of GTCC waste should increase, DOE could still develop any appropriate type of disposal facility under the provisions of the proposed amendments.

COMPLICATE LICENSING OF REPOSITORY

There were several comments pointing out that the possible addition of GTCC wastes to the geologic repository would complicate DOE's task of characterizing the performance of the repository, necessary for licensing. DOE's work to date has assumed a reference inventory of radionuclides corresponding to spent fuel and reprocessing HLW. Commenters stated that the proposed rule would make DOE include this additional type of waste in its performance assessments of the repository.

Response:

Again, the Commission stresses that the proposed rule does not force DOE to place GTCC waste in the repository. If DOE finds that demonstrating performance assessment of GTCC wastes in the repository is too great an obstacle, it may propose another form of disposal for GTCC.

However, given the relatively less hazardous inventory of radionuclides in GTCC waste, compared to spent fuel and reprocessing waste, it is difficult to imagine how adding GTCC waste to the repository would make DOE's performance assessment tasks much more burdensome.

DON'T ABANDON RISK BASED CLASSIFICATION

Several comments objected to abandoning the attempts, as exemplified in the approach proposed in the advance notice of proposal rulemaking (ANPR) on the definition of high-level radioactive waste (51 CFR 5992), to base the waste classification system on risk or hazard of the waste.

Response:

The Commission agrees that this type of classification system would have certain advantages. However, in the context of the present waste management system, it would present offsetting disadvantages. The reasoning behind the change in approach represented by the proposed Part 61 amendments was summarized by the Commission in the supplemental information to the proposed rule (58 FR 17709). It need only be reiterated in brief here.

While the theoretical advantage of a risk-based classification system was acknowledged by many public comments on the ANPR there was a disparity in views on how this should be implemented. There was no consensus supporting the Commission's approach, or any alternative approach. This would mean that a new classification system would have to be developed. The Commission had to consider whether a major technical effort to develop a new risk-based classification system was justified.

Several factors were crucial in reaching the decision that such an effort was not justified. Reprocessing waste inventories, currently classified as HLW, did not seem to be good candidates for reclassification. This waste, regardless of concentration, contains such large total inventories of radionuclides that reclassification would pose practical problems for disposal. Also, the historic legislative treatment of reprocessing waste as HLW would pose practical problems for reclassification.

Finally, the NRC staff has been working with DOE to develop appropriate classifications for defense reprocessing wastes under existing laws and regulations. These efforts have led to agreement that decontaminated salts at Savannah River and West Valley, generated incidentally in the course of processing, should not be classified as HLW. Additional efforts are now underway to review materials to be produced at Hanford during projected operations in order to determine whether disposal thereof is subject to Commission licensing.

For non-reprocessing waste, Classes A, B, and C LLW were recognized as a State responsibility by the LLWPAA. Other LLW--GTCC waste--is a very minor component of the total LLW stream. As it is clearly a Federal responsibility, its classification would not alter Federal/State responsibilities. The volume of GTCC waste is just too minor to warrant a large-scale effort to classify some as HLW and the rest LLW. Further, any effort to do so would necessarily involve some judgements with respect to practical design concepts that are more appropriately made in the first instance by DOE as the license applicant. In fact, classification of some GTCC waste as HLW would encourage disposal of those wastes in a deep geological repository, restricting DOE's flexibility to develop the most appropriate type of disposal facility for those wastes. The Commission considers it more appropriate for DOE to develop an acceptably safe disposal facility for GTCC wastes than to worry about classification of those wastes as HLW or non-HLW.

RELATIONSHIP OF PROPOSED AMENDMENTS TO DEFENSE WASTES

Some comments were concerned with any effects this rulemaking would have on defense wastes. The State of Washington expressed interest in Commission activities to establish standards for GTCC facilities other than deep geologic repositories, and how these activities may relate to DOE activities with respect to defense waste disposal.

Response:

The proposed amendments apply solely to commercial GTCC LLW, and have no bearing on defense LLW. NRC has licensing authority only over commercially generated LLW; it has no licensing authority over defense LLW, including defense LLW that might be analagous to GTCC waste. Therefore, DOE plans for disposal of certain defense materials similar to GTCC waste would be unaffected by the proposed amendments.

These efforts would have no effect on defense LLW disposal, since (as indicated above) Part 61 by its terms would only apply to DOE activities subject to NRC jurisdiction, and such jurisdiction is lacking for defense LLW. In the case of facilities authorized for the disposal of HLW, the Commission does have jurisdiction and Part 61 would continue to apply. Accordingly, to the extent that DOE disposes of HLW in facilities other than geologic repositories, a license under Part 61 would be required as before. DOE would not necessarily be precluded from proceeding with such disposal, but as has always been the case they would need to obtain the Commission's approval.

The NRC addressed the issue of whether 10 CFR Part 61 was applicable to near-surface disposal of waste using methods that incorporate engineered barriers or structures and other alternatives to conventional shallow land burial disposal practices in the EIS for Part 61. It was later re-examined in NUREG-1241 ("Licensing of Alternative Methods of Disposal of Low-Level Radioactive Waste", December, 1986). It was concluded that 10 CFR Part 61 was

applicable to alternative methods for the land disposal of low-level radioactive waste. Subsequent to the publication of NUREG-1241, the NRC revised its Standard Review Plan (NUREG-1200) in January, 1988 to provide guidance on additional near-surface disposal concepts that incorporate structures constructed of cementitious materials with an earthen cover.

RESTRICT ALTERNATIVES TO FEDERAL FACILITIES

Many comments, including some by States and regional state LLW compacts, argued for restricting the alternatives to geologic repository disposal. These comments were concerned that GTCC waste could be disposed of in State or State compact operated facilities. NRC was urged to "eliminate the option" of disposal in State or State compact facilities, by limiting alternative disposal methods to Federal facilities.

Response:

The LLWPAA addressed Federal and State responsibilities for radioactive waste disposal. States are responsible only for commercial LLW classified as "A", "B", or "C" waste according to Part 61. All HLW, and all GTCC LLW, is a Federal responsibility. The concerns expressed by commenters on this point have therefore been addressed, to a large extent, by legislation. No public health and safety concerns have been presented that would persuade the Commission to require the use of Federal facilities, to the exclusion of other facilities licensed under the Atomic Energy Act, for the disposal of all GTCC. Indeed, the LLWPAA appears to recognize the continued authority of a State, subject to the provisions of its compact, or a compact region, to accept GTCC waste for disposal, and in the absence of some compelling reason the Commission's judgment is that this option should be preserved.

WHAT STANDARDS WOULD APPLY TO GTCC WASTE EMPLACED IN A GEOLOGIC REPOSITORY?

Both EPA and DOE, among other commenters, were concerned about one aspect of possible geologic repository disposal of GTCC waste. Should GTCC LLW be emplaced in a repository along with HLW, these two categories of waste would be subject to different standards -- EPA's HLW standard and EPA's LLW standard . In addition, they questioned whether NRC's 10 CFR Part 60 or 10 CFR Part 61 would apply to GTCC waste in a repository. Commenters cited the potential for confusion in having dual standards apply to waste in the same repository.

Response:

10 CFR Part 60 -- Disposal of Radioactive Waste in Geologic Repositories-- does not apply only to HLW. It was promulgated to apply to any radioactive waste emplaced in a geologic repository. However, some requirements in Part 60, for example §60.113(a)(ii)(A), which specifies performance requirements for the waste package, apply to HLW only. This situation has parallel in other NRC regulations; for instance Part 61 contains different packaging requirements for Class C LLW than for Class A LLW.

It is expected that GTCC waste emplaced in the repository will have to meet the general Part 60 performance criteria. However, for those sections of Part 60 referring to HLW specifically, alternative requirements would need to be developed for GTCC waste. The Commission is currently planning to provide this guidance in future rulemaking.

For all wastes disposed of in a repository, Part 60 now requires:

(1) waste disposal operations shall be conducted in compliance with the radiation protection requirements of Part 20 of the NRC's regulations (section 60.111(a).

(2) the option of waste retrieval shall be maintained for a period up to 50 years after the start of waste emplacement operations (section 60.111(b), and

(3) "... any release of radionuclides from the engineered barrier system shall be a gradual process which results in small fractional releases to the geologic setting over long times ... The release rate of any radionuclide from the engineered barrier system following the containment period shall not exceed one part in 100,000 per year of the inventory of that radionuclide calculated to be present at 1,000 years following permanent closure ... (section 60.113).

Also implicit in Part 60 is a requirement that any GTCC wastes disposed of in a repository not prevent HLW or spent fuel from meeting the specific performance objectives for those types of wastes.

These general objectives can be achieved in various ways for different wastes. For example, containment within a durable waste canister might be appropriate for short-lived wastes (half-lives about 30 years or less), while processing of wastes to reduce leachability of use of retardant backfill materials might be more appropriate for longer-lived wastes. The NRC is initiating an effort, as contemplated by section 60.135(d) of Part 60, to specify in more detail the waste form and packaging criteria appropriate for specific types of CTCC wastes. The Commission anticipates that DOE will develop specific waste form and packaging alternatives for consideration by the NRC in that rulemaking, and the Commission would welcome similar suggestions from other interested parties.

Previous development of EPA's standards has addressed types of wastes rather than types of disposal facilities as in NRC's regulations. Thus, it is possible that a repository containing both HLW and GTCC LLW would be subject to two EPA standards. The NRC does not anticipate that this will cause significant problems for DOE. If it should pose an insurmountable difficulty, DOE would still be able to develop a separate facility only for GTCC waste. The NRC staff will consult with EPA, as appropriate, to address (and resolve, if possible) potential issues related to differences in regulatory approach.

OBJECTION TO TYING ALTERNATIVE DISPOSAL METHODS TO PART 61

Some commentors objected to tying proposals for alternative disposal methods to Part 61. The proposed amendments state that such alternative proposals be for disposal of GTCC waste in a disposal site licensed "pursuant to this Part" (Part 61). Commenters wanted the reference to Part 61 eliminated, reasoning that this restricted the flexibility of DOE to pursue alternative methods for disposal of GTCC waste.

Response:

The Commission has promulgated two sets of regulations for the disposal of radioactive waste; 10 CFR Part 60, which governs the disposal of radioactive waste in geologic repositories, and 10 CFR Part 61, which governs land disposal of radioactive waste. Since the alternative disposal methods referenced are in lieu of geologic repository disposal, 10 CFR Part 60 would not be applicable. The single remaining NRC regulatory framework in existence is Part 61. Part 61 is applicable not only to disposal of radioactive waste by means of near-surface disposal but to other types of land disposal.

As provided in §61.1, Part 61 establishes procedures, criteria, and terms and conditions with respect to "land disposal of radioactive waste". In implementing this objective, §61.3 requires that the disposal of low-level waste at any "land disposal facility" must be authorized under Part 61. §61.7 notes that additional technical criteria might be needed for licensing of disposal facilities other than "near-surface" disposal. If needed, such criteria would be added to Part 61 before licensing an "intermediate" disposal facility. Since "land disposal facility" is defined broadly (so as to include any facility other than a geologic repository), the reference to licensing under Part 61 is proper and in conformance with the existing regulatory structure.

GENERAL

DOE Comment

The Department's first objection is that the proposed rule fails to acknowledge the comprehensive scheme for developing a policy for disposal of GTCC wastes which was created by Congress in the Low-Level Radioactive Waste Policy Amendments Act of 1985, Public Law 99-240, (LLWPAA). This statute confers on the Department a long-range responsibility to identify disposal options, financing mechanisms, and the legislation needed to implement them, and further provides that no disposal shall be undertaken until the Department's recommendations have been submitted to Congress.

Response:

The Commission considers the proposed rule to be entirely consistent with the "comprehensive scheme for developing a policy for disposal of GTCC wastes" referred to in this comment. The proposed rule does not constrain DOE's ability to "identify disposal options, financing mechanisms, and the legislation needed to implement them." Nor does the proposed rule require disposal of GTCC wastes prior to submittal of the Department's recommendations to Congress. The proposed rule only requires that GTCC wastes be disposed of in a facility licensed by the NRC -- a constraint imposed by the LLWPAA.

In DOE's 1987 report to Congress regarding management of GTCC wastes (DOE/NE-0077), DOE stated that certain regulatory actions were needed before DOE could proceed with identification of disposal options and costs. One of these actions was a decision by NRC whether or not to proceed with development of a concentration based definition of high-level waste. The Commission has decided not to develop such a definition for the reasons discussed elsewhere in this response to comments. Thus, one of the regulatory impediments previously identified by DOE will be removed by this rulemaking.

DOE Comment

If this proposed rule is misinterpreted as a premature designation that all GTCC wastes shall be disposed of in a geologic repository (unless placed in some other licensed facility), the Nuclear Regulatory Commission (Commission) will disturb the deliberative process mandated by Congress before that process can be completed. This interferes with the Department's ability to perform an objective study unbiased by other regulatory initiatives.

Response:

The Commission would not consider the proposed rule to be "mis terpreted" nor a "premature designation" that all GTCC wastes be disposed of in a geologic repository or other licensed facility. On the contrary, the Commission considers this to be exactly the requirement imposed by Section 3(b)(2) of the LLWPAA, i.e., "[GTCC wastes] shall be disposed of in a facility licensed by the Nuclear Regulatory Commission . . ."

DOE Comment

By suggesting that the Department obtain legislation to implement the Commission's policy choice, the Commission is asking the Department to act without first having complied with its own responsibility under the LLWPAA.

Response:

The Commission did not suggest that the Department obtain any legislation. The Commission merely recognized that additional legislation may be needed -- a point emphasized by DOE in its own comments.

As the Commission clearly stated in its Federal Register notice, "[t]his proposal reflects the Commission's view that intermediate disposal facilities may never be available, in which case a repository would be the only type of facility generally capable of providing safe disposal for GTCC wastes. At the same time, the Commission wishes to avoid foreclosing possible use of intermediate disposal facilities by the Department of Energy (DOE). If DOE

chooses to develop one or more intermediate disposal facilities . . ." The Commission could scarcely have stated more clearly that it was leaving the selection of disposal facilities to the discretion of DOE. The Commission's policy choice is merely to require repository disposal of GTCC wastes if no other suitable disposal facility is proposed and developed by DOE.

DOE Comment

The Department believes that the proposed rule should be abandoned, and that the Commission should resume the course announced in the ANPR of developing a definition for HLW. This would be of great assistance to the Department in defining GTCC LLW--prerequisite for evaluating policy options--and would be consistent with more conventional regulatory procedures. If this course is followed, then, once the Department has developed appropriate disposal options and has advised Congress of needed legislation, and Congress has acted on those recommendations, the Department will be in a position to work with the Commission regarding technical matters and licensing procedures. This would be a far better approach to the problem of disposal of GTCC wastes in that it would not foreclose deliberations intended by Congress to be the responsibility of the Department.

Response:

The Commission fails to see (and DOE fails to demonstrate) that there would be any benefit to be gained by classifying some GTCC wastes as HLW. On the contrary, such an action might have the effect of encouraging or requiring repository disposal of those wastes -- thus restricting DOE's flexibility to develop appropriate disposal options.

The Commission also fails to see (and again DOE fails to demonstrate) that there is any deficiency in the description of GTCC wastes provided by the LLWPAA. That act refers to "any other low-level radioactive waste [other than certain wastes generated by the Federal government] with concentrations of radionuclides that exceed the limits established by the Commission for class C

radioactive waste, as defined by section 61.55 of title 10, Code of Federal Regulations, as in effect on January 26, 1983." Absent a demonstration of deficiency in this description, the Commission sees no merit in developing a revised definition of GTCC wastes.

DOE Comment

If, however, the Commission does not accept the Department's recommendation concerning this matter [developing a definition of HLW], then, in the alternative, the Department recommends that the proposed rule be amended to preserve the Department's policy-making responsibility under the LLWPAA. In either case, the Department urges the Commission to proceed with developing an appropriate risk-based definition of waste streams, as initially proposed in the ANPR.

Response:

As discussed previously, the Commission does not recognize any infringement on DOE's "policy-making responsibility" resulting from the proposed rule. Thus, no amendment would be needed for the purpose stated by DOE. The Commission's reasons for departing from the risk-based approach suggested in the ANPR were articulated in the supplementary information accompanying the proposed amendments, and are discussed further below.

DOE Comment

The proposed wording for section 61.55(a)(2)(iv) states, in part, that "In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository . . . unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are submitted to the Commission for approval." The wording of the preamble and the proposed rule create confusion and might be misinterpreted to imply that the Commission is expressing a preference for disposal in a repository. GTCC wastes need better definition to determine whether, or which, GTCC wastes require the isolation of a geologic repository. Disposal in a geologic repository may be an unnecessarily expensive alternative for some GTCC wastes and for some

low-activity wastes that may be considered HLW under a source-based definition while it may be the only appropriate alternative for others. The activity levels of the various forms of GTCC wastes and low activity HLW should be considered to assure an appropriately safe form of disposal without excessive costs to the generators and the public. Further, the addition of a new waste form for disposal in a geologic repository may well impact the design of such a repository and/or necessitate special treatment of the new waste form. Licensing and permitting of the repository may also be complicated by the inclusion of another form of waste.

Response:

It would not be a misinterpretation to conclude that the Commission is expressing a preference for repository disposal of GTCC wastes. This preference results from the lack of any DOE proposal for alternative disposal facility for those wastes. However, the proposed rule clearly provides for use of an alternative type of disposal facility if one is proposed, developed, and licensed. If the Department finds repository disposal of GTCC wastes to be "unnecessarily expensive" or complicated, development of an alternative means of disposal would be a logical course of action. The intent of the Commission's proposed rule is to avoid continuation of the current situation where no disposal facility of any kind is available for GTCC wastes, causing those wastes to be retained in temporary storage indefinitely.

DOE Comment

The Department suggests that the wording of the rule be modified to allow the Department the clearest opportunity for maximum flexibility by changing the last sentence of 61.55(a)(2)(iv) to read as follows: "Such waste must be disposed of either in a disposal site or sites licensed pursuant to this Part or in a facility licensed pursuant to Part 60 of this Chapter."

Response:

(See earlier response to "Objection to Tying Alternative Disposal Methods to Part 61").

DOE Comment

The preamble further states that additional legislation may be needed by the Department to provide for payment of disposal costs of GTCC wastes or to authorize receipt of such wastes for disposal at a repository. Unless the Commission makes a determination under section 2(12)(B) of the Nuclear Waste Policy Act (NWPA) that GTCC waste requires permanent isolation, the Department agrees that such legislation would be required. The Department has no authority to dispose of wastes other than high-level (as defined in the NWPA) and spent fuel in a repository authorized by the NWPA.

Response

DOE agrees with the Commission's suggestion that additional legislation may be needed before GTCC wastes - if not determined to be HLW - could be disposed of in a repository. This may be a regrettable constraint, but it is an unavoidable one. It remains open for DOE to propose disposal of such waste in an alternative facility; if such disposal were approved by the Commission, in the exercise of its existing or extended jurisdiction, the limitations of the NWPA would be of no consequence. Further, DOE itself may determine that, based on economic considerations as well as safety and environmental concerns, certain well-defined categories of GTCC should be classified by the Commission as HLW. This could be accomplished in the course of further rulemaking; to the extent the Commission were then to conclude that the materials thus categorized by DOE ought to be defined as HLW, under the statutory standard, the need for legislation would be eased (although adjustments might in any event still be required to address the advance-contracting limitations of Section 302(b)(2).

The LLWPAA directed DOE to identify options for ensuring that those who benefit from activities resulting in the generation of GTCC waste bear the costs of disposing of such waste, and also to identify any statutory authority required for disposal of such waste [LLWPAA, §3(b)(3)].

DOE Comment

The Commission states that "Technical criteria to implement the performance objectives of [10 CFR 61] and [the Environmental Protection Agency] environmental standards would be developed by the Commission after the DOE [the Department] had completed its conceptual design and selected a site for a specific type of facility." The Department would like the opportunity to discuss the applicability of the existing repository technical criteria for spent nuclear fuel and HLW to the disposal of GTCC wastes in a repository.

Response

The Commission's regulations for a deep geologic repository (10 CFR Part 60) were specifically developed to accommodate disposal of wastes other than HLW and spent nuclear fuel. Paragraph (d) of section 60.135 specifies that "[d]esign criteria for waste types other than HLW will be addressed on an individual basis if and when they are proposed for disposal in a geologic repository." Thus, the existing criteria of Part 60 would not necessarily be applicable for GTCC wastes. If and when DOE proposes to dispose of GTCC wastes in a specific type of facility (repository or other), the NRC staff will initiate development of appropriate technical criteria for that type of facility.

DOE Comment

While the Department appreciates the flexibility the Commission is making available in the proposed rule, the Department is concerned that the effort to define high-level waste has been discontinued by the Commission. A risk-based definition of high-level waste, which is tied to adequate protection of public health and safety, is needed. The Department would like to see this effort resumed and is willing to assume a more active role in the effort, if requested by the Commission.

Response

The Commission does not agree that a risk-based definition of high-level waste is needed. For GTCC wastes, it is more important to develop one or more suitable disposal facilities than to divide the population of GTCC wastes into HLW and non-HLW subsets. Instead, the Commission considers that it would be more productive to deal with GTCC wastes as a separate waste class. DOE would be permitted the flexibility to dispose of these wastes in any way technically responsible.

An unstated goal of this comment may be "deregulation" of some or all of the reprocessing wastes currently in tank storage at DOE's Hanford reservation. But, regardless of any revised definition of HLW that might be developed pursuant to the Nuclear Waste Policy Act, the Commission considers that reprocessing wastes would remain "high-level wastes" for purposes of the Energy Reorganization Act and hence subject to NRC jurisdiction.* Thus, licensing of the facilities to be used for disposal of these wastes would be required, and the goal of "deregulation" would not be accomplished. Stated another way, if the Commission's licensing responsibility for the Hanford "tank wastes" is to be eliminated, this must be accomplished by amendment of the Energy Reorganization Act rather than by any unilateral action by the Commission or by DOE.

*The Nuclear Waste Policy Act authorizes the Commission for purposes of the NWPA to define the term "high-level radioactive waste." Regulatory jurisdiction is defined by the Energy Reorganization Act, not by NWPA. Moreover, Section 8 of the Act states that ". . . the provisions of this Act shall not apply with respect to any atomic energy defense activity or . . . facility . . ." Thus, any revised definition of HLW that might be developed by the Commission would not apply to the Hanford wastes that might be found to be acceptable for some form of near-surface disposal.

DETAILED COMMENTS

DOE Comment

Nowhere in the proposed rule has the Nuclear Regulatory Commission (Commission) attempted to insure that its policy objectives are consistent with the Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLWPAA), Public Law 99-240, . . .

Response

The Commission's single policy objective is to achieve safe disposal of GTCC and high-level wastes consistent with the law. As discussed above, the proposed amendments allow DOE virtually unlimited flexibility to select disposal facilities for GTCC wastes. The only constraint imposed on DOE is that the facilities selected must be licensed by the Commission -- a constraint already provided by the LLWPAA. The Commission sees no inconsistency with the law.

DOE Comment

. . . the Department was hampered by the lack of a definition of greater-than-Class-C (GTCC) wastes. The Department urged the Commission to provide such a definition so that a disposal policy could be formulated . . .

Response

DOE's 1987 report to Congress (DOE/NE-0077) cited uncertainty about development of a numerical definition of HLW as an impediment to proceeding with identification of disposal options for GTCC wastes and with estimation of disposal costs. The present rulemaking ends that uncertainty, since revisions to existing definitions are no longer contemplated. As stated in a previous NRC staff letter to DOE, disposal of GTCC wastes in a HLW repository appears to be an acceptable alternative. Should DOE desire to pursue this alternative, the NRC staff will work with DOE to develop appropriate criteria for such disposal.

DOE Comment

The Department of Energy believes it is inappropriate for the Commission to require that a particular type of waste be disposed of in a specified facility. The Commission should be concerned with disposal of radioactive waste without undue risk to the health and safety of the public.

Response

The proposed amendments would require repository disposal of GTCC wastes only if no other acceptable type of disposal facility were available. Such a requirement is entirely consistent with the Commission's mandate to protect the public health and safety.

DOE Comment

As noted in the preamble, the Nuclear Waste Policy Act (NWPA) of 1982, as amended, would need to be amended in order for the Department to comply with the requirement of the proposed rule that GTCC waste be disposed of in a geologic repository, unless the Commission determines that GTCC waste requires permanent isolation in accordance with section 2(12)(B) of the NWPA.

Response

If such an amendment to the NWPA is needed and is unavailable, the Department may develop an alternative means of disposal, as permitted by the proposed amendments. However, if DOE concludes that some GTCC should be disposed of in a repository (considering costs and other relevant factors) and if the need for legislation is viewed as an obstacle, DOE may petition the Commission at that time to classify GTCC so identified as HLW under the statutory criteria.

DOE Comment

The proposed change that would require commercial GTCC waste to be disposed of in a geologic repository unless a licensed intermediate disposal facility is

available may still necessitate long-term storage of GTCC wastes by the Department.

Response

A recent report by the Congressional Office of Technology Assessment (U.S. Congress, Office of Technology Assessment, An Evaluation of Options for Managing Greater Than Class C Low Level Radioactive Waste, OTA-BP-O-50, October, 1988, forecasts that long term storage of GTCC wastes will be required regardless of the specific final disposal technology ultimately chosen by DOE. The NRC agrees that storage will be required, and considers that the present rulemaking has no impact on the need for or the length of such storage.

DOE Comment

Our concern with the proposed rule is that its interpretation and effect are unclear. [Comment details areas considered to be unclear.]

Response

The wording of the proposed rule has been amended to clarify the Commission's intent.

DOE Comment

The proposed use of geologic repository space for GTCC waste deserves more thorough evaluation and consideration including the following:

(a) Risk basis;

(b) Systems analysis of alternative GTCC disposal methods versus deep geologic repository for safety and cost;

(c) Accurate forecast of GTCC waste volume for repository planning;

(d) High unit disposal cost; and

(e) Suitable waste forms and canisters for GTCC that are amenable to the proposed repository design.

Response

The Commission agrees that the factors listed will be relevant to DOE's decision regarding the type of disposal facility to be used for GTCC wastes. The OTA report considers these factors in arriving at its recommendations. NRC is providing DOE with the flexibility it needs to make a decision.

DOE Comment

The Department strongly encourages the Commission to clarify the performance objectives to be used for the GTCC waste, whether it is to be disposed of in a geologic repository or in another facility, so as to facilitate the Department's decision on how to dispose of the GTCC wastes.

Response

Performance objectives are set out in 10 CFR §60.111-60.113 and in 10 CFR Part 61, Subpart C for a geologic repository and for land disposal facilities other than a repository, respectively.

DOE Comment

[Long list of difficulties associated with repository disposal of GTCC wastes.]

Response

The proposed rule does not require repository disposal of GTCC wastes. If the cited difficulties prove insurmountable, DOE could choose to pursue an alternative means of disposal. It is not clear, however, that these (or

similar) difficulties would not also be encountered for an alternate disposal approach.

DOE Comment

Footnote 1, page 5993 (ANPR) (51 FR 5992) from the February 27, 1987, proposed rule should have been included in the Background section of the Supplementary Information provided in the preamble at p. 1771. This footnote clarified that the waste generated in further treatment of HLW, such as decontaminated salt, at the Savannah River Plant was considered incidental wastes and not within the Appendix F definition.

Response

A more complete statement regarding classification of reprocessing wastes, including the "incidental waste" concept, will be included in the Supplementary Information for the final rule.

DOE Comment

The Department is concerned that the Commission has changed its longstanding plans to define radioactive material based on its hazardous characteristics rather than its source. We believe that a risk-based definition which distinguishes HLW from LLW is the most reasonable, technically sound, and appropriate basis for management of such material.

Response

As discussed above, the Commission does not agree that there is a need for such a risk-based definition. On the contrary, the Commission considers that such a definition could prove counterproductive, as explained previously.

COMMENTS ON THE CLASSIFICATION SYSTEM PROPOSED BY KOCHER AND CROFF

In the Advance Notice of Proposed Rulemaking (ANPRM), the Commission proposed to develop a definition of HLW by evaluating the waste isolation capabilities of less secure, "intermediate" disposal facilities. Then, in the proposed rule, the Commission rescinded this proposal arguing that the performance of such "intermediate" facilities would be so speculative and site-specific that it would not provide a technically defensible basis for classifying wastes as HLW or non-HLW. In support of this revised view, the Commission cited a technical report which had recently been published (Kocher, D. C. and A. G. Croff, A Proposed Classification System for High-Level and Other Radioactive Wastes, ORNL/TM-10289, Oak Ridge National Laboratory, 1987). The Commission further stated that it could not accept an alternative classification approach presented in that report because that approach was based solely on the short-term storage and handling risks associated with the heat and external radiation levels generated by a waste rather than on the degree of waste isolation required following disposal.

The authors of the cited report (Kocher and Croff) commented on the proposed rule alleging that the Commission had misrepresented the content and conclusions of their report. Specifically, Kocher and Croff summarized their comments as follows:

> The NRC is incorrect in stating that our approach to defining HLW is based only on consideration of short-term risks associated with decay heat and external radiation but not on consideration of long-term risks from waste disposal.
>
> The NRC is incorrect is implying that we considered only short-term risks during waste handling and storage in defining HLW, but did not consider short-term risks during waste disposal.
>
> The NRC's discussion of our analysis of risks from disposal of wastes in intermediate disposal facilities is potentially misleading, because it

implies that (1) our initial goal was to use this analysis in developing a definition of HLW, (2) we developed an alternative definition of HLW only after our analysis for intermediate disposal facilities proved too uncertain to be useful, and (3) our analysis for intermediate disposal facilities supports the NRC's decision not to revise the definition of HLW. None of these implications are correct.

Regarding the first criticism above, the Commission acknowledges that its statement was potentially misleading. A key element of Kocher and Croff's suggested classification system is the assumption that the Class C limits of 10 CFR Part 61 are appropriate for distinguishing between wastes that require permanent isolation and those that do not. The Commission would have been more accurate if it had stated:

"For wastes with radionuclide concentrations exceeding the Class C limits of Part 61, Kocher and Croff's approach to defining HLW is based only on consideration of short-term risks associated with decay heat and external radiation but not on consideration of long-term risks from waste disposal."

The Commission also acknowledges that its characterization of Kocher and Croff's analysis of short-term risks was inaccurate. Their report did discuss short-term disposal risks (e.g., boiling of water that might contact waste containers) as well as handling and storage risks.

Finally, the Commission acknowledges that its description of Kocher and Croff's analyses of "intermediate" disposal facility performance might have been misleading. In Appendix C of their report, Kocher and Croff state that analyses of intermediate disposal facilities could provide a basis for determining which wastes require permanent isolation. Since one of the authors had previously commented favorably (in response to the ANPRM) regarding the NRC's proposed analyses of intermediate facility performance, the Commission inferred that the authors would have preferred to have based their HLW definition on such analyses if they could have been carried out in a technically defensible manner. The Commission acknowledges that such an inference was unwarranted.

The Commission's purpose in referring to Kocher and Croff's report was solely to support its view that the proposal presented in the ANPRM, i.e., classification of wastes based on analyses of the projected performance of "intermediate" disposal facilities, should not be pursued because of the limited development of these facilities and because their performance is likely to be highly site-specific. The Commission continues to believe that Kocher and Croff's report supports this view.

"ARE APPROVED" IN PLACE OF "SUBMITTED FOR APPROVAL"

A comment noted that the language in 61.55(a)(2)(iv) of the proposed amendments;

"in the absence of specific requirements in this part, such waste must be disposed of in a geologic repository as defined in Part 60 of this chapter unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are submitted to the Commission for approval."

would allow GTCC waste to escape geologic repository disposal as long as alternative proposals for disposal were submitted to the Commission. A series of inadequate proposals could be submitted, simply to avoid repository disposal. The commenter suggested that this possibility could be eliminated by changing the language from "submitted to the Commission for approval" to "are approved by the Commission".

Response:

The Commission agrees that this suggested new language better represents the basic position taken in the proposed rule-- that geologic repository disposal is necessary in the absence of a Commission-approved alternative means of disposal. Accordingly, the change has been incorporated in the final amendments to Part 61.

ALL WASTE HAZARDOUS FOR OVER 100 YEARS SHOULD BE FEDERAL RESPONSIBILITY

Some comments argued that all radioactive waste with a hazardous life of over 100 years should be made a Federal responsibility.

Response:

The Commission sees no need to provide for this change in responsibilities in its regulations. 10 CFR Part 61 regulates land disposal of radioactive waste. As part of the Part 61 rulemaking, extensive technical studies of the performance of shallow land burial facilities were carried out. These studies confirmed that, for Classes A, B, and C LLW, the risks posed by waste inventories up to 500 years after emplacement were acceptable. Thus, LLW for which States are responsible (Classes A, B, C) can be effectively managed by disposal methods currently in use by States. Moreover, many States and State compacts are planning disposal facilities more secure than shallow land burial. There is not sufficient reason to presume that any change in responsibility for some of these wastes would significantly enhance public health and safety.

Additionally, relative State/Federal responsibilities for waste management were clarified by the LLWPAA in 1985. Classes A, B, and C LLW were retained as a State responsibility, and only GTCC wastes were made a Federal responsibility. No public health and safety concerns exist which would lead the Commission to interfere with that statutory mandate in this rulemaking.

EPA noted that some GTCC waste could contain hazardous waste subject to RCRA regulations. The final rule should contain some reference to EPA involvement in any decision concerning alternative disposal licensing.

Response:

If some GTCC waste does contain hazardous waste subject to RCRA regulations, EPA would certainly be a factor in regulation of those wastes. The supplementary information to the final amendments acknowleges the EPA role.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NAMES OF COMMENTERS

1. Desiderio D. Demes
2. E. Nemethy/ Ecology Alert
3. Tom Spoors
4. Susan L. Hiatt/ Ohio Citizens for Responsible Energy
5. State of Indiana
6. Rich Ferguson/ Sierra Club- Santa Lucia Chapter
7. New York State Low Level Radioactive Waste Siting Commission
8. State of South Carolina
9. Gerald Drake
10. Midwest Interstate Low Level Radioactive Waste Commission
11. Walbridge J. Powell
12. State of Vermont
13. David C. Kocher and Allen G. Croft/ ORNL
14. Union Electric
15. American Society of Mechanical Engineers
16. State of Michigan
17. Mr. and Mrs. Carl Berg
18. Madison County Environmental Defense League
19. State of Washington
20. Argonne National Laboratory
21. Washington Public Power Supply System
22. DOE
23. Edison Electric Institute
24. Yankee Atomic
25. State of Tennessee
26. (misdocketed)
27. Nuclear Information and Resource Service
28. Duke Power
29. Marvin Lewis
30. Judith H. Johnsrud/ Environmental Coalition on Nuclear Power
31. Donna Monro
32. Judith H. Johnsrud/ Food and Water
33. EPA
34. DOE
35. Midwest Interstate Low Level Radioactive Waste Commission
36. State of Pennsylvania

(1)

DOCKET NUMBER
PROPOSED RULE PR 61
(53FR17709)

DOCKETED
USNRC

To the Secretary of USNRC
Attn: Docketing and Service Branch
Washington, D.C. 20555.

Re: Request/Question.

'88 JUN -9 P5:46

Pine Bluff, June 6, 1988.

OFFICE OF THE SECRETARY
DOCKETING & SERVICE
BRANCH

Dear Sirs:

In 1987 I (qua contractor, director/principal investigator) was completely absorbed in the U.S.Army's Chemical Stockpile Disposal Program's Community Review. Therefore, I had no time to pay adequate attention to the NRC's extended deadline (July 29, 1987) for comments on its intention to revise the definition of "high-level radioactive waste."

At this time I raise the alternatives:

1) If you made a re-classification of "high-level radioactive waste" in the meantime, please, send me a copy of the redefined/reclassified text of your determination.

2) If you didn't make a redefiniton/reclassification, as yet, would you like to accept my own "comment" for the same purpose? If yes, indicate a "deadline". Thanks.

Sincerely,

O. D. Demecs

Desiderio D. Demecs
Ph.D. in Philosophy
Ph.D. in Economics and Commerce
Professor of Humanities & Philosophy
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DOCKET NUMBER
PROPOSED RULE PR 61
(53 FR 17709)

(2)

[illegible]
[illegible] 17515

June 16 -88

E Nemethy, Sec'y

Sec'y - NRC

ATT: DOCKETING & SERVICE BRANCH

DOCKETED
USNRC

Re: Proposed rule - Disposal of Radioactive wastes - Fed Reg May 18-88, p 17709

88 JUN 20 P1:02

OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

Gentlemen -

Your proposal - to place all wastes (regardless of class), which are not acceptable for near-surface disposal, into a geologic repository - has our vote.
It would elminate endless nit-picking as to what is, or is not HLW. We suggest all transuranics be disposed of this way - regardless of their concentrations in nCi/g.

Also, we're glad to see NRC will retain control of licensing authority over DOE - an agency notorious for its sloppy procedures at Hanford, Svaannah River, etc etc etc.

E Nemethy

(3)

DOCKET NUMBER
PROPOSED RULE PR 61
(53 FR 17709)

DOCKETED
USNRC

'88 JUN 21 P7:30

OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

Secretary of the Commission
U S NRC
Washington DC 20555

Dear Commission,

I am concerned about Ratioactive Waste issues. Please: Review & develop a more responsible nuclear/energy policy Meanwhile, respect state & compact authority.

Stop NRC's Emergency Access ruling.
Restrict "host" state dumps to designated commercial wastes, none greater than proper Class C
Approve on-site, monitered, retrieval storage.

Thank you
Tom Spoor
1003 E. Kent
Greenville Mich. 48838

TABLE 7.3-3. Reference Radionuclide Inventory *

	Isotope	Half Life (Years)	Average Activity in Waste (Ci/m³)	As-buried Activity per Trench (Ci)	Total Burial Ground Inventory at Time of Site Closure (Ci)	Half-Life
hydrogen (tritium)	^{3}H	1.2×10^{1}	1.6×10^{-1}	1.3×10^{3}	1.1×10^{5}	12.26 years
carbon	^{14}C	5.7×10^{3}	5.0×10^{-3}	4.2×10^{1}	7.6×10^{3}	5730 years
chromium	^{51}Cr	7.6×10^{-2}	5.7×10^{-1}	4.7×10^{3}	3.0×10^{2}	27.8 days
manganese	^{54}Mn	8.3×10^{-1}	3.3×10^{-1}	2.7×10^{3}	1.9×10^{4}	303 days
iron	^{55}Fe	2.6×10^{0}	5.7×10^{-1}	4.7×10^{3}	1.0×10^{5}	2.6 years
cobalt	^{58}Co	2.0×10^{-1}	5.7×10^{-1}	4.7×10^{3}	5.2×10^{3}	71.3 days
	^{60}Co	5.3×10^{0}	1.7×10^{0}	1.4×10^{4}	6.2×10^{5}	5.26 years
nickel	^{59}Ni	8.0×10^{4}	1.7×10^{-2}	1.4×10^{2}	2.5×10^{4}	80,000 year
	^{63}Ni	9.2×10^{1}	3.2×10^{0}	2.6×10^{4}	4.2×10^{4}	92 years
zinc	^{65}Zn	6.7×10^{-1}	2.7×10^{-2}	2.2×10^{2}	1.2×10^{3}	243.6 days
strontium	^{90}Sr	2.8×10^{1}	6.4×10^{-3}	5.3×10^{1}	6.7×10^{3}	28.1 years
yttrium	^{90}Y (a)	7.3×10^{-3}	---	---	6.7×10^{3}	64 hours
zirconium	^{93}Zr	1.8×10^{-1}	2.7×10^{-2}	2.2×10^{2}	2.0×10^{2}	65 days
technetium	^{99}Tc	2.1×10^{5}	4.3×10^{-5}	3.6×10^{-1}	6.5×10^{1}	212,000 yea
ruthenium	^{106}Ru	1.0×10^{0}	2.7×10^{-2}	2.2×10^{2}	1.9×10^{3}	367 days
rhodium	^{106}Rh (a)	9.5×10^{-7}	---	---	1.9×10^{3}	130 minute
antimony	^{125}Sb	1.6×10^{-1}	6.6×10^{-3}	5.5×10^{1}	3.8×10^{1}	60.3 days
	^{125}Sb	2.7×10^{0}	6.6×10^{-3}	5.5×10^{1}	1.3×10^{3}	2.7 years
iodine	^{129}I	1.7×10^{7}	8.5×10^{-6}	7.0×10^{-2}	1.3×10^{1}	17 million yea
cesium	^{134}Cs	2.0×10^{0}	6.4×10^{-1}	5.3×10^{3}	9.4×10^{4}	2.05 years
	^{135}Cs	3.0×10^{6}	4.3×10^{-5}	3.6×10^{-1}	6.8×10^{2}	3000000 y
	^{137}Cs	3.0×10^{1}	1.1×10^{0}	9.1×10^{3}	1.2×10^{4}	30.23 year
cerium	^{144}Ce	7.8×10^{-1}	2.7×10^{-2}	2.2×10^{2}	1.4×10^{3}	284.9 days
praseodymium	^{144}Pr (a)	3.0×10^{-5}	---	---	1.4×10^{3}	17.3 minutes
radon	^{222}Rn (b)	1.0×10^{-2}	---	---	2.1×10^{2}	3.823 days
radium	^{226}Ra	1.6×10^{3}	1.5×10^{-4}	1.2×10^{0}	2.1×10^{2}	1600 years
thorium	^{230}Th	8.0×10^{4}	9.4×10^{-5}	7.8×10^{-1}	1.4×10^{2}	80000 year
	^{232}Th	1.4×10^{10}	1.1×10^{-5}	9.1×10^{-2}	1.6×10^{1}	14.1 billion y
uranium	^{235}U	7.1×10^{8}	4.3×10^{-5}	3.6×10^{-1}	6.5×10^{1}	710 million years
	^{238}U	4.5×10^{9}	9.4×10^{-4}	7.8×10^{0}	1.4×10^{3}	4.5 billion yea
neptunium	^{237}Np	2.1×10^{6}	6.1×10^{-4}	5.1×10^{-3}	9.2×10^{-2}	2 140 000 years
plutonium	^{238}Pu	8.6×10^{1}	4.3×10^{-4}	3.6×10^{0}	6.0×10^{2}	86 years
	^{239}Pu	2.4×10^{4}	5.7×10^{-5}	4.7×10^{-1}	8.5×10^{1}	24400 years
	^{240}Pu	6.6×10^{3}	8.9×10^{-5}	7.4×10^{-1}	1.3×10^{2}	6580 years
	^{241}Pu	1.3×10^{1}	2.2×10^{-2}	1.8×10^{2}	1.6×10^{4}	13.2 years
	^{242}Pu	3.8×10^{5}	3.2×10^{-7}	2.6×10^{-3}	4.7×10^{-1}	379000 years
americium	^{241}Am	4.6×10^{2}	4.0×10^{-5}	3.3×10^{-1}	5.1×10^{2}	458 years
	^{243}Am	8.0×10^{3}	2.8×10^{-4}	2.3×10^{-2}	4.1×10^{0}	7370 years
curium	^{242}Cm	4.4×10^{-1}	3.3×10^{-3}	2.7×10^{1}	9.4×10^{1}	163 days
	^{244}Cm	1.8×10^{1}	2.5×10^{-4}	2.1×10^{0}	2.2×10^{2}	17.6 years

(a) Short-lived daughter of parent with same mass number.
(b) Short-lived daughter of ^{226}Ra.

* From "Technology, Safety and Costs of Decommissioning a Reference Low-level

$1.1 \times 10^{5} = 110,000$ curies
$7.6 \times 10^{3} = 7,600$
$9.2 \times 10^{-2} = .092$
The amount tells how many

To determine the period of time during which a radioactive material remains hazardous multiply the half-life

Christian Science Monitor January 25, 1988

'Safe' level of radiation exposure needs to be reevaluated, data show

By Peter N. Spotts
Staff writer of The Christian Science Monitor

Boston

Tighter radiation exposure limits may lie ahead, based on new estimates of the effects of atomic bombs that were dropped on Hiroshima and Nagasaki.

The revisions indicate that survivors received much lower doses of radiation than previously thought. When combined with the survivors' health records since then, the new estimates suggest that it takes less radiation to induce cancer than previously thought.

The resulting radiation risk assessments are under study by groups such as the US National Research Council's Committee on the Biological Effects of Radiation. "We're expecting a moderately large shoe to drop" when studies are completed, says Warren K. Sinclair, president of the US National Council on Radiation Protection and Measurements.

US agencies are likely to wait for the council's results – expected later this year – before deciding if the new risk estimates warrant changes in exposure standards, says Ray Cooper of the council's Board of Radiation Effects Research.

Other countries are moving more quickly. Britain's National Radiological Protection Board recommended last month that the British government reduce by 70 percent the annual maximum legal exposure level for those working with radioactive materials. It also asked that the maximum allowable exposure for the public be halved.

Mr. Cooper says that any change in standards will most likely affect people working directly with radioactive materials or processes. But he says it's possible that if a change is large enough, it could affect a broader segment of society by requiring larger evacuation zones around nuclear power plants, for example.

Studies of the 90,000 Japanese who survived the atomic bombs arouse such interest because they account for about half the data scientists use to determine effects of radiation on humans, Dr. Sinclair says.

The revised dose estimates come from the US-Japanese Radiation Effects Research Foundation. It found that the Hiroshima bomb's yield was 20 percent higher than the original estimate. The Nagasaki bomb's yield fell nearly 5 percent. Housing provided about twice the shielding allowed for in previous estimates, while the body was found to be a less effective shield for its organs.

As a result of these and other changes, the dose of neutrons from the Hiroshima bomb fell to about 10 percent of its previous level, with the gamma ray dose 2 to 3.5 times higher. For Nagasaki, the neutron dose estimate fell by half; the gamma ray dose was trimmed slightly.

Mr. Cooper says several uncertainties remain as scientists sort through the implications of the new dose estimates.

One involves the relative damage done by neutrons and gamma rays. Animal tests are used to get at this problem. But questions remain on how applicable the results are to humans, he says. "Neutrons are more damaging" he says, but estimates range from 10 to 20 times more. Refining that figure will help pin down the relative risks from neutrons and gamma rays.

Another is the extent to which scientists can extrapolate the risks from high exposures to levels perhaps a million times less. "Most radiation is at pretty low levels," Cooper says. "And the data come from people who received very high doses. Only theory exists for extrapolating downward from that high a level."

DOCKET NUMBER
PROPOSED RULE PR 61

(53FR1770

June 30, 1988

COMMENTS OF OHIO CITIZENS FOR RESPONSIBLE ENERGY, INC. ("OCRE") ON PROPOSED RULE, DISPOSAL OF RADIOACTIVE WASTES, 53 FED. REG. 17709 (May 18, 1988)

'88 JUL -5 P2:34

The Commission has proposed a revision to 10 CFR Part 61 which would require all greater than Class C waste to be disposed of in a geologic repository, unless an alternative proposal is approved by the NRC. OCRE supports this proposed rule. This is an important step forward toward the protection of the public health and safety from the hazards of such radioactive materials.

Respectfully submitted,

Susan L. Hiatt

Susan L. Hiatt
OCRE Representative
8275 Munson Road
Mentor, OH 44060
(216) 255-3158

ROBERT D. ORR, GOVERNOR
WOODROW A. MYERS, JR., M.D., STATE HEALTH COMMISSIONER

INDIANA STATE BOARD OF HEALTH
1330 WEST MICHIGAN STREET
P.O. BOX 1964
INDIANAPOLIS, IN 46206-1964

INDIANA STATE BOARD OF HEALTH
AN EQUAL OPPORTUNITY EMPLOYER

Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Docketing & Service Branch
Subject; Proposed Rule, 10 CFR Part 61

Dear Sir:

Thank you for including the Indiana State Board of Health in your review. My staff has reviewed the proposed Rule, 10 CFR Part 61, which requires the burying of "greater-than-Class-C" low-level radioactive wastes in a deep geologic repository unless disposal elsewhere has been approved by the Commission. We wish to comment favorably.

If we may be of service, please contact us.

Sincerely,

T. S. Danielson, Jr., M.D., M.P.H.
Indiana State Liaison Officer

"The health of the people is really the foundation upon which all their happiness and all their powers as a state depend."
--Disraeli

61
(53FR17709)

SIERRA CLUB ~ SANTA LUCIA CHAPTER

Rocky Canyon Star Route
Creston, CA 93432
(805) 238-5437

'88 JUL 11 A8:25

July 5, 1988

OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

Secretary
US Nuclear Regulatory Commission
Washington, DC 20555

Attn: Docketing & Service

Dear Sir:

I would like to take this opportunity to comment on the proposals for the storage of Greater than Class C radioactive waste (Federal Register, May 18, (53 FR 96:17709)).

Greater than Class C wastes are extremely hazardous and should remain under federal control, closely monitored by the NRC. It is not in the public interest for states or state compacts to design storage facilities for this material, even with approval of the Nuclear Regulatory Commission.

Ideally, Greater than Class C materials should be stored in a deep geologic repository. Interim storage of these materials at selected low-level storage sites may be acceptable. However, the design of such storage facilities should be done by independent experts using standards promulgated by the NRC. One of the National Laboratories such as Brookhaven or Argonne would seem to be a reasonable choice for such design work.

Proposed storage technologies for Greater than Class C wastes should receive thorough review from the scientific community, from the NRC and from the public before being implemented. Facilities eventually accepting these wastes should be regularly monitored by the NRC to ensure that design and safety criteria are met.

The public interest demands that the federal government maintain responsibility for extremely hazardous radioactive materials. The NRC should not be perceived as acquiescing to storage schemes proposed by private enterprise. The agency must not relinquish its leadership role in the safe storage of radioactive materials. By setting safety standards, overseeing independent design efforts and ensuring full review, the NRC can develop public confidence in the national radioactive waste storage program.

Sincerely,

Rich Ferguson, Chair
SC/NRCC

61
(53 FR 17709)

New York State
Low - Level
Radioactive Waste
Siting Commission

JAY D. DUNKLEBERGER • *Executive Director*

July 6, 1988

Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attn: Docketing and Service Branch

Re: 10 CFR Part 61
Proposed Rule

Dear Sir:

This letter conveys the views of the New York State Low-Level Radioactive Waste Siting Commission (Siting Commission) on the proposed modification of 10 CFR Part 61 published in the Federal Register on May 18, 1988. The proposed rule would require disposal of "greater-than-Class C" low-level radioactive waste (LLRW) in a deep geologic repository unless disposal elsewhere has been approved by the Nuclear Regulatory Commission.

The Siting Commission has a direct interest in the proposed rule. In July 1986, New York State enacted the New York LLRW Management Act which provided a detailed plan for establishing a LLRW disposal facility by the 1993 Federal deadline. The Siting Commission is responsible for choosing both a location and disposal method for a LLRW disposal facility in New York.

The Siting Commission has always interpreted the Federal LLRW Policy Act and its amendments as establishing a Federal responsibility for the disposal of commercially generated LLRW with radionuclide concentrations exceeding the limits established in 10 CFR Part 61 for Class C waste. Nevertheless, the lack of a clear Federal statement to date about the ultimate disposal of these "greater-than-Class C" wastes has created an element of uncertainty in New York's planning for development of LLRW disposal capability. By specifying through the proposed rule that these wastes will be disposed of in a geologic repository, unless otherwise approved by the Commission, it removes this uncertainty. We regard this change as beneficial to New York's LLRW disposal program.

1215 Western Avenue • Albany, New York 12203 • (518) 438-6130

The Siting Commission, therefore, supports the proposed rule and urges its adoption.

Sincerely,

Jay D. Dunkleberger
Executive Director

BGG/JDD/rlg

South Carolina Department of Health and Environmental Control

DOCKET NUMBER PROPOSED RULE PR 61 (53FR 17709)

2600 Bull Street
Columbia, S.C. 29201

Commissioner
Michael D. Jarrett

88 JUL -7 P3:25

BRANCH

July 5, 1988

Secretary, U.S. Nuclear
Regulatory Commission
Washington, D.C. 20555

Attention: Docketing and Service Branch

Reference: Page 17709, Federal Register Notice
Vol. 53, No. 96, Dated May 18, 1988
Proposed Rule 10CFR Part 61

Dear Sir:

In regards to the above, the following comments are hereby offered:

The South Carolina Department of Health and Environmental Control, Bureau of Radiological Health supports the proposed rule to require greater than Class C Waste to be disposed of in a manner other than shallow land disposal; e.g., intermediate disposal such as a geological repository unless specific approval is granted.

As an Agreement State with regulatory authority for by-product material waste disposal (low-level radioactive waste) at the Barnwell, South Carolina facility, we urge the NRC to proceed as expeditiously as possible with such rule making.

Thank you for the opportunity to provide comments.

Very truly yours,

Heyward G. Shealy

Heyward G. Shealy, Chief
Bureau of Radiological Health

VRA/md

cc: Mr. Don Nussbaumer, Agreement State Program

GERALD A. DRAKE, M.D.

DOCKET NUMBER
PROPOSED RULE PR 61
(53FR1770)

WINTER ADDRESS:
210 B SPRING LANE
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919-933-0831

SUMMER ADDRESS:
7921 INDIAN GARDEN ROAD
PETOSKEY, MI 49770
616-347-9530

'88 JUL 11 A8:26

OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

July 2.

U.S. Nuclear Regulatory Commission
Washington D.C. 20555
Att: Docketing and Service

Gentlemen:

Concerning 53 FR 96: 17709, I worry that the Department of Energy will dispose of greater than class C wastes in deep-burial not regimented by the NRC.

I would suggest deleting the option for states to have greater than class C wastes and include a requirement for very exact knowledge for over 100 years to be needed as final responsibility.

Yours truly,

Gerald Drake MD

Midwest Interstate Low-Level Radioactive Waste Commission

Room 588 • 350 N. Robert Street • St. Paul, MN 55101 • (612) 293-0126

July 8, 1988

Mr. Samuel Chilk
Secretary
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Chilk:

The Midwest Interstate Low-Level Radioactive Waste Commission has reviewed the proposed rule notice on "Disposal of Radioactive Wastes" (Federal Register, May 18, 1988, p. 177709) and requests that the following comments be considered.

The Midwest Commission noted, in its April 16 comment on the advanced notice of proposed rulemaking (Federal Register, February 27, 1987, p. 5992), that the Nuclear Regulatory Commission (NRC) should "consider the institutional implications of redefining high-level radioactive waste, especially any potential effects on the current structure for management and disposal of low-level radioactive waste." One such implication is the possibility that new commercial low-level radioactive waste disposal facilities could be used for disposal of some greater-than-Class-C (GTCC) waste.

The Midwest Commission supports the basic approach taken by the NRC in requiring that all GTCC waste be disposed of in a geologic repository. However, we request that the NRC amend the language in the proposed rule by limiting the exception to such disposal to Department of Energy (DOE) facilities. The additional wording (underlined) should be inserted in Part 61.55(a)(2)(iv):

> Waste that is not generally acceptable for near surface disposal is waste for which waste form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository as defined in Part 60 of this chapter unless proposals for disposal of such waste in a Department of Energy intermediate disposal site licensed pursuant to this part are submitted to the Commission for approval.

Reasons for inserting the additional language include the following:

1) The additional language is consistent with the regulatory analysis and the NRC desire to accommodate DOE intermediate disposal facilities. The NRC has stated, on

page 17710 of the May 18 Federal Register notice, that the exception to disposal of GTCC wastes in a geologic repository is provided because "the Commission wishes to avoid foreclosing possible use of intermediate disposal facilities by the DOE. If the DOE chooses to develop one or more intermediate disposal facilities, the Commission anticipates that the acceptability of such facilities would be evaluated in the light of the particular circumstances, considering for example the existing performance objectives of 10 CFR Part 61 and any generally applicable radiation protection standards that might have been established by the U.S. Environmental Protection Agency. Technical criteria to implement the performance objectives and environmental standards would be developed by the Commission after the DOE had completed its conceptual design and selected a site for a specific type of facility."

2) According to the Low-Level Radioactive Waste Policy Amendments Act of 1985, GTCC waste is not a state responsibility. New commercial low-level radioactive waste disposal facilities will not be designed for disposal of GTCC wastes, and it is highly unlikely that states will voluntarily accept GTCC waste.

Without the qualifying language, however, the proposed rule invites speculation that new low-level radioactive waste disposal sites will dispose of GTCC waste. Some of the compacts and states developing these sites already have encountered public opposition to the disposal of even Class C waste. In addition, Resnikoff's recent book (Living Without Landfills) has further contributed to public apprehension with its assumption that new sites will be used for disposal of GTCC waste. By limiting the repository exception specifically to DOE facilities, the NRC would eliminate arguments that can now be made regarding an "open door" for disposal of GTCC wastes at low-level radioactive waste sites, despite the denials of compacts and states.

We appreciate this opportunity to comment on the proposed rule. If you have any questions, please do not hesitate to contact our office.

Sincerely,

Teri Vierima

Dr. Teri Vierima
Chair

cc: Midwest Commissioners
Compacts and States

(11)

WALBRIDGE J. POWELL
ENGINEER & GEOLOGIST (206) 232-5295
4314 island crest way mercer island, WA 98040

DOCKET NUMBER
PROPOSED RULE PR 61
(53FR 17709)

July 8, 1988

'88 JUL 18 A10:03

OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

Secretary USNRC
Washington D.C. 20555

Gentlemen:

Subject: Low-level waste Redesignation

I am totally opposed to disposal of "greater than Class C" waste in any facility not regulated by the NRC.

I request then, that the NRC delete the option for states to take greater than Class C waste.

I further request that the NRC include a requirement for any waste hazardous for 10^12 years to be a federal responsibility.

Please include this in the record and place me on the mailing list for any present and future changes in classification of hazardous nuclear wastes both low + high level.

JUL 18 1988

Yours very truly
Walbridge J Powell

State of Vermont

AGENCY OF NATURAL RESOURCES
103 So. Main St.
Center Building
Waterbury, Vermont 05676

OFFICE OF THE SECRETARY

Department of Fish and Wildlife
Department of Forests, Parks, and Recreation
Department of Environmental Conservation
State Geologist
Natural Resources Conservation Council

6 July 1987

Secretary
U.S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Docketing & Service Branch

TO: The Nuclear Regulatory Commission

The proposed rule concerning "greater than Class C" low-level radioactive waste attaches the responsibility for such waste to the federal government as is legally necessary. However, the State of Vermont would urge that other components of the low-level waste stream be included in the Federal Government's area of responsibility, going beyond what the proposed rule suggests.

Our concern is that the remaining waste classified as A, B, and C in 10 CFR 61 includes wastes that are of small volume, but which contain higher concentrations of short and long lived radionuclides that will be hazardous for longer than the institutional control period of 100 years.

It is neither practical nor efficient to require states to be responsible for such wastes. The need to design and build a repository to be secure for 500 years or more adds substantially to the costs of low-level waste disposal and in some respects may increase short-term risks by interfering with appropriate management practices. Furthermore, NRC's systems approach to determining concentrations is built on modeling assumptions that involve Site Characteristics, Design and Operation, Institutional Control, Waste Form and Intruder Barriers. The public finds such modeling unpersuasive and the need to rely on modeling assumptions to assess long-term risks increases the likelihood of strong public opposition. We would prefer to deal with risks that are scientifically more certain, the known decay rates of radioactive substances, and make a state responsible for

waste that decays to innocuous levels within a reasonable time frame such as 100 years.

The Nuclear Regulatory Commission's proposal would make the state responsible for concentrations of waste determined by methods that will be difficult to defend in a public setting. The Low-Level Radioactive Waste Policy Amendments Act makes the states responsible for the waste, but preempts the states from determining what they reasonably can handle.

We, therefore, would request that wastes that will not decay to innocuous levels within 100 years be placed with greater than Class C waste and be handled as a federal responsibility.

Sincerely,

Jonathan Lash

Jonathan Lash, Secretary
Agency of Natural Resources

JL/lw

DOCKET NUMBER
PROPOSED RULE PR 61 (13)
(53FR17709)

OAK RIDGE NATIONAL LABORATORY
OPERATED BY MARTIN MARIETTA ENERGY SYSTEMS, INC.

POST OFFICE BOX 2008
OAK RIDGE, TENNESSEE 37831

'88 JUL 15 P4:26

July 14, 1988

OFFICE OF THE SECRETARY
DOCKETING & SERVICE
BRANCH

Secretary of the Commission
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attention: Docketing and Service Branch

Dear Sirs:

We are submitting the attached comments (Attachment 1) in response to the Proposed Rule for 10 CFR Part 61, "Disposal of Radioactive Wastes," which was published in the *Federal Register* on May 18, 1988.

In the supplementary information for the Proposed Rule, the Commission discussed a recent report which we co-authored entitled "A Proposed Classification System for High-Level and Other Radioactive Wastes." Our objections to this discussion are the subject of our comments in Attachment 1.

Because of the Commission's unusual action of commenting in the *Federal Register* on our report, which was not prepared under its sponsorship, we believe that we deserve an opportunity to respond in kind. Therefore, we request that the Commission take the following further actions.

[1] We request that the Commission explicitly include the substance of our specific objections to the discussion of our report in the Proposed Rule in preparing the supplementary information for the Final Rule. That is, we request that our objections be duly noted in the *Federal Register* itself.

[2] We request that the Commission specifically provide us with the opportunity to review drafts of the supplementary information for the Final Rule as it pertains to our work. This would provide a mechanism for resolving any further misunderstandings of our work that might arise before publication of the Final Rule in the *Federal Register*.

Should the Commission decide to withdraw the Proposed Rule for 10 CFR Part 61 or reinstitute rulemaking proceedings for revising the definition of the term "high-level radioactive waste" in 10 CFR Part 60, rather than proceed with promulgation of the Final Rule for amending 10 CFR Part 61, then our requests would still apply to these actions.

COMMENTS ON NRC PROPOSED RULE 10 CFR PART 61 DISPOSAL OF RADIOACTIVE WASTES

D. C. Kocher
Health and Safety Research Division

A. G. Croff
Chemical Technology Division

Oak Ridge National Laboratory
Oak Ridge, TN 37831

Introduction

On May 18, 1988, the Nuclear Regulatory Commission (NRC) published a Proposed Rule to amend 10 CFR Part 61 (53 FR 17709). The proposed amendments would require disposal of "greater-than-Class-C" low-level waste in a deep geologic repository, unless disposal elsewhere has been approved by the NRC.

The supplementary information for the Proposed Rule discusses a previous Advance Notice of Proposed Rulemaking (ANPRM), which announced the intent of the NRC to revise the definition of the term "high-level radioactive waste" (HLW) in 10 CFR Part 60. The Proposed Rule clearly indicates that the NRC no longer intends to proceed with revising the traditional definition of HLW as the primary wastes from reprocessing of spent nuclear fuel. In presenting its rationale for this decision, the NRC discussed a recent report which we co-authored on the development of generally applicable and risk-based definitions of HLW and other waste classes.

The purpose of these comments is to express our objections to the NRC's discussion of our report in the supplementary information for the Proposed Rule. The discussion contains serious factual errors concerning our proposed definition of HLW and could result in a misleading view of our entire waste classification system.

In order to provide a framework for discussing our objections in detail, the paragraph in the supplementary information for the Proposed Rule that describes our report is presented in its entirety below.

> Following publication of the ANPRM, a technical report (Kocher, D. C. and A. G. Croff, *A Proposed Classification System for High-Level and Other Radioactive Wastes*, ORNL/TM-10289, Oak Ridge National Laboratory, 1987) was published which attempted to provide a

generally acceptable for near-surface land disposal; these limits are obtained from the NRC's 10 CFR Part 61 and its supporting documentation and methodology. Indeed, a similar approach to defining HLW was discussed by the NRC in the ANPRM for 10 CFR Part 60.

A second error concerns the attribute "highly radioactive" included in our proposed definition of HLW. As implied by the NRC, this attribute is related to short-term risks resulting from high levels of decay heat and external radiation. In particular, we proposed that HLW, in addition to requiring permanent isolation as defined above, would have a power density greater than 50 W/m^3 or an effective dose-equivalent rate greater than 1 Sv/h (100 rem/h) at a distance of 1 m from the waste form.

However, the next-to-last sentence of the NRC's discussion is incorrect in implying that we considered short-term risks only during waste storage and handling. In Sections 3.1.3 and 4.2.2 of our report, we emphasized that the proposed quantitative and generally applicable definition of "highly radioactive," particularly in regard to the level of decay heat, was based primarily on the need to mitigate shorter-term risks from waste disposal. As indicated in Section 4.2.5, Appendix A.3, and Table 1, decay heat would be the controlling factor in determining wastes that are "highly radioactive," except for those wastes in which Cs-137 is the predominant radionuclide.

Potential for Misinterpretation of Waste Classification System

We now address our concerns regarding the potential for misinterpretation of our entire waste classification system.

The NRC's discussion of our report emphasizes our analysis of risks from disposal of wastes in "intermediate" disposal facilities, which we refer to as greater confinement disposal (GCD). On the basis of an assumed scenario for exposure of an inadvertent intruder at a hypothethical GCD facility, we estimated maximum concentrations of radionuclides that would be acceptable for disposal. Wastes with concentrations of radionuclides greater than these limits then would require disposal in a deep geologic repository (or another system with equivalent waste-isolation capabilities). This analysis is in accord with one of the approaches to defining HLW discussed by the NRC in the ANPRM for 10 CFR Part 60.

The NRC's discussion of our analysis for GCD is misleading in three important respects. First, the NRC implies that we attempted to use this analysis in quantifying the attribute "requires permanent isolation" and, thus, in developing our generally applicable definition of HLW. In fact, however, our analysis for GCD is completely irrelevant to our proposed

definition of HLW. This is evidenced by the definition of "requires permanent isolation" discussed in the previous section of these comments and by several parts of our report (e.g., Fig. C-1 and Sections 3.1.4, 4.3, and 4.6).

Second, the next-to-last sentence in the NRC's discussion implies that we developed our proposed definition of HLW only after the analysis for GCD appeared too uncertain to be useful. This is not the case. The definitions of HLW and the other waste classes are completely developed in our report before the role of GCD is first discussed in Section 4.6. Our analysis for GCD was presented only to encourage further investigations into the feasibility of intermediate disposal facilities. Furthermore, as indicated in Section 4.6 and Appendix C.1 of our report, we believe it is not uncertainties in the intruder dose analysis that preclude defining HLW at the present time on the basis of GCD.

We recognized that a waste classification system which could be implemented at the present time must be consistent, to the fullest extent possible, with existing law and regulations (see Section 1.2 of our report). Therefore, at the beginning of our work, we concluded that a generally applicable waste classification system should require only two disposal technologies, i.e., near-surface land disposal and deep geologic repositories, because these are the only technologies for which the legal and regulatory framework has been established. We recognized, as has the NRC, that it is impractical at present to develop a definition of HLW based on the existence of GCD, primarily because the required legal and regulatory framework is not in place. We would also note that our waste classification system is compatible with the NRC's proposed amendment to 10 CFR Part 61 regarding disposal of greater-than-Class-C low-level waste in a deep geologic repository, except we would call such waste by a different name.

Third, the NRC's discussion seems to imply that our analysis for GCD supports the NRC's decision not to revise the definition of HLW. On the contrary, noting again that our analysis for GCD was not relevant to our waste classification system, we believe that our work and the support it received during extensive peer reviews shows that a reasonable quantitative, generally applicable, and risk-based definition of HLW and other waste classes can be implemented at the present time.

Summary

In conclusion, we would summarize the factual errors and potential for misinterpretation in the NRC's discussion of the report on our proposed waste classification system as follows.

- The NRC is incorrect in stating that our approach to defining HLW is based only on consideration of short-term risks associated with decay heat and external radiation but not on consideration of long-term risks from waste disposal.

- The NRC is incorrect in implying that we considered only short-term risks during waste handling and storage in defining HLW, but did not consider short-term risks during waste disposal.

- The NRC's discussion of our analysis of risks from disposal of wastes in intermediate disposal facilities is potentially misleading, because it implies that (1) our initial goal was to use this analysis in developing a definition of HLW, (2) we developed an alternative definition of HLW only after our analysis for intermediate disposal facilities proved too uncertain to be useful, and (3) our analysis for intermediate disposal facilities supports the NRC's decision not to revise the definition of HLW. None of these implications are correct.

A PROPOSED CLASSIFICATION SYSTEM FOR HIGH-LEVEL AND OTHER RADIOACTIVE WASTES*

D. C. Kocher
Health and Safety Research Division

A. G. Croff
Chemical Technology Division

Oak Ridge National Laboratory
Oak Ridge, TN 37831

ABSTRACT

This paper presents a proposal for quantitative, generally applicable, and risk-based definitions of high-level and other radioactive wastes. Heretofore, high-level waste (HLW) has been defined only qualitatively as waste from chemical reprocessing of spent nuclear fuel. On the basis of the definition of HLW in the Nuclear Waste Policy Act of 1982 and previous descriptions of reprocessing wastes, we propose a definition based on the concept that HLW is any waste which is highly radioactive and requires permanent isolation. This conceptual definition of HLW leads to a two-dimensional waste classification system in which one axis, related to "highly radioactive," is associated with shorter-term risks from waste management and disposal due to high levels of decay heat and external radiation, and the other axis, related to "requires permanent isolation," is associated with longer-term risks from waste disposal. Wastes that are highly radioactive are defined quantitatively as wastes with a decay heat (power density) greater than 50 W/m^3 or an external dose-equivalent rate greater than 100 rem/h (1 Sv/h) at a distance of 1 m

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from the waste, whichever is more restrictive. Wastes that require permanent isolation are defined quantitatively as wastes with concentrations of radionuclides greater than the Class-C limits that are generally acceptable for near-surface land disposal, as obtained from the Nuclear Regulatory Commission's 10 CFR Part 61 and its associated methodology. This proposal leads to similar definitions of two other waste classes: transuranic (TRU) waste and equivalent is any waste that requires permanent isolation but is not highly radioactive; and low-level waste (LLW) is any waste that does not require permanent isolation, without regard to whether or not it is highly radioactive. This paper also discusses (1) various considerations on the intended implementation of the waste classification system, (2) the intended relationship between definitions of waste classes, selection of technologies for waste disposal, and development of waste acceptance criteria, and (3) impacts of the waste classification system on selected commercial and defense wastes.

1. INTRODUCTION

This paper presents a proposed definition of high-level radioactive waste (HLW)* that is (1) quantitative, (2) generally applicable to any waste, regardless of its source or isotopic composition, and (3) based primarily on consideration of risks from waste management and disposal. From the proposed definition of HLW, we also develop quantitative, generally applicable, and risk-based definitions of two other waste classes: transuranic (TRU) waste and equivalent, and low-level waste (LLW). The three waste classes defined herein are intended to encompass all radioactive wastes. As demonstrated below, quantitative and generally applicable definitions do not presently exist for any class of radioactive waste.

The impetus for this work was the Nuclear Waste Policy Act (NWPA) of 1982 (Public Law 97-425), which defines HLW as -

> "(A) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and
>
> (B) other highly radioactive material that the [Nuclear Regulatory] Commission, consistent with existing law, determines by rule requires permanent isolation."

Similar to previous definitions of HLW,[1,2] the definition in the NWPA is only qualitative; i.e., the terms "contains fission products in sufficient concentrations," "highly radioactive," and "requires permanent isolation" are not quantified. The definition in clause (A) represents the

* The acronyms used in this paper are listed in Table I.

traditional description of HLW as the more hazardous radioactive wastes from a particular source, i.e., from chemical reprocessing of spent nuclear fuel.[1,2] The definition in clause (B) represents a significant departure from the traditional source-based definition by calling for development of a generally applicable definition of HLW, i.e., one that is not based on the source of the waste.

The NWPA assigns responsibility for developing a generally applicable definition of HLW to the Nuclear Regulatory Commission (NRC). The NRC has indicated that a revision of 10 CFR Part 60 may be forthcoming in which a quantitative and generally applicable definition of HLW will be developed, in response to clause (B), that will also encompass and quantify the traditional source-based definition in clause (A).[2] This approach to defining HLW has been taken in this paper.

Two other classes of radioactive waste have been defined in law and regulations: TRU waste and LLW. TRU waste is defined, in part, as waste containing more than 100 nCi/g of long-lived, alpha-emitting transuranic radionuclides.[3,4] However, since the definitions of TRU waste explicitly exclude HLW and, as demonstrated above, HLW currently is defined only qualitatively, a quantitative definition of TRU waste that unambiguously distinguishes such waste from HLW is lacking.

LLW is defined in the Low-Level Radioactive Waste Policy Amendments Act (LLRWPAA) of 1985 (Public Law 99-240), but only by exclusion. Since the definition of LLW particularly excludes HLW, a quantitative and generally applicable definition of LLW also is lacking. The LLRWPAA also assigns to the NRC the responsibility for classifying radioactive materials as LLW. In this regard, it is important to note that the NRC's 10 CFR Part 61 does not define LLW, but only establishes classes of waste

(Classes A, B, and C) that are generally acceptable for near-surface land disposal.[5,6] We also note that the definition of LLW in the LLWRPAA implicitly includes TRU waste.

The foregoing discussion on the definitions of radioactive wastes in current law and regulations clearly indicates the need for development of a classification system that (1) encompasses all radioactive wastes and (2) unambiguously distinguishes between different waste classes. Such a waste classification system is proposed in this paper. We retain the traditional names of waste classes (i.e., HLW, TRU waste, and LLW), except TRU waste herein is called TRU waste and equivalent. But for the first time, we develop quantitative and generally applicable definitions of the three waste classes based on common considerations of risks from waste management and disposal.

This paper is organized as follows. Section 2 describes the conceptual approach used to obtain quantitative, generally applicable, and risk-based definitions of HLW, TRU waste and equivalent, and LLW; and Section 3 presents the proposed quantification of the waste classification system. Sections 4-6 then discuss (1) various considerations on the intended implementation of the waste classification system, (2) the intended relationship between the definitions of waste classes, selection of technologies for waste disposal, and development of waste acceptance criteria for specific disposal facilities, and (3) impacts of the waste classification system on selected commercial and defense wastes, respectively. In Section 5, we particularly emphasize that some form of greater confinement disposal could provide an acceptable alternative to deep geologic repositories for relatively dilute wastes classified as HLW or TRU waste and equivalent. Finally, Section 7 summarizes the proposed

waste classification system, compares the definitions of waste classes with the current definitions described above, and discusses important conclusions from this study.

The discussions and analyses in this paper usually are presented only in summary form. A complete presentation of the proposed waste classification system is contained in a recent report.[7]

2. CONCEPTUAL DEFINITIONS OF HIGH-LEVEL WASTE AND OTHER WASTE CLASSES

This section presents the conceptual approach used to obtain quantitative, generally applicable, and risk-based definitions of HLW, TRU waste and equivalent, and LLW.

2.1 Conceptual Definition of High-Level Waste

It has long been recognized that the more hazardous radioactive wastes from chemical reprocessing of spent nuclear fuel have two important properties:[1]

- high concentrations of fission products, principally ^{90}Sr and ^{137}Cs in wastes that are aged for about a decade, which produce high heat generation rates and external radiation doses; and
- high concentrations of long-lived radionuclides, principally alpha-emitting TRU radionuclides, that would result in high internal radiation doses per unit activity of inhaled or ingested material.

HLW traditionally has been defined in terms of the source of the waste,

rather than its properties, because fuel reprocessing was the only significant source of waste with these properties.

The properties of reprocessing wastes described above also have long been associated with risks from waste management and disposal.[1] First, high heat generation rates and external doses necessitate systems for heat removal and shielding to limit shorter-term risks to workers and the public during waste handling and storage. The NRC also has recognized the potential importance of decay heat in limiting risks from disposal of HLW in deep geologic repositories by requiring substantially complete containment of radionuclides within waste packages during the period of highest heat generation (i.e., for at least 300 years).[8] Second, high concentrations of long-lived radionuclides necessitate waste disposal systems that provide a high degree of isolation from the biosphere to limit longer-term risks to the public.

In this paper, we assume that the two properties of reprocessing wastes described above, and their associations with risks from waste management and disposal, provide a suitable basis for a quantitative, generally applicable, and risk-based definition of HLW. The view that HLW can be characterized in this way, regardless of the source of the waste, is supported by the definition in clause (B) of the NWPA given in Section 1 - namely, that HLW is "other highly radioactive material that...requires permanent isolation."

Thus, we propose a definition based on the concept that HLW has two distinct attributes:

HLW is any waste that is -

(1) highly radioactive and

(2) requires permanent isolation.

This conceptual definition of HLW results in a two-dimensional waste classification system in which one axis is related to "highly radioactive" and the other axis to "requires permanent isolation." Furthermore, we propose (1) that "highly radioactive" is a general attribute related to the potential for significant shorter-term risks from waste management and disposal due to high heat generation rates (power densities) or external dose rates and (2) that "requires permanent isolation" is a general attribute related to limitation of longer-term risks from waste disposal.

2.2 Conceptual Definitions of Other Waste Classes

From the proposed definition of HLW, conceptual definitions of the other two classes of radioactive waste then follow immediately:

[1] TRU waste and equivalent is any waste that requires permanent isolation but is not highly radioactive; and

[2] LLW is any waste that does not require permanent isolation, without regard to whether or not it is highly radioactive.

The first of these classes is called TRU waste and equivalent because it not only encompasses traditional TRU waste but also may include high concentrations of long-lived, non-TRU radionuclides (e.g., ^{14}C, ^{99}Tc, and ^{129}I). The conceptual definition of LLW is consistent with the NRC's 10 CFR Part 61 in the sense that wastes that are generally acceptable for near-surface land disposal are defined therein only from consideration of longer-term risks from waste disposal, but without regard to shorter-term risks due to high levels of decay heat or external radiation.[5,6]

2.3 Qualitative Depiction of Waste Classification System

The two-dimensional waste classification system that results from the proposed conceptual definitions of HLW, TRU waste and equivalent, and LLW is depicted in Fig. 1. The vertical axis is related to shorter-term risks due to the levels of decay heat and external radiation. Although decay heat and external radiation depend on the total activity concentration of all radionuclides, high levels result primarily from high concentrations of relatively short-lived radionuclides. The horizontal axis is related to longer-term risks from waste disposal, and depends only on the total activity concentration of long-lived radionuclides. The Permanent Isolation boundary separates wastes that require permanent isolation (HLW or TRU waste and equivalent) from those that do not (LLW). The Highly Radioactive boundary then separates HLW from TRU waste and equivalent, but has no bearing on the definition of LLW.

3. QUANTITATIVE DEFINITIONS OF HIGH-LEVEL WASTE AND OTHER WASTE CLASSES

This section presents the proposed quantification of the Permanent Isolation and Highly Radioactive boundaries depicted in Fig. 1. The quantification of these boundaries is based on considerations of risk. We focus principally on risks from waste disposal, since disposal is the primary goal of waste management. We first develop the definition of the Permanent Isolation boundary, because this boundary is used in defining all three waste classes, and then develop the definition of the Highly Radioactive boundary.

3.1 Quantification of Permanent Isolation Boundary

As described in Section 2.1, we associate the attribute "requires permanent isolation" with longer-term risks from waste disposal due to high concentrations of long-lived radionuclides. We quantify the Permanent Isolation boundary on the basis of the concept that disposal systems for HLW or TRU waste and equivalent must limit radiation doses (risks) to the public to acceptable levels.

It is important to recognize that the concept of "permanent isolation" has been applied in law and regulations to the disposal of all radioactive wastes; e.g., see refs. 3-5, the NWPA, and the LLRWPAA. For any waste and regardless of the disposal technology used, "permanent" means that there is no intent to recover the waste after disposal, and "isolation" refers to requirements for long-term protection of public health. Thus, for example, "permanent isolation" does not necessarily imply disposal in deep geologic repositories. The intended relationship between "requires permanent isolation," as defined in this paper, and the selection of disposal technologies is discussed in Section 5.

3.1.1 *Definition of Permanent Isolation Boundary*

At the present time, near-surface land disposal and deep geologic repositories are the only technologies for waste disposal that are recognized in law and for which radiation standards and technical criteria[3-5,8,9] have been established. However, the regulations for these technologies differ in the following important respect: whereas maximum concentrations of radionuclides that are generally acceptable for near-surface land disposal have been established,[5,6] minimum concentrations of

radionuclides that would require deep geologic repositories or equivalent for protection of public health have not been established.[2]

In order to provide reasonable compatibility with existing law and regulations, we propose the following quantitative and generally applicable definition of wastes that require permanent isolation:

"Requires permanent isolation" means -

- wastes with concentrations of radionuclides greater than the Class-C limits that are generally acceptable for near-surface land disposal, as obtained from the NRC's 10 CFR Part 61 and its associated methodology.[5,6,10,11]

From the conceptual definitions of the three waste classes given in Sections 2.1 and 2.2, LLW includes only those wastes that are generally acceptable for near-surface land disposal, whereas the other two classes include all wastes that are not generally acceptable for such disposal.

3.1.2 *Radionuclide Concentrations Corresponding to Permanent Isolation Boundary*

From the definition of "requires permanent isolation" given above, concentrations of radionuclides that correspond to the Permanent Isolation boundary are based entirely on the NRC's 10 CFR Part 61 and its associated methodology. The resulting boundary concentrations for selected radionuclides are given in Table II, and were obtained from the following sources:

- Tables 1 and 2 of the Final Rule[5] for ^{14}C, ^{59}Ni, ^{63}Ni, ^{90}Sr, ^{94}Nb, ^{99}Tc, ^{129}I, and ^{137}Cs;

- Section 7 of Appendix C of the Final Environmental Impact Statement (FEIS)[6] for all TRU radionuclides;

- Table 4.5 of the Main Report of the FEIS[6] for ^{135}Cs, ^{235}U, and ^{238}U;

- Table 4-3 of Volume 2 of the revised impacts analysis methodology[11] for ^{226}Ra; and

- calculations of Class-C limits which we performed, using the revised impacts analysis methodology,[10,11] for ^{108m}Ag, ^{126}Sn, ^{210}Pb, ^{227}Ac, ^{229}Th, ^{230}Th, ^{232}Th, ^{231}Pa, ^{232}U, ^{233}U, ^{234}U, and ^{236}U.

We have considerably expanded the list of radionuclides for which Class-C limits are given in the Final Rule[5] and the FEIS[6] in order to provide a generally applicable definition; the NRC established Class-C limits only for those radionuclides expected to be of primary importance in commercial wastes that could be acceptable for near-surface land disposal.[5,6] The boundary concentrations for ^{241}Pu, ^{243}Cm, and ^{244}Cm are based on the Class-C limits for their respective longer-lived daughter products ^{241}Am, ^{239}Pu, and ^{240}Pu and the half-lives of each parent and daughter.[5,6]

There are two noteworthy aspects of the boundary concentrations in Table II. First, whereas Table 1 of the Final Rule[5] gives a Class-C limit of 100 nCi/g for all long-lived, alpha-emitting TRU radionuclides and Table 4-3 of ref. 11 gives 20 nCi/g for ^{226}Ra, we use the separate concentration limits in Ci/m^3 for each TRU radionuclide given in the FEIS[6] and a limit for ^{226}Ra in the same units because: (1) activity per unit volume, not per unit mass, is the quantity directly related to the limits on dose to an inadvertent intruder at a disposal site, which provide one of the bases for the NRC's Class-C limits;[5,6] and (2) a single Class-C

limit for several TRU radionuclides is not appropriate for a generally applicable definition, due to considerable differences in some cases in the dose to an intruder per unit concentration in the disposal facility, but was used by the NRC to represent expected mixtures of TRU radionuclides in commercial wastes.[6] In converting the Class-C limit for ^{226}Ra from nCi/g to Ci/m^3, we assumed a waste density of 1.6 g/cm^3, in agreement with the NRC's assumption for TRU radionuclides.[6]

Second, the NRC's revised impacts analysis methodology[10,11] contains models and parameter values that differ in many respects from those used in developing the Class-C limits for the Final Rule.[5,6] In addition, the Class-C limits we obtained from the revised methodology were based on a limit on annual effective dose equivalent[12] to an inadvertent intruder of 0.5 rem (5 mSv), whereas the Class-C limits in the Final Rule were based on similar limits on annual dose equivalent to whole body or the critical organ.[5,6] We believe that our choice of retaining the Class-C limits that were developed for the Final Rule, even though they are based on models and data bases that since have been updated by the NRC, but calculating the Class-C limits for the other radionuclides using the revised methodology provides the most reasonable balance between the goals of (1) preserving the limits that are well established in 10 CFR Part 61 and (2) defining the Permanent Isolation boundary using current calculational methods. However, because of the inconsistencies in the results obtained from the NRC's original and revised methodologies, which cannot be completely reconciled,[7] the Class-C limits that we calculated from the revised methodology are regarded as provisional.

Wastes usually contain mixtures of radionuclides. A determination of whether such wastes require permanent isolation is based on the sum-of-

fractions rule; i.e., wastes require permanent isolation if the ratios of radionuclide concentrations to the corresponding boundary concentrations in Table II, summed over all radionuclides, exceed unity.

Because of the way in which the Permanent Isolation boundary is defined, a separate and explicit quantitative definition of a "long-lived" radionuclide is not needed. Instead, it is sufficient to recognize that a radionuclide is "long-lived" only if it can exist in concentrations greater than its Class-C limit; otherwise, the radionuclide will always be classified as LLW. The Class-C limit for any radionuclide is based, in part, on an assumption that exposures of inadvertent intruders do not occur until 500 years after disposal.[5,6] Therefore, the minimum half-life that would be "long-lived" generally is about 15-20 years, because radionuclides with shorter half-lives will always decay within 500 years to levels sufficient to meet a dose limit for intruders. The minimum half-life that would be "long-lived" is also radionuclide-specific, because the value depends on the transport of radionuclides through environmental pathways and on the dose per unit exposure.[6,10]

3.2 Quantification of Highly Radioactive Boundary

As described in Section 2.1, we associate the attribute "highly radioactive" with shorter-term risks from waste management and disposal due to high levels of decay heat (power density) or external radiation. We quantify the Highly Radioactive boundary on the basis of the concept that, at some level of power density or external radiation, engineered systems or other design considerations are required for heat removal or radiation shielding in order to prevent undesirable occurrences that could

result in unacceptable consequences, i.e., to limit risks to acceptable levels.

3.2.1 *Level of Power Density That Defines Highly Radioactive Boundary*

In order to quantify a level of power density that defines the Highly Radioactive boundary, we examined a variety of waste management and disposal systems and estimated the power densities that would limit system design or operation if effective control measures for heat removal were not taken to prevent undesirable occurrences. The results of these analyses[7] are summarized below.

- A limit on power density of about 50 W/m^3 would be required to limit the temperature rise to less than 55 °C (100 °F) in a stack of waste containers with a diameter of 5 m, which is a representative stack dimension for waste storage and disposal. The assumed limit on temperature rise should be sufficient to prevent degradation of waste materials or boiling of water that contacts waste containers.

- During storage of liquid wastes in large underground tanks, power densities above about 10-50 W/m^3 require active cooling systems to prevent self-boiling of the waste.[13,14]

- The power density in a transport container for contact-handled (CH) defense TRU waste[9] is limited to 40 W/m^3.[15] At this power density, decay heat is not a principal consideration in design of the transport containers.

- Power densities above about 100 W/m^3 require special design

considerations for heat dissipation for waste disposal in deep geologic repositories in a variety of environments.[16]

- At the Waste Isolation Pilot Plant (WIPP) facility for disposal of defense TRU waste,[17] the limit on power density for CH waste is 15 W/m^3.[9] At this power density, close stacking of waste containers is permitted and would not cause unacceptable thermal impacts in the host rock.[9] For remote-handled (RH) waste, which generally has a higher power density than CH waste, the limit on power density for the standard waste package is 300 W/m^3.[9] However, this power density is sufficiently high that a a limit on the number of waste containers per unit area is prescribed in order to prevent unacceptable heat loadings.[9]

The analyses summarized above indicate that power densities above about 10-100 W/m^3 require special control measures to mitigate potentially unacceptable shorter-term risks in a variety of waste systems. Although the choice of a power density to define the Highly Radioactive boundary thus is somewhat arbitrary, the limiting power densities for the different systems analyzed do not vary by more than an order of magnitude.

From these results, we propose that a power density of 50 W/m^3 provides the first part of a quantitative and generally applicable definition of the Highly Radioactive boundary. This choice is based primarily on the estimated limit on power density that would be required to limit the temperature rise in a stack of waste containers and the approximate power density that requires special design considerations for heat dissipation in deep geologic repositories, because both of these situations are relevant for limiting shorter-term risks from waste

disposal. A similar power density is obtained from the analyses on self-boiling of liquid wastes in large storage tanks, but this situation provides a less satisfactory basis for our definition because liquid wastes are not in a form appropriate for disposal.

3.2.2 *Level of External Radiation That Defines Highly Radioactive Boundary*

While we have shown in Section 3.2.1 that reasonable technical analyses related to limitation of shorter-term risks from waste management and disposal can be used to select a level of power density that defines the Highly Radioactive boundary, the choice of a level of external radiation to define this boundary is rather arbitrary. On the one hand, external radiation generally is less important than power density in limiting shorter-term risks from waste disposal. For example, the high levels of electron and photon radiation that would occur in borosilicate glass containing commercial reprocessing wastes, e.g., absorbed dose rates of about 1 Mrad/h (10 kGy/h), have little effect on leaching of radionuclides from the waste form and other aspects of waste-package performance; and radiolysis of water often has little effect on leaching of waste forms for photon dose rates in excess of the same value.[18] On the other hand, levels of external radiation that would not require shielding of waste or limits on exposure times to prevent unacceptable doses to radiation workers, i.e., annual dose equivalents greater than 5 rem (50 mSv),[19] are quite low.

We propose that an external dose-equivalent rate of 100 rem/h (1 Sv/h) at a distance of 1 m from the waste provides the second part of a

quantitative and generally applicable definition of the Highly Radioactive boundary. The dose rate includes contributions from neutrons as well as photons. This choice is supported by the limit of 100 rem/h at the surface of a waste package for RH TRU waste at the WIPP facility;[9] the WIPP acceptance criterion is relevant because the purpose of the Highly Radioactive boundary is to distinguish TRU waste and equivalent from HLW. We chose a distance of 1 m instead of the surface of a waste package for use in the definition, because the former is a more likely location of individuals who could receive accidental exposures.

3.2.3 *Summary of Definition of Highly Radioactive Boundary*

From the analyses summarized in Sections 3.2.1 and 3.2.2, we propose the following quantitative and generally applicable definition of wastes that are highly radioactive:

> "Highly radioactive" means -
>
> (1) a power density greater than 50 W/m^3 or
>
> (2) an external dose-equivalent rate greater than 100 rem/h (1 Sv/h) at a distance of 1 m from the waste.

Whether or not a waste is highly radioactive is determined by the more restrictive of these two criteria.

3.2.4 *Radionuclide Concentrations Corresponding to Highly Radioactive Boundary*

A determination of whether waste is highly radioactive at the present time can be based on direct measurements of power density and external

dose rate. However, as discussed in Sections 4.1 and 4.2, classification of wastes for altered waste forms and at future times is important. Predictions of power density and external dose rate in such cases require knowledge of radionuclide concentrations in the waste; i.e., it is necessary to determine concentrations of individual radionuclides that correspond to the Highly Radioactive boundary.

Although high levels of power density and external dose rate are determined primarily by the presence of shorter-lived radionuclides, the depiction of the waste classification system in Fig. 1 shows that concentrations of radionuclides that correspond to the Highly Radioactive boundary need to be determined only for those radionuclides that also are sufficiently long-lived that they could require permanent isolation. As discussed in Section 3.1.2, radionuclides with half-lives shorter than about 15-20 years can be excluded from consideration, because they would be classified as LLW in any concentration. Conversely, radionuclides with half-lives greater than a few tens of thousands of years need not be considered, because such radionuclides have low specific activities and, thus, cannot occur in sufficient concentrations to be highly radioactive according to our definition.

The calculation of radionuclide concentrations corresponding to a given power density is straightforward. The power density (W/m^3) per unit concentration of a radionuclide (Ci/m^3) is proportional to the total energy (MeV) per disintegration (dis) of all ionizing radiations emitted in the decay. The radionuclide concentration C_i corresponding to the proposed Highly Radioactive boundary of 50 W/m^3 is given in terms of the total energy per disintegration E_T by[7]

$$C_i(Ci/m^3) = (8.45 \times 10^3)/E_T(MeV/dis) , \qquad (1)$$

where the constant has units of MeV-Ci/dis-m^3.

The calculation of radionuclide concentrations corresponding to a given external dose-equivalent rate at a particular distance from the waste is considerably more complex than the calculation for power density described above. The dose rate per unit concentration of a radionuclide depends not only on the particular decay spectrum of photons but also on (1) the size, geometrical configuration, and orientation of the waste package and (2) the shielding provided by materials in the waste package and any materials between the waste package and the receptor. Thus, a model is needed to relate external dose rate to concentrations of particular radionuclides in the waste.

In this analysis, we assume that the waste package is a 55-gallon drum in which radionuclides are mixed uniformly with dirt, polyethylene, concrete, or air in order to simulate a variety of filler materials. This type of waste package often is used for near-surface land disposal[6] and is acceptable for disposal of CH TRU waste at the WIPP facility.[9] The waste package is assumed to contain a uniform concentration of ^{137}Cs, because this is the only radionuclide of concern that reasonably can exist in concentrations sufficient to exceed the Highly Radioactive boundary for which an external dose-equivalent rate of 100 rem/h (1 Sv/h) at a distance of 1 m from the waste is more restrictive than a power density of 50 W/m^3. For all other radionuclides, either the half-life is too short to be of concern for defining the Highly Radioactive boundary, the power density is more restrictive than external dose rate, expected concentrations in wastes are far below levels that correspond to the Highly Radioactive boundary, or the half-life is sufficiently long that the radionuclide cannot reasonably occur in concentrations that would give an external

dose-equivalent rate of 100 rem/h.

The estimated external dose-equivalent rate to a reference adult at a distance of 1 m in air from the assumed waste package is in the range 0.008-0.034 rem/h per Ci/m^3 of ^{137}Cs, depending on the assumed filler material and orientation of the drum relative to the receptor location.[7] On the basis of these results, we conclude that a ^{137}Cs concentration of about 5 x 10^3 Ci/m^3 corresponds to an external dose-equivalent rate of 100 rem/h (1 Sv/h) at a distance of 1 m from the waste.

The concentrations of selected radionuclides that correspond to the Highly Radioactive boundary, as obtained from the calculations described above, are given in Table III. In calculating the boundary concentration for all radionuclides except ^{137}Cs from eq. (1) on the basis of a power density of 50 W/m^3, the total decay energy of the radionuclide and any short-lived daughter products was obtained from ref. 20.

We note that use of the sum-of-fractions rule to determine whether wastes containing mixtures of radionuclides are highly radioactive is not strictly correct for wastes containing ^{137}Cs and other radionuclides, because the boundary concentration is based on external dose rate for ^{137}Cs but power density otherwise. However, use of the sum-of-fractions rule does not lead to serious errors in this case, because the concentration of ^{137}Cs that corresponds to a power density of 50 W/m^3 is only about twice the value in Table III.

We also note that the concentrations of the important fission products ^{90}Sr and ^{137}Cs corresponding to the Highly Radioactive boundary are the same as their respective Class-C limits for wastes that are generally acceptable for near-surface land disposal.[5] These results are largely fortuitous, because the Class-C limits are not based on

consideration of shorter-term risks due to high levels of power density or external radiation.[6] This is particularly the case for ^{137}Cs, because of the rather arbitrary choice of an external dose-equivalent rate to define the Highly Radioactive boundary. However, we suggest in Section 6.5 that use of the Class-C limits to define both the Highly Radioactive and the Permanent Isolation boundaries for ^{90}Sr and ^{137}Cs has desirable consequences for the proposed waste classification system.

3.3 Depiction of Quantitative Waste Classification System

The quantitative and generally applicable waste classification system that results from the definitions of the Permanent Isolation and Highly Radioactive boundaries given in Sections 3.1 and 3.2 is depicted in Fig. 2. The quantification of these boundaries in terms of the concentrations of individual radionuclides given in Tables II and III permits an unambiguous classification of any radioactive waste.

4. CONSIDERATIONS ON IMPLEMENTATION OF WASTE CLASSIFICATION SYSTEM

This section discusses various considerations on the intended implementation of the proposed waste classification system including (1) the waste forms to which the definitions would apply, (2) the time after generation at which waste would be classified, (3) the volume of waste to which the definitions would apply, (4) the classification of spent nuclear fuel, and (5) the classification of surface-contaminated wastes. In each case, the principal consideration is that disposal is the primary goal of waste management.

4.1 Role of Waste Form in Waste Classification System

We intend that the waste classification system should be applied to expected radionuclide concentrations in waste forms that are suitable for final disposal. Thus, the classification system would be applied only to specified types of solid wastes.[3-5,8,9]

During processing and storage, many wastes occur as liquids or sludges. While such wastes could be classified according to the proposed system, it is important to recognize that conversion of liquids or sludges to solid forms suitable for disposal could significantly change the radionuclide concentrations and, thus, the waste classification. In addition, concentrations of radionuclides in solid wastes could change significantly during processing for disposal (e.g., via waste compaction). Therefore, we recommend that any wastes not in a form intended for disposal should be classified on the basis of the radionuclide concentrations in the expected final waste form.

4.2 Role of Time in Waste Classification System

We intend that the waste classification system should be applied to expected radionuclide concentrations at the time of final disposal. Sound waste management practices often will involve decontamination, concentration, solidification, partitioning, or other waste treatments that could change the classification, and defining wastes for the time of final disposal would encourage flexibility in developing such practices.

We do not intend that disposal can be postponed indefinitely in order to change a waste classification by radioactive decay, because expeditious disposal should be an important goal of waste management. We suggest that

a limit of 100 years after waste generation be placed on the assumed time for disposal, in accordance with the time period currently assumed by regulatory authorities for active institutional controls over disposal facilities.[3,5] A time period of 100 years between generation and disposal would allow significant decay of the important fission products ^{90}Sr and ^{137}Cs and corresponding reductions in the level of decay heat that is important for the design of some disposal systems.[8,9,16]

4.3 Role of Waste Volume in Waste Classification System

We intend that wastes should be classified on the basis of concentrations of radionuclides averaged over the volume of the waste package that will be used for final disposal. It then would be improper in most cases to change a waste classification by placing a relatively small volume of waste in a package that is much larger than needed for disposal. However, some wastes may be of such small volume but also so highly radioactive that waste packages much larger than the source itself are needed to protect workers during disposal operations. In such cases, we propose that the radionuclide concentrations can be averaged over a volume not to exceed 1 m^3, which is the volume of a standard package for RH TRU waste at the WIPP facility.[9]

4.4 Classification of Spent Nuclear Fuel

The definition of HLW in the NWPA, given in Section 1, does not include spent nuclear fuel. Since current regulations for disposal of HLW also apply to spent fuel[3,8] and, for the foreseeable future, spent fuel from commercial power reactors will not undergo reprocessing prior to

disposal, we intend that the waste classification system may be applied to spent fuel. But we also recommend that spent fuel not be classified until the fuel is declared to be waste. Classifying spent fuel only under this condition would permit re-use of fuel in reactors, e.g., if prior burnups were relatively low, and would encourage development of future policies regarding reprocessing of commercial spent fuel.

4.5 Classification of Surface-Contaminated Wastes

The waste classification system assumes implicitly that radionuclides are distributed throughout a volume of material. However, many wastes for which activity is reported on a per unit volume (or mass) basis are surface-contaminated. For example, in compactible or noncompactible trash and filter cartridges, radionuclides often are deposited on surfaces of glass, metal, glove boxes, etc.[6] Similarly, an investigation we performed indicates that about 80% by volume of the defense TRU waste currently in storage probably is surface-contaminated.

A method for applying the waste classification system to surface-contaminated wastes may be needed, but only for large waste forms (e.g., glove boxes and large metal forms) that are noncompactible. Otherwise, surface-contaminated wastes will be effectively distributed throughout a volume of material at disposal and can be regarded as volume-contaminated waste without further consideration.

We propose that classification of surface-contaminated wastes needing separate treatment be based on the surface area-to-volume ratio for the waste form; i.e., a given activity of a radionuclide per unit area on the surface would be multiplied by the surface area-to-volume ratio for the

particular waste form to give the appropriate activity per unit volume for use in classifying the waste. This approach would be consistent with that used by the NRC in determining the activity per unit volume for wastes intended for near-surface land disposal.[6]

5. WASTE CLASSIFICATION AND TECHNOLOGIES FOR DISPOSAL

This section discusses (1) the intended relationship between the waste classification system, selection of technologies for waste disposal, and development of waste acceptance criteria for specific disposal facilities and (2) the potential acceptability of greater confinement disposal (GCD) as an alternative to deep geologic repositories for relatively dilute wastes classified as HLW or TRU waste and equivalent.

5.1 Relationship Between Waste Classes, Disposal Technologies, and Waste Acceptance Criteria

Prior definitions of HLW, TRU waste, and LLW usually have not associated each type of waste with requirements for use of specific disposal technologies, except the NWPA implies that commercial spent fuel and reprocessing wastes require disposal in deep geologic repositories. We retain the view that it is neither necessary nor desirable to associate the three waste classes defined in this paper with particular disposal technologies, in order to encourage flexibility in developing waste disposal systems that protect public health in a cost-effective manner. In particular, although near-surface land disposal and deep geologic repositories are the only disposal technologies currently recognized in law for which regulatory standards and technical criteria have been

developed,[3-5,8,9] all HLW or TRU waste and equivalent would not necessarily require deep geologic repositories. Rather, as discussed in Section 5.2 below, some of these wastes could be acceptable for GCD. In addition, relatively dilute wastes in any class could be disposed of using technologies developed for more concentrated wastes, even though the waste-isolation capabilities would be considerably greater than required for protection of public health.

We also emphasize that the waste classification system does not provide a substitute for site-specific analyses of the performance of disposal systems to ensure that applicable health-protection standards and technical criteria are met; i.e., the waste classification system does not define waste acceptance criteria for specific disposal technologies or facilities. Rather, the waste classification system only indicates disposal technologies that likely would be acceptable for the different classes of waste.

5.2 Role of Greater Confinement Disposal

Alternatives to near-surface land disposal and deep geologic repositories or equivalent would involve technologies for GCD which are expected to provide intermediate waste-isolation capabilities.[21-23] The intended role of GCD in the proposed waste classification system is stated as follows:

- Relatively dilute wastes classified as HLW or TRU waste and equivalent may be acceptable for greater confinement disposal on a site-, waste-, and technology-specific basis, provided applicable standards for protection of public health will be met.

maximum concentrations of long-lived radionuclides that would be acceptable for intermediate-depth burial were estimated on the basis of (1) a solid-waste drilling scenario for an inadvertent intruder,[24] which is assumed to occur at 500 years after disposal, and (2) a limit on annual effective dose equivalent for an intruder of 0.5 rem (5 mSv). The dose limit for an intruder and the time at which intrusion occurs are similar to the assumptions used by the NRC in developing the Class-C concentration limits for near-surface land disposal.[5,6]

The results of the analysis are summarized in Table IV. The concentration limits for GCD appear reasonable in the sense that the values for most of the important radionuclides in existing wastes lie between their Class-C limits for near-surface land disposal in Table II and expected concentrations in commercial spent fuel and reprocessing wastes,[18,25] which usually contain the highest concentrations of long-lived radionuclides of any wastes.

The concentration limits in Table IV define an example GCD-Permanent Isolation boundary, which is depicted in Fig. 3. Again, this boundary would separate wastes that are acceptable for GCD from those that require deep geologic repositories or equivalent. The depiction of this boundary as a cross-hatched bar represents the considerable uncertainty inherent in its determination. In particular, the analysis has not taken into account the need to comply with the stringent containment and ground-water protection requirements in current standards for disposal of spent fuel, HLW, and TRU waste;[3] and, furthermore, technical criteria applicable to GCD have not been specified in regulations. Thus, our analysis is intended primarily to demonstrate that it is reasonable to consider GCD as an alternative to deep geologic repositories for relatively dilute HLW or

TRU waste and equivalent.

As indicated in Fig. 3, the acceptability of GCD for some HLW or TRU waste and equivalent would not affect the proposed definitions of these waste classes. But the waste classification system does not preclude defining subclasses of HLW or TRU waste and equivalent corresponding to (1) wastes that are acceptable for GCD and (2) wastes that require deep geologic repositories or equivalent. A precedent for defining subclasses of waste is provided by the NRC's 10 CFR Part 61, in which concentration limits and associated technical criteria are specified for three classes of waste that are generally acceptable for near-surface land disposal.[5,6]

6. IMPACTS OF WASTE CLASSIFICATION SYSTEM

This section discusses impacts of the proposed waste classification system on the present classification of selected wastes, including (1) commercial spent fuel and reprocessing wastes, (2) defense reprocessing wastes, (3) commercial and defense TRU wastes, (4) commercial uranium mill tailings, and (5) wastes containing ^{90}Sr and ^{137}Cs.

6.1 Commercial Spent Fuel and Reprocessing Wastes

Radionuclide concentrations have been reported for 10-year old spent fuel from commercial light-water reactors and for liquid wastes and wastes encapsulated in borosilicate glass that would be obtained from reprocessing of commercial spent fuel.[18,25] Each of these wastes would be classified as HLW, because the radionuclide concentrations greatly exceed both the Highly Radioactive and the Permanent Isolation boundaries. Such a result intuitively would be required of any reasonable waste

classification system.

Alkaline (liquid and sludge) and acid (liquid) reprocessing wastes obtained primarily from commercial spent fuel are stored at the West Valley Demonstration Project.[26] Reported radionuclide concentrations[27] generally are less than those in the commercial reprocessing wastes discussed above. The acid wastes and alkaline sludges would be classified as HLW, but the alkaline liquids would be classified as TRU waste and equivalent. However, as emphasized in Section 4.1, these classifications do not necessarily apply to solid wastes prepared for disposal, and they do not take into account any further processing that may occur prior to solidification (e.g., removal of ^{137}Cs from the supernatant or concentration of wastes by removal of inert salts).[26]

6.2 Defense Reprocessing Wastes

Defense wastes currently called HLW, because they arise from fuel reprocessing, occur in several forms and with widely varying radionuclide concentrations. The radionuclide concentrations in most of these wastes are considerably less than the projected concentrations in commercial reprocessing wastes.[18,25]

Reprocessing wastes at the Savannah River Plant will be encapsulated in borosilicate glass,[28] which is a form appropriate for disposal. Projected radionuclide concentrations for sludge-supernate and sludge-only glass wastes[28] indicate that these wastes would be classified as HLW, because the radionuclide concentrations considerably exceed both the Highly Radioactive and the Permanent Isolation boundaries.

The calcine wastes currently stored at the Idaho National Engineering

Laboratory[27] apparently would be classified, on average, as TRU waste and equivalent, because the concentrations of ^{90}Sr and ^{137}Cs do not exceed the Highly Radioactive boundary. Similarly, many of the wastes stored at the Hanford site as liquids, sludges, salt cake, and slurries[27] would be classified, on average, as TRU waste and equivalent, due to the low concentrations of ^{90}Sr and ^{137}Cs, or even LLW in cases where the concentrations of long-lived TRU radionuclides also are low.

Radionuclide concentrations in defense reprocessing wastes that are not in a form appropriate for disposal could change significantly with further processing and solidification. Furthermore, radionuclide concentrations often are reported only as averages over many waste storage units,[27] and these data may not adequately represent the concentrations in individual units. Therefore, the analysis described above indicates only that a considerable amount of defense waste currently called HLW could be reclassified as TRU waste and equivalent or LLW, but a proper classification would require more detailed data on particular wastes and expected waste forms for disposal.

6.3 Commercial and Defense TRU Wastes

TRU waste, which currently contains more than 100 nCi/g of long-lived, alpha-emitting TRU radionuclides but excludes HLW,[3,4] is generated by commercial and defense activities, but current and projected inventories of defense waste constitute by far the larger portion.[27,29] Defense TRU waste that can be properly certified[9] is intended for disposal at the WIPP facility,[4,17] but no disposal technology or facility has been proposed specifically for commercial TRU waste.[29]

6.3.1 *Impacts of Permanent Isolation Boundary*

The potential impacts of the Permanent Isolation boundary on existing commercial and defense TRU wastes arise from (1) the use of radionuclide-specific Class-C concentration limits in Ci/m^3 for long-lived, alpha-emitting TRU radionuclides, rather than the single value of 100 nCi/g for all such radionuclides, and (2) the inclusion of high concentrations of long-lived, non-TRU radionuclides in TRU waste and equivalent.

The use of separate Class-C concentration limits in Ci/m^3 for all TRU radionuclides provides a risk-based and generally applicable definition of the Permanent Isolation boundary (see Section 3.1.2). In both commercial and defense TRU wastes, ^{238}Pu, ^{239}Pu, ^{240}Pu, and ^{241}Am usually are the most important alpha-emitting TRU radionuclides.[6,10,27] For wastes containing low concentrations of ^{238}Pu, the Class-C limit in Ci/m^3 is essentially equivalent to 100 nCi/g for expected waste densities,[6] so the definition of the Permanent Isolation boundary would not significantly affect the volume of existing TRU waste that would be classified as TRU waste and equivalent.

For ^{238}Pu, however, the Class-C limit in Table II is one-to-two orders of magnitude greater than 100 nCi/g for expected waste densities,[6] primarily because of its relatively short half-life of about 88 years. This difference could impact current definitions and disposal options for ^{238}Pu wastes. Commercial waste containing concentrations of ^{238}Pu between 100 nCi/g and the Class-C limit in Table II, and low concentrations of other TRU radionuclides, would not be generally acceptable for near-surface land disposal according to the NRC's 10 CFR Part 61,[5] but would be generally acceptable for such disposal according to our proposed

definition of LLW. Defense TRU waste containing similar concentrations of ^{238}Pu and the other TRU radionuclides would be acceptable for disposal at the WIPP facility,[9] even though we would not classify the waste as TRU waste and equivalent. Regarding defense waste, we emphasize that the waste classification system does not preclude the WIPP facility from accepting ^{238}Pu wastes with concentrations less than the Class-C limit in Table II but greater than 100 nCi/g.

Long-lived, non-TRU radionuclides (e.g., ^{14}C, ^{99}Tc, and ^{129}I) are included in TRU waste and equivalent because these radionuclides in concentrations greater than their Class-C limits would require disposal technologies with waste-isolation capabilities equivalent to those required for TRU waste. A change in definition from traditional TRU waste to TRU waste and equivalent would not affect present requirements for disposal of commercial wastes, because neither of these waste classes is generally acceptable for near-surface land disposal.[5] With regard to defense wastes, TRU waste and equivalent could contain such low concentrations of TRU radionuclides (i.e., less than 100 nCi/g) that the waste would not be acceptable for disposal at the WIPP facility.[9] Again, however, the waste classification system does not preclude the WIPP facility from maintaining its criterion for the minimum concentration of TRU radionuclides. Wastes classified as TRU waste and equivalent that do not meet this criterion would require disposal elsewhere.

6.3.2 *Impacts of Highly Radioactive Boundary*

The Highly Radioactive boundary could affect disposal of defense TRU waste at the WIPP facility, since acceptance criteria on external dose-

elsewhere, e.g., in a repository for spent fuel and HLW.

Second, as indicated in Section 6.2, use of the boundary value of 50 W/m^3 in a generally applicable waste classification system could result in reclassification of significant volumes of defense reprocessing wastes as TRU waste and equivalent. Since much of the affected waste probably would contain greater than 100 nCi/g of long-lived, alpha-emitting TRU radionuclides,[27] the volume of waste that could be acceptable for disposal at the WIPP facility might be increased substantially. This volume would be increased even more if the Highly Radioactive boundary were increased to 300 W/m^3 to agree with the WIPP acceptance criterion. We emphasize, however, that it is not necessary that all such wastes be placed in the WIPP facility if serious distortions of existing agreements or planned operations[14] would result.

6.4 Commercial Uranium Mill Tailings

Uranium mill tailings are a type of byproduct material, as defined in Section 11e.(2) of the Atomic Energy Act of 1954; and, according to the current definition in the LLRWPAA, mill tailings are specifically excluded from LLW. However, if there were no legal restrictions on the classification of byproduct materials, then data on concentrations of natural uranium, ^{230}Th, and ^{226}Ra in sands, slimes, and liquids[27] indicate that commercial uranium mill tailings could be classified as LLW. Furthermore, most of the wastes could be classified as Class-A LLW according to the criteria in 10 CFR Part 61,[5,6] because the radionuclide concentrations generally are less than one-tenth of the Class-C limits in Table II.

Disposal of uranium mill tailings is subject to health-protection standards and technical criteria[30,31] that differ considerably from those applicable to near-surface land disposal of other radioactive wastes.[5,6] If mill tailings could be classified as LLW, then the waste classification system would not preclude separate regulations for disposal of mill tailings and other types of LLW, because the waste classes are not associated with requirements for specific disposal technologies.

6.5 Wastes Containing ^{90}Sr and ^{137}Cs

The important fission products ^{90}Sr and ^{137}Cs are included in defining both the Highly Radioactive and the Permanent Isolation boundaries. Furthermore, for each radionuclide, the same concentration is used to define both boundaries - namely, the Class-C limit for near-surface land disposal specified by the NRC.[5,6] As discussed in Section 3.2.4, the correspondence between the Class-C limits and the Highly Radioactive boundary is largely fortuitous, but we believe that the resulting classification of ^{90}Sr and ^{137}Cs wastes is reasonable and has desirable consequences.

Inclusion of ^{90}Sr and ^{137}Cs in defining the Permanent Isolation boundary appears at odds with the historical precedents for describing reprocessing wastes summarized in Section 2.1, because the attribute "requires permanent isolation" was associated with high concentrations of longer-lived TRU radionuclides, but not with high concentrations of shorter-lived fission products. However, since we have defined this boundary in terms of concentrations of <u>any</u> radionuclide that exceed its Class-C limit, wastes containing ^{90}Sr and ^{137}Cs in sufficient

concentrations would require permanent isolation, just as wastes with sufficient concentrations of longer-lived radionuclides. In addition, wastes with concentrations of ^{90}Sr and ^{137}Cs greater than their Class-C limits would be classified as HLW, but not as TRU waste and equivalent, which agrees with the precedent that TRU waste contains considerably lower concentrations of fission products than most reprocessing wastes.

If ^{90}Sr and ^{137}Cs were included only in defining the Highly Radioactive boundary, then these radionuclides would be classified as LLW in any concentration. However, there exist wastes at the Hanford site in which the concentrations of ^{90}Sr and ^{137}Cs exceed their Class-C limits by several orders of magnitude.[27] It seems reasonable that such wastes should be called HLW, because they certainly are highly radioactive and, as indicated by the example analysis summarized in Table IV, they may also require disposal in deep geologic repositories or equivalent.

7. SUMMARY AND CONCLUSIONS

This section summarizes the proposed waste classification system, compares the definitions of waste classes with current definitions of HLW, TRU waste, and LLW, and presents some conclusions from this study.

7.1 Summary of Waste Classification System

This paper has presented a quantitative, generally applicable, and risk-based classification system for HLW and other radioactive wastes. HLW has been defined historically as waste from reprocessing of spent nuclear fuel, but the need for a generally applicable definition arises from a description in the NWPA that HLW is "other highly radioactive

material that...requires permanent isolation." In addition, the need for a generally applicable definition of LLW is indicated by the LLRWPAA.

On the basis of the definition of HLW in the NWPA and previous descriptions of the properties of reprocessing wastes including (1) high levels of decay heat and external radiation, due principally to high concentrations of the fission products ^{90}Sr and ^{137}Cs, and (2) high concentrations of long-lived, alpha-emitting TRU radionuclides, we proposed the following conceptual definition:

> HLW is any waste that is -
>
> (1) highly radioactive and
>
> (2) requires permanent isolation.

Thus, HLW is assumed to have two distinct attributes which are associated with shorter-term risks due to high levels of decay heat or external radiation and longer-term risks from waste disposal, respectively.

From the conceptual definition of HLW, similar definitions of two other wastes classes then followed immediately:

- TRU waste and equivalent is any waste that requires permanent isolation but is not highly radioactive; and

- LLW is any waste that does not require permanent isolation, without regard to whether or not it is highly radioactive.

The three waste classes so defined are intended to encompass all radioactive wastes.

A quantitative definition of the attribute "highly radioactive" was developed from analyses of levels of decay heat (power density) and external radiation that would require engineered systems or other design

considerations to limit shorter-term risks in a variety of waste management and disposal systems. From these analyses, we proposed the following definition:

"Highly radioactive" means -

(1) a power density greater than 50 W/m^3 or

(2) an external dose-equivalent rate greater than 100 rem/h (1 Sv/h) at a distance of 1 m from the waste.

The Highly Radioactive boundary determined by this definition separates HLW from TRU waste and equivalent. Simple models were used to derive concentrations of radionuclides, given in Table III, that correspond to the Highly Radioactive boundary.

Quantification of the attribute "requires permanent isolation" was based on the following definition:

"Requires permanent isolation" means -

- wastes with concentrations of radionuclides greater than the Class-C limits that are generally acceptable for near-surface land disposal, as obtained from the NRC's 10 CFR Part 61 and its associated methodology.[5,6,10,11]

The Permanent Isolation boundary determined by this definition separates LLW from HLW or TRU waste and equivalent. The concentrations of radionuclides that correspond to the Permanent Isolation boundary are given in Table II.

The two-dimensional waste classification system resulting from the definitions of the Highly Radioactive and Permanent Isolation boundaries is depicted in Fig. 2. The waste classification system is intended primarily for application to expected radionuclide compositions and waste

forms at the time of final disposal, since disposal is the primary goal of waste management.

The definitions of waste classes are not associated with requirements for particular disposal technologies, in order to encourage flexibility in developing cost-effective systems for waste disposal. At the present time, near-surface land disposal (for LLW) and deep geologic repositories (for HLW or TRU waste and equivalent) are the only disposal technologies for which regulatory standards and technical criteria have been developed. However, a form of GCD, which would provide intermediate waste-isolation capabilities, could be acceptable for some wastes that are not generally acceptable for near-surface land disposal. We performed an example analysis to estimate maximum concentrations of long-lived radionuclides that would be acceptable for GCD, assuming intermediate-depth burial as the disposal technology. The results of this analysis, given in Table IV, demonstrate that it would be reasonable to consider GCD as an alternative to deep geologic repositories for relatively dilute HLW or TRU waste and equivalent. However, the definitions of waste classes do not depend on the development of GCD technologies with their appropriate regulatory framework.

7.2 Comparison with Present Definitions of Waste Classes

We have developed a waste classification system that includes only HLW, TRU waste and equivalent, and LLW in order to maintain a desirable consistency with existing law and regulations that have established HLW, TRU waste, and LLW as the principal waste classes. Since the waste classification system is based on common considerations of risks from

waste management and disposal and all wastes would be positively identified on the basis of known radionuclide concentrations, the proposed definitions of the three waste classes would remove any ambiguities in the present definitions.

The generally applicable definition of HLW developed in this paper encompasses and quantifies the traditional source-based definition of HLW as waste from fuel reprocessing. In particular, for reprocessing wastes that have been aged for about a decade, the proposed definition of HLW quantifies the term "contains fission products in sufficient concentrations" in the source-based definition in the NWPA essentially as concentrations of ^{90}Sr and ^{137}Cs that exceed their Class-C limits for near-surface land disposal. The proposed definition also quantifies the concentrations of long-lived, alpha-emitting TRU radionuclides in reprocessing wastes (i.e., concentrations in excess of their Class-C limits) which, in conjunction with the sufficient concentrations of fission products, would constitute HLW. Wastes from fuel reprocessing with concentrations of ^{90}Sr, ^{137}Cs, and long-lived, alpha-emitting TRU radionuclides less than their Class-C limits would not be classified as HLW, but as TRU waste and equivalent or LLW. In addition, the proposed definition of HLW includes waste from any source other than fuel reprocessing in which the radionuclide concentrations exceed both the Highly Radioactive and the Permanent Isolation boundaries.

The generally applicable definition of TRU waste and equivalent encompasses the traditional definition of TRU waste as waste that contains more than 100 nCi/g of long-lived, alpha-emitting TRU radionuclides, but excluding HLW. But with the proposed quantification of the Highly Radioactive boundary, the ambiguity in distinguishing HLW from TRU waste

according to current definitions would be eliminated. In order to provide a generally applicable definition, the Permanent Isolation boundary is expressed in terms of radionuclide-specific limits on the concentrations of long-lived, alpha-emitting TRU radionuclides in units of Ci/m^3, rather than the single limit of 100 nCi/g for all such radionuclides. For many existing wastes, however, the proposed definition is consistent with the current definition of TRU waste. Finally, the definition of TRU waste and equivalent expands the traditional definition of TRU waste by including wastes with high concentrations of long-lived, non-TRU radionuclides, because both types of radionuclides in concentrations greater than their Class-C limits would require disposal technologies with equivalent waste-isolation capabilities.

The generally applicable definition of LLW is determined entirely by the Class-C limits on concentrations of radionuclides that are generally acceptable for near-surface land disposal, as obtained from the NRC's 10 CFR Part 61 and its associated methodology. The proposed definition includes fewer wastes than the present definition of LLW in the LLRWPAA, because the latter also includes any wastes except spent fuel, HLW, or byproduct material with concentrations of radionuclides greater than their Class-C limits. In particular, the LLRWPAA implicitly includes TRU waste in greater-than-Class-C LLW. In the waste classification system, all greater-than-Class-C wastes would be classified as HLW or TRU waste and equivalent. The proposed definition of LLW also could include most byproduct materials, if there were no legal restrictions to such a classification, because different types of LLW still could be subject to different requirements for disposal.

7.3 Conclusions

We have developed for the first time a quantitative and generally applicable waste classification system that is based primarily on considerations of risks associated with waste disposal. The proposed definitions of waste classes can be applied unambiguously in any waste management program.

It is important to recognize that development of the waste classification system involved a number of subjective judgments based essentially on consideration of the consequences of possible choices. The need for such judgments arose from important ambiguities inherent in the conceptual definitions of the attributes "highly radioactive" and "requires permanent isolation," which form the basis for the waste classification system, and important uncertainties in the technical analyses used to quantify these attributes. However, subjective judgments also have been involved in all prior definitions of waste classes. Therefore, we conclude that any efforts to develop generally applicable definitions of waste classes necessarily will involve judgments that cannot be based entirely on rigorous and objective technical analysis.

In spite of the ambiguities and uncertainties inherent in this study, we have clearly demonstrated that a quantitative and generally applicable waste classification system based on considerations of health and safety is feasible. Furthermore, we have shown that differences between the waste classification system and current definitions of HLW, TRU waste, and LLW do not result in unnecessary or unreasonable adverse impacts on current waste management and disposal practices for a wide variety commercial and defense wastes.

An important general conclusion was obtained from consideration of impacts of the waste classification system on defense reprocessing and TRU wastes. Because of the ambiguity in current definitions of HLW and TRU waste and the nature of the acceptance criteria for TRU waste at the WIPP facility, it is evident that any generally applicable and risk-based definitions of waste classes necessarily would either conflict to some extent with current definitions of defense HLW and TRU waste (i.e., would result in reclassification of a considerable amount of HLW as either TRU waste and equivalent or LLW) or could significantly affect the quantities of waste that might be acceptable for disposal at the WIPP facility. This general conclusion emphasizes the importance of distinguishing between a generally applicable waste classification system and site-specific waste acceptance criteria as a means of mitigating potentially adverse impacts of the waste classification system on current waste management practices.

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29. U.S. Department of Energy, "Recommendations for Management of Greater-Than-Class-C Low-Level Radioactive Waste," DOE/NE-0077 (1987).

30. U.S. Environmental Protection Agency, "Part 192 - Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations, Title 40, Parts 190 to 399*, p. 16, U.S. Government Printing Office (1986); see also *Fed. Registr.* 48, 602 (1983) and *Fed. Registr.* 48, 45946 (1983).

31. U.S. Nuclear Regulatory Commission, "Part 40 - Domestic Licensing of Source Material. Appendix A -- Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content," *Code of Federal Regulations, Title 10, Parts 0 to 199*, p. 428, U.S. Government Printing Office (1987); see also *Fed. Registr.* 52, 43553 (1987).

LIST OF TABLES

Table I. Listing of acronyms

CFR	Code of Federal Regulations
CH	Contact-handled
FEIS	Final Environmental Impact Statement
GCD	Greater confinement disposal
HLW	High-level waste
LLRWPAA	Low-Level Radioactive Waste Policy Amendments Act
LLW	Low-level waste
NRC	[U.S.] Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act
RH	Remote-handled
TRU	Transuranic
WIPP	Waste Isolation Pilot Plant

Table II. Concentrations of selected radionuclides corresponding to Permanent Isolation boundary in waste classification system[a]

Nuclide	Boundary concentration (Ci/m^3)	Nuclide	Boundary concentration (Ci/m^3)
C-14	8	Th-232	1E-2[c]
C-14[b]	8E1	Pa-231	3E-2[c,e]
Ni-59[b]	2E2	U-232	5E-2[c]
Ni-63	7E2	U-233	4E-1[c]
Ni-63[b]	7E3	U-234	5E-1[c]
Sr-90	7E3	U-235	4E-1
Nb-94[b]	2E-1	U-236	6E-1[c]
Tc-99	3	U-238	5E-1
Ag-108m	3E-2[c]	Np-237	4E-2
Sn-126	1E-2[c]	Pu-238	7
I-129	8E-2	Pu-239	1E-1
Cs-135	8E2	Pu-240	1E-1
Cs-137	5E3	Pu-241	5[f]
Pb-210	2E2[c]	Pu-242	1E-1
Ra-226	3E-2[d]	Am-241	1E-1
Ac-227	1[c]	Am-243	7E-2
Th-229	5E-2[c]	Cm-243	8E1[g]
Th-230	6E-2[c]	Cm-244	4E1[h]

[a]Boundary concentration is defined as Class-C limit that is generally acceptable for near-surface land disposal, as obtained from NRC's rulemaking 10 CFR Part 61 and associated methodology (refs. 5, 6, 10, 11). Permanent Isolation boundary for wastes containing mixture of radionuclides is determined from boundary concentration for each radionuclide using sum-of-fractions rule.

[b]Radionuclide in activated metals only.

[c]Value calculated from refs. 10 and 11 is regarded as provisional.

[d]Value assumes Pb-210 is in secular equilibrium with Ra-226.

[e]Value assumes Ac-227 is in secular equilibrium with Pa-231.

[f]Value is 30 times boundary concentration for Am-241.

[g]Value is 850 times boundary concentration for Pu-239.

[h]Value is 360 times boundary concentration for Pu-240.

Table III. Concentrations of selected radionuclides corresponding to Highly Radioactive boundary in waste classification system[a]

Nuclide[b]	Boundary concentration (Ci/m^3)	Nuclide[b]	Boundary concentration (Ci/m^3)
C-14	2E5	U-232 + d	2E2
Ni-63	5E5	Pu-238	2E3
Sr-90 + d	7E3[c]	Pu-239	2E3
Cs-137 + d	5E3[c]	Pu-240	2E3
Sm-151	4E5	Pu-241	2E6
Pb-210 + d	1E3	Am-241	2E3
Ra-226 + d	3E2	Am-243 + d	1E3
Ac-227 + d	2E2	Cm-243	1E3
Th-229 + d	3E2	Cm-244	1E3
Pa-231	2E3	Cm-245	2E3

[a]Boundary concentration for any radionuclide is based on power density of 50 W/m^3 or external dose-equivalent rate of 100 rem/h (1 Sv/h) at distance of 1 m from the waste, whichever is more restrictive (see Section 3.2.4); for all radionuclides listed except Cs-137, boundary concentration is based on power density. Highly Radioactive boundary for wastes containing mixture of radionuclides is determined from boundary concentration for each radionuclide using sum-of-fractions rule.

[b]Notation "+ d" means short-lived daughter products are assumed to be in secular equilibrium with parent radionuclide.

[c]Value is same as Class-C limit for wastes that are generally acceptable for near-surface land disposal, as specified in NRC's rulemaking 10 CFR Part 61 (ref. 5).

Table IV. Estimates of concentration limits of selected radionuclides that are acceptable for greater confinement disposal, assuming intermediate-depth burial and a solid-waste drilling scenario for exposure of inadvertent intruders[a]

Nuclide	Concentration (Ci/m^3)	Ratio to Class-C[b]	Nuclide	Concentration (Ci/m^3)	Ratio to Class-C[b]
C-14	1E1	1	Th-232	1E-1	1E1
C-14[c]	1E3	1E1	Pa-231	2E-1[e]	7
Ni-59[c]	2E5	1E3	U-232	3E1	6E2
Ni-63	3E4	4E1	U-233	2E1	5E1
Ni-63[c]	3E6	4E2	U-234	2E1	4E1
Sr-90	2E6	3E2	U-235	4	1E1
Nb-94[c]	3E1	2E2	U-236	2E1	3E1
Tc-99	9	3	U-238	No limit	-
Ag-108m	4	1E2	Np-237	4E-2	1
Sn-126	2E-1	2E1	Pu-238	4E2	6E1
I-129	9	1E2	Pu-239	8	8E1
Cs-135	2E2	3E-1	Pu-240	8	8E1
Cs-137	7E4	1E1	Pu-241	2E1[f]	8
Pb-210	2E7	1E5	Pu-242	8	8E1
Ra-226	2E-1[d]	7	Am-241	8E-1	8
Ac-227	3E6	3E6	Am-243	3E-1	4
Th-229	8E-1	2E1	Cm-243	6E3[g]	8E1
Th-230	3	5E1	Cm-244	3E3[h]	8E1

[a]Concentration limits define example GCD-Permanent Isolation boundary (see Section 5.2). Boundary for wastes containing mixture of radionuclides is determined from boundary concentration for each radionuclide using sum-of-fractions rule.

[b]Class-C concentration limits for near-surface land disposal are given in Table II.

[c]Radionuclide in activated metals only.

[d]Value assumes Pb-210 is in secular equilibrium with Ra-226.

[e]Value assumes Ac-227 is in secular equilibrium with Pa-231.

[f]Value is 30 times concentration limit for Am-241.

[g]Value is 850 times concentration limit for Pu-239.

[h]Value is 360 times concentration limit for Pu-240.

LIST OF FIGURES

ORNL-DWG 86C-11634R2

QUALITATIVE DEPICTION OF WASTE CLASSIFICATION SYSTEM

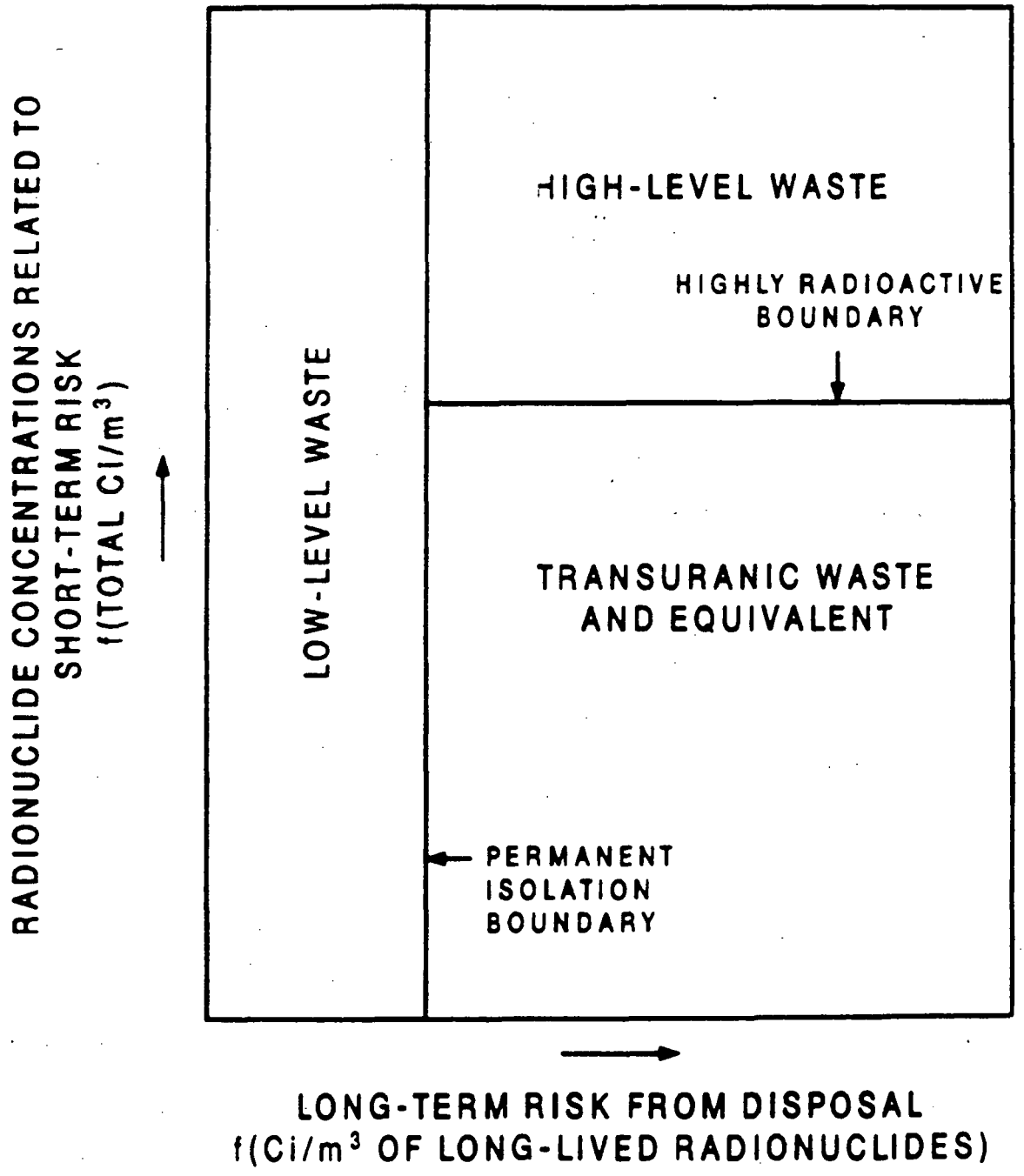


Fig. 1

ORNL-DWG 86C-11635R

QUANTIFICATION OF WASTE CLASSIFICATION SYSTEM

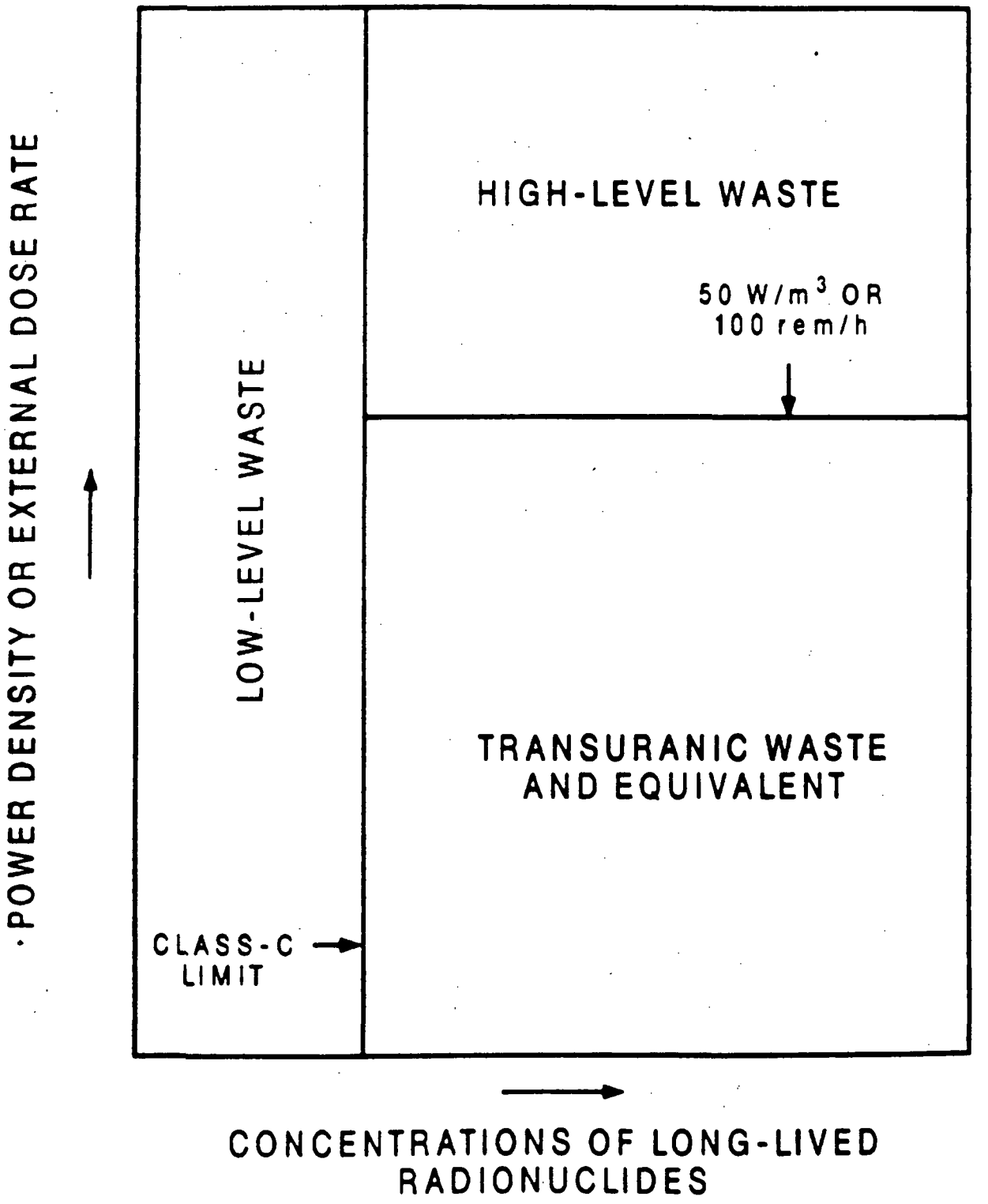


Fig. 2

QUANTIFICATION OF WASTE CLASSIFICATION SYSTEM INCLUDING GCD

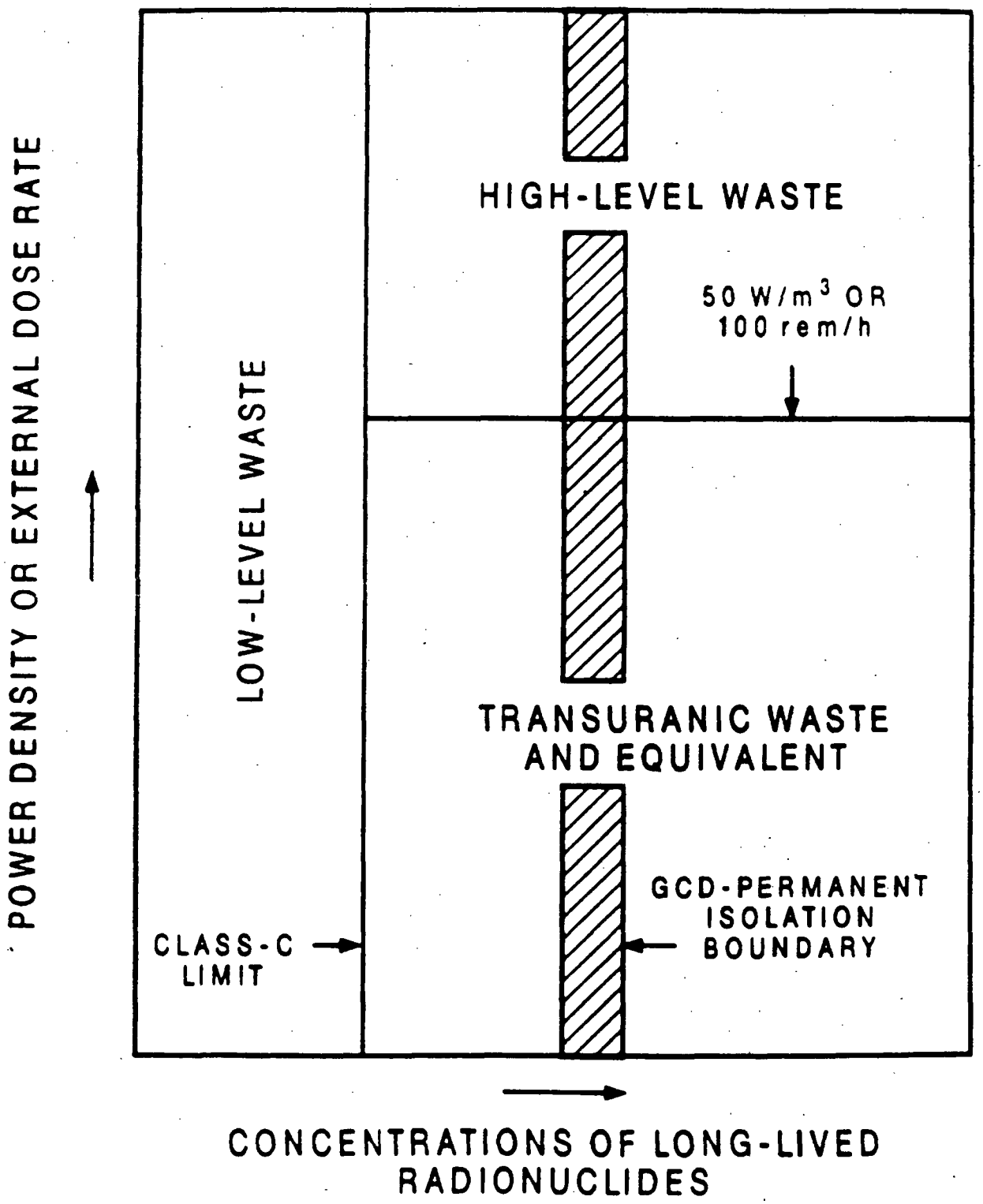


Fig. 3

(17)

DOCKET NUMBER
PROPOSED RULE PR 61
(53FR17709)

UNION ELECTRIC

1901 Gratiot Street St. Louis

ULNRC-1806

'88 JUL 15 P4:59

July 14, 1988

Secretary
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attn: Docketing and Service Branch

Dear Sir:

COMMENTS ON PROPOSED RULE FOR DISPOSAL OF RADIOACTIVE WASTES AMENDING 10 CFR PART 61 AS NOTICED IN FEDERAL REGISTER VOL. 53, NO. 96 PAGES 17709-17711

The purpose of this letter is to provide comments on the proposed rule as indicated above. Union Electric Company supports the proposed rule as written and agrees with the Commission that there is no need to develop a technical definition of high-level waste (HLW).

Additionally, we also support the wording which allows an alternative proposal for disposal of greater-than-Class-C (GTCC) waste with approval by the Commission.

The concern does exist as to whether or not the volume of GTCC waste (including possible defense-related waste) will significantly impact current planning and schedules for development of a deep geologic repository. This concern should be evaluated and addressed by the Commission prior to final rulemaking.

Potential delays associated with the need for additional legislation to authorize disposal or provide for payment of disposal costs for GTCC waste, as indicated in the notice, should be thoroughly evaluated for impact on the current schedule for establishing a deep geologic repository.

We appreciate the opportunity to comment on this proposed rule.

Sincerely,

Michael C. Williams
Principal Health Physicist

MCW/plh

Mailing Address: P.O. Box 149, St. Louis, MO 63166

cc: R. J. Irwin
A. C. Passwater
J. R. Polchow
N. G. Slaten
E210.01

The American Society of Mechanical Engineers

Suite 218
1825 K Street, N.W.
Washington, DC 20006-1202
202-785-3756

July 15, 1988

Secretary
U.S. Nuclear Regulatory Commission
Attn: Docketing and Service Board
Washington, D.C. 20555

Re: Notice of Proposed Rulemaking on "Greater than Class-C" wastes, 53 FR 17709, May 18, 1988.

Comments prepared jointly by the High-Level Radioactive Waste Committee and the Risk Analysis Task Force of the American Society of Mechanical Engineers were previously provided to the Nuclear Regulatory Commission on its Advance Notice of Proposed Rulemaking on the definition of high-level radioactive waste (51 FR 5992). Essentially, our comments urged the NRC to develop a risk-based definition of high-level waste.

The proposed rule on the greater than Class-C waste disregards the significance of risk in distinguishing between greater than Class-C waste and high-level radioactive waste. The comment period for the proposed rule making was too short for us to prepare a response based on the technical issues involved in the development of a risk-based definition of these two classes of waste. However, we wish to reiterate our previous view that the ultimate goal of regulations dealing with these classes of waste is the protection of human health and the environment; and risk assessment is the correct technical process to assure that this goal is met.

We plan to establish a panel of experts to provide the NRC and the nation with advice on the details of technical aspects of the definition of high-level and greater than Class-C wastes. This panel will be established quickly and will review the entire issue.

The panel intends to hear from representatives of various government agencies, particularly the NRC, industry, professional societies and academia. The panel plans to coordinate its activities to assure the availability of a statement on the subject in a timely manner to the NRC and the general public.

If you have any questions, please contact Philip W. Hamilton, Director, Federal Government Relations in the Society's Washington, D.C. office. The telephone number is (202) 785-3756.

Sincerely,

A. Alan Moghissi, Ph.D.
Chairman, Risk Analysis Task Force

(16)

STATE OF MICHIGAN

JAMES J. BLANCHARD, Governor

DEPARTMENT OF MANAGEMENT AND BUDGET

P.O. BOX 30026 LANSING MICHIGAN 48909

SHELBY P. SOLOMON, Director

July 13, 1988

Samuel J. Chilk, Secretary
Nuclear Regulatory Commission
Washington, D.C. 20555
Attention: Docketing and Service Branch

Dear Secretary Chilk:

The Michigan Department of Public Health and the Michigan Low-Level Radioactive Waste Authority have reviewed the proposed amendments requiring disposal of greater-than-Class-C radioactive waste in a deep geologic repository unless disposal elsewhere has been approved by the Nuclear Regulatory Commission (NRC). We suggest the following additions (in bold print) and deletions (in strikeout print) to the proposed language of 10 CFR 61.55(a)(2)(iv):

> ". . . In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository as defined in Part 60 of this chapter unless proposals for disposal of such waste in a **Federally owned** disposal site licensed pursuant to this part ~~submitted to the Commission for approval~~ **are approved by the Commission.**"

The first addition in bold print clarifies the responsibilities of the states and federal government in the disposal of greater-than-Class C radioactive waste. Although it is clear that disposal of greater-than-Class-C radioactive waste is a responsibility of the Federal Government, as is pointed out by the following excerpts from the Low-Level Radioactive Waste Policy Amendments Act of 1985, Public Law 99-240, readers of the proposed rule are left with the impression that the NRC may, after further evaluation, allow a state 10 CFR 61 low-level radioactive waste disposal facility to accept the waste.

Section 3 of Public Law 99-240 gives the states the responsibility for the disposal of:

> ". . . low-level radioactive waste generated within the State (other than by the Federal Government) that consists of or contains class A, B, or C radioactive waste as defined by section 61.55 of title 10, Code of Federal Regulations, as in effect on January 26, 1983; . . ."(a)(1)(A)

Section 3 further gives the Federal Government the responsibility for the disposal of:

> ". . . any other low-level radioactive waste with concentrations of radionuclides that exceed the limits established by the Commission for class C radioactive waste, as defined by section 61.55 of title 10, Code of Federal Regulations, as in effect on January 26, 1983. . . ."(b)(1)(D)

Current public perception, especially by those that oppose the development of state low-level radioactive waste disposal facilities, is that the NRC will eventually force the states to dispose of greater-than-Class C radioactive waste. The suggested language eliminates any chance for this erroneous perception to remain.

Secondly, we perceive that the proposed language may allow a period of time in which a generator of greater-than-Class C waste may avoid having to properly dispose of the waste simply by proposing a series of disposal methodologies. The deletion (in strike-out print) and second addition (in bold print) simply requires that greater-than-Class-C radioactive waste be disposed of in a geologic repository unless the Nuclear Regulatory Commission has approved a disposal option rather than only receiving a proposal for a disposal option.

Thank-you for the opportunity to comment.

Sincerely,

Lee E. Jager, State Liaison Officer
Bureau of Environmental and Occupational Health
Michigan Department of Public Health

James F. Cleary, Commissioner
Michigan Low-Level Radioactive Waste Authority

c. G. Larson

PROPOSED RULE PR 61
(53 FR 17709)

'88 JUL 18 P3:19

OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

Dear Sirs:

Please delete the option for state to take greater than Class C Wastes.

Please ~~[redacted]~~ include a requirement for any waste hazardous for longer than 100 years to be considered a federal responsibility.

Please give this your attention - our country needs to be kept as safe as possible.

The Companies who are building and operating low-level sites also need more supervision.

Sincerely,
Mr. & Mrs. Carl Berg
Rt. 1, Box 99
Winside, Ne. 68790

(1)

DOCKET NUMBER
PROPOSED RULE PR 61
(53FR17269)

Madison County Environmental Defense League

P. O. Box 291
MARS HILL, N. C. 28754

JUL 18 P3:19

LOU ZELLER
Chairman
Phone 656-2773

OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

Lou Zeller

JUL 20 1988

ACKNOWLEDGED BY CARD

(14)

WARREN A. BISHOP

DOCKET NUMBER
PROPOSED RULE PR 61
DOCKETED
USNRC
(53FR17709)

'88 JUL 18 P3:20

OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

STATE OF WASHINGTON

NUCLEAR WASTE BOARD

Mail Stop PV-11 • Olympia, Washington 98504 • (206) 459-6670

July 14, 1988

Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attn: Docketing and Service Branch

Dear Mr. Secretary:

Please find enclosed the state of Washington's comments on the May 18, 1988 Federal Register Notice regarding a proposed rule to amend 10CFR 61 to require disposal of "greater-than-Class-C" low-level radioactive wastes in a deep geologic repository unless an alternate disposal technology has been approved by the Commission. These comments were developed by the state's Nuclear Waste Board under its authority to develop state policies relating to the management of radioactive wastes and to represent the citizens of Washington State in these issues. These comments have also received the concurrence of the Yakima Indian Nation through consultation with their staff.

Thank you for your consideration of the state's concerns associated with this proposed rulemaking.

Sincerely,

Warren A. Bishop

Warren A. Bishop, Chair
Washington State
Nuclear Waste Board

WAB:js

Enclosure

COMMENTS ON
THE NUCLEAR REGULATORY COMMISSION'S
PROPOSED RULEMAKING

DISPOSAL OF RADIOACTIVE WASTES

Introduction

The Washington State Nuclear Waste Board developed the following comments on the Federal Register Notice dated May 18, 1988. The Federal Register presented a proposed rule to amend 10CFR 61 to require disposal of "greater-than-Class-C" low-level radioactive wastes in a deep geologic repository unless an alternate disposal technology has been approved by the Commission. Washington State legislation gives the Nuclear Waste Board the responsibility for developing state policies related to the management of radioactive wastes, evaluating federal actions, and serving as a spokesman on behalf of Washington State citizens. The Board has also worked closely in the past with the Yakima Indian Nation and through consultation with Yakima Indian Nation Staff, have received their concurrence with the positions taken in these comments.

The Board's principal focus in these comments is on the potential impacts that this action may have on the disposal of the federal government's reprocessing wastes presently stored at Hanford, and the commercial low-level disposal facility also located on the Hanford Reservation.

The Board supports the Commission's efforts to address the GTCC disposal problem. The Board also takes a measure of comfort from the fact that this proposal brings in additional wastes under the Commission's authority. However, while the Board supports the concept of requiring GTCC waste disposal to take place in a deep geologic repository, we continue to have concerns over the criteria to be used by the Commission in evaluating alternate disposal facilities that may be proposed by the U.S. Department of Energy (USDOE), the Commission's involvement in licensing potentially similar reprocessing waste facilities, the timing of the Commission's involvement in that evaluation, and the opportunity for public comment on any associated licensing action.

The future of the Hanford tank wastes is of particular concern. These wastes present a unique situation in that they are a complex mixture of chemical and radioactive materials resulting from primary and secondary reprocessing cycles, in some cases combined with wastes from other USDOE facilities. There are currently 149 single shell tanks containing about 50 million gallons of waste in place on the Hanford Reservation. Entities with regulatory authority over these wastes include the state of

Washington along with several federal agencies. The interaction and potential impacts involved with the overlapping regulatory authorities are not clearly identified or addressed by the various agencies. Special considerations as to the ultimate disposal ofGTCC wastes may be necessary due to the potential for high toxicity, high activity concentrations and long half-lives.

Therefore, because the requirements for disposal of GTCC wastes and the licensing process for alternate disposal technologies may involve similar considerations as those used for the near surface disposal of reprocessing wastes, those requirements should be established in a way that allows for coordinated and timely disposal decisions and involvement of all relevant parties.

Commission Licensing Authority Over GTCC and Defense Wastes

Following is a discussion of the essence of relationships as the Board understands them following extensive discussions with cognizant agencies. If the result seems confusing, it is reflective of a situation requiring clarification - with work needing to be done by both the federal legislative and executive branches.

Currently, 10CFR 60.2 defines HLW, for purposes of the licensing of a geologic repository as follows:
"High-level radioactive waste" or "HLW" means: (1) irradiated reactor fuel, (2) liquid wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuel, and (3) solids into which such liquid wastes have been converted.

In the February 27, 1988 Advance Notice of Proposed Rulemaking (ANPRM) the Commission observed that if the Department of Energy were to were to pursue the in-place stabilization alternative described in their Draft EIS (DOE/EIS-0113), most or all of the disposal facilities would need to be licensed by the Commission. The Commission's existing authority to license these facilities is derived from Section 202, Paragraphs 3 and 4, of the Energy Reorganization Act of 1974 which addresses first cycle reprocessing wastes.

The Commission and the USDOE have taken the position that neither the NWPA nor the Commission's 10 CFR60 regulations expressly require that any radioactive materials, whether HLW or not, be stored or disposed of in a geologic repository. Due to this interpretation, the Commission felt that their original attempt to redefine HLW would have no impact on the amount of waste that would require disposal there. This point, itself, is confusing inasmuch as the essence of the NWPA is that Congress contemplated disposal of high-level wastes in a deep geologic repository.

The Hanford single-shell tank wastes are a mixture of chemically hazardous and radioactive materials which have not been characterized on a tank to tank basis. In

addition to the lack of specific knowledge on waste constituents, there is also a lack of information on whether individual tanks contain first cycle solvent extraction wastes, subsequent cycle extraction wastes or a mixture of each. The extent of uncertainty as to waste make-up on the part of USDOE also brings uncertainty as to which waste categories these wastes are regulated under. USDOE representatives have stated in the past that some of the tank wastes could not be classified as HLW because they were dilute and resulted from a subsequent extraction cycle. Commission representatives also stated that wastes produced by USDOE, that are not first cycle reprocessing wastes, do not come under their authority.

Currently, DOE/EIS-0113 proposes to divide double shell tank wastes into a low activity and a high activity fraction, with the low activity wastes ,(less than Class C concentrations), placed in a near surface grout facility. All parties involved felt that a similar decision on the single shell tanks was technically premature at this time chiefly because of uncertainties with regard to tank contents.

USDOE is proceeding in accordance with the recent EIS to dispose the bulk of its reprocessing wastes through direct stabilization (grouting) and land disposal within Resource Conservation and Recovery Act (RCRA) vaults. USDOE is also moving ahead to manage those reprocessing wastes with a high activity content by separation, vitrification of the radioactive phase, and grouting of the remaining high volume, but low activity residual.

In the original ANPRM, the Commission stated that its regulatory licensing authority would not be affected by the current rulemaking process. Thus, as noted above, the Commission asserts that first cycle reprocessing wastes at Hanford remain under its licensing authority under any in-place stabilization proposal.

On that point, previous Commissioner Asselstine raised concerns that licensing authority might be affected by the reclassification of wastes as "Above Class C low-level wastes." Specifically, he requested input on the impact on Commission authority over long-term storage or in-situ disposal of Hanford tank wastes.

In this regard, the Board is interested in Commission activities to establish standards for GTCC facilities other than deep geologic repositories and how these activities may relate to USDOE activities with defense waste disposal. Currently no standards exist in 10 CFR61 or 10 CFR60 to use in a future licensing process. The Board advocates that any attempt to establish such standards be subject to public review comparable to that required for rulemaking.

The Board continues to be interested in the Commission's role and schedule for the first cycle reprocessing waste licensing process and the associated impacts of other federal legislation such as RCRA and CERCLA. The Board believes that these wastes should be subject to state and federal hazardous waste management programs as well as to the authorities given to USDOE and the Commission.

The rulemaking should discuss the Commission's authority to regulate and license alternative disposal, given that the NWPA does not authorize USDOE to construct or operate facilities for the disposal of HLW by means other than deep geologic. The Board would also be interested in receiving a copy of the Commission's response to former Commissioner Asselstine's questions.

In addition, the rulemaking should review the Commission authority over the long-term storage of these wastes. At what point in the defense waste storage at sites around the nation does the Commission's licensing authority begin? Could these wastes be "stored" for hundreds of years without entering into the licensing process for disposal?

The Board also requests an estimate of the volume of USDOE's defense materials production and any other GTCC wastes. This proposal mentioned only the quantity of commercially-produced GTCC waste.

Impacts on Commercial Low-Level Waste Facilities

The proposal repeatedly states that due to the projected low volumes of commercial GTCC wastes, it may be economically unattractive to construct separate intermediate facilities. Therefore applications for license variances to dispose GTCC wastes at commercial LLW facilities may be anticipated from those entities currently possessing GTCC wastes. In fact, the state has received informal inquiries in the past concerning the possibility of disposing GTCC wastes at the commercial low-level facility. It would be helpful if the Commission would discuss how it will deal with these requests and what the role of the low-level waste compacts or states will be. For example, who may submit variance requests? what technical criteria will be used in the evaluation of variance requests? what existing sites would be looked upon as the recipient of GTCC wastes? and what would be the role for the agreement state with a commercial LLW facility?

Impacts on Utilities and Ratepayers

The proposed rule does not address the potential cumulative impacts on utilities who have contracted with USDOE for the disposal of their HLW in a deep geologic repository. Adding GTCC waste to the current volume of HLW needing disposal could lead to an increase in Nuclear Waste Fund payments for repository development and operation. Augmenting the Nuclear Waste Fund for the disposal of GTCC wastes could affect electric consumers, since the Nuclear Waste Fund is ultimately paid by utility ratepayers.

If the volumes of GTCC wastes, both defense and commercial, are large enough to present a significant repository funding problem, the question of how costs will be shared between defense and civilian nuclear waste programs still needs to be answered. The rulemaking should address the potential for this occurrence.

Suggested Language Change

On Page 10, the last paragraph was somewhat cumbersome and unclear as to the licensing process being described. We understand this paragraph to say that proposals for alternate disposal facilities other than a deep geologic repository for GTCC wastes must be submitted to, and approved by, the Commission prior to beginning facility construction. The Board notes that in 10CFR 61.58 there is authority which appears to us to override the provisions of 10CFR 61.55 (a) (2) (iv). Does the absence of this language in the proposed revision weaken the Commission's licensing authority? Are there any revisions required to the language of 10CFR 61.58?

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439

(2)

July 15, 1988

Secretary, U.S. Nuclear
Regulatory Commission
Washington, D.C. 20555
Attn: Docketing & Service Branch

Dear Mr. Secretary:

Subject: **Comments to Proposed Amendment to 10 CFR 61**

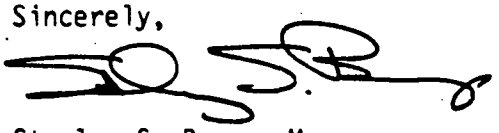
Please consider the following comments on the notice of May 18, 1988 (53 FR 17709), proposing the amendment of 10 CFR 61. The main items of that proposal are that: (1) Greater-than-Class-C, low-level, radioactive wastes (GTCC) must be disposed of in a deep geologic repository unless disposal elsewhere has been approved by the Commission, and (2) the current definition for high-level waste (HLW) which is based on the source of the waste rather than the physical characteristics of the waste be retained.

A source-based definition of HLW effectively prohibits emplacement of non-TRU wastes derived from HLW in a disposal facility other than a geological repository. Recent advances in separations science and engineering enables the fractionation of large volumes of HLW into small volumes of long-lived wastes that would require geologic disposal and large volumes of short-lived (<40 year half-life) wastes that have only moderate radiological hazard (GTCC wastes). A large savings in cost can be realized through the application of such technology, but such applications are prevented by a narrowly-interpreted source-based definition of HLW.

The preamble to the proposed amendment (53 FR 17710) suggests that because of the small volume (2000 m^3) of commercial GTCC wastes, an intermediate disposal facility may be economically unattractive. However, it should be recognized that extrapolation of present volume-production rates would seriously underestimate future volume accumulations should fractionation be put into practice. Application of fractionation of reprocessing wastes would result in the generation of large volumes of GTCC wastes. At present, it is unknown whether commercial GTCC wastes and DOE wastes would be emplaced in the same "intermediate" disposal facility. If they were combined, and if fractionation was utilized, the economics of an "intermediate" disposal faiclity would inevitably be favorable. For example, it is estimated that fractionation of the HLW stored at Hanford alone could result in volumes of 3.9×10^4 to 1.3×10^5 m^3 of solid, non-TRU waste. This waste, because of its high content of Cs-137 and/or Sr-90 would exceed the Class C limits.

I suggest that we should be careful to avoid ruling out the application of recent and future developments of safer and more economic methods of disposal and to preserve the opportunity for utilizing alternatives for lessening the economic burden of HLW disposal. In the interest of these goals I encourage the Commission to reconsider defining HLW on the basis of its physical characteristics. Barring that, I suggest that any statement that the current definition of HLW will be retained should be accompanied by the statement that the classification and disposal of non-TRU wastes derived from HLW will be determined by the Commission on a case-by-case basis, according to the results of performance assessment.

Sincerely,



Stanley S. Borys, Manager
Office of Waste Management Programs

SSB/ksl

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

P.O. Box 968 • 3000 George Washington Way • Richland, Washington 99352

July 14, 1988

Samuel J. Chilk, Secretary
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Docketing & Service Branch

Subject: PROPOSED RULE ON DISPOSAL OF "GREATER THAN CLASS C" WASTES

References: (1) Federal Register, V. 53, N.96, pp. 17709-17711
(2) Federal Register, V. 52, N.39, pp. 5992-6001

The subject proposed rule would require radioactive wastes which are classified as "greater than Class C" (GTCC) to be disposed of in a geologic repository unless disposal elsewhere is approved by the Commission. Although the Supply System is generally supportive of the proposal, we offer the following brief comments for your consideration.

The advanced notice on the definition of high-level radioactive wastes (Reference 2) acknowledged that it may be possible to dispose of several categories of GTCC waste materials in low-level or intermediate disposal facilities (52 FR 5999). Activated metal from reactor decommissioning is an example. The proposed revision to Section 61.55 is intended to allow an alternative to disposal in a geologic repository. We believe, however, that the proposal is unnecessarily restrictive by inferring that only alternatives licensed pursuant to Part 61 would be considered. Since the intent of the Commission is to perform a case-by-case review of alternative disposal schemes for GTCC wastes, we recommend the following wording for the second sentence in Section 61.55(a)(2)(iv): " . . . of this chapter unless proposals for alternative methods of disposal are submitted to the Commission for approval."

A broader issue is how the requirement that GTCC wastes (commercial and defense) be sent to a geologic repository will affect the design and capacity of the repository planned under the Nuclear Waste Policy Act of 1982. The projection of need for a second repository will depend on good estimates of the GTCC volumes. Institutional issues will include the allocation of costs for the different classes and sources of wastes.

Thank you for the opportunity to comment on the proposed rule.

Very truly yours,

G. C. Sorensen, Manager
Regulatory Programs

(22)

Department of Energy
Washington, DC 20585

'88 JUL 18 P3:52

Secretary
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Sir:

The Department of Energy (DOE) is preparing comments on the Commission's proposed rule change to 10 CFR Part 61, published at 53 FR 17709 on May 18, 1988. This proposed rule change has the potential for major impacts of importance to three offices within the Department and the relatively short comment period of only 60 days has required preparation and coordination of comments to take place on an extremely compressed time schedule.

Comments are, however, now in draft form ready to enter the final concurrence process. The comments will be closely coordinated among the concerned offices within the Department and we expect to have comments to the Commission no later than July 25th.

If you have any questions, please feel free to contact Mr. Edward Regnier of the Licensing Branch on 586-4590.

Sincerely,

Charles E. Kay

Charles E. Kay
Acting Director
Office of Civilian Radioactive
Waste Management

(23)

LORING E. MILLS, Vice President

EDISON ELECTRIC INSTITUTE The association of electric companies

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July 18, 1988

Mr. Samuel J. Chilk
Secretary
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attention: Docketing and Service Branch

Subject: Notice of Proposed Rulemaking Concerning Disposal of Radioactive Wastes (53 Fed. Reg. 17709)

Dear Mr. Chilk:

On May 18, 1988, the NRC published in the Federal Register a notice of proposed rulemaking (53 Fed. Reg. 17709) to amend 10 CFR Part 61 to require disposal of greater than Class C (GTCC) waste in a geologic repository, absent either specific requirements in 10 CFR Part 61 regarding such disposal, or a proposal for disposal of such waste at a site licensed under Part 61. The Edison Electric Institute (EEI) and the Utility Nuclear Waste Management Group (UNWMG) are pleased to comment on this notice of proposed rulemaking. EEI is the association of the nation's investor-owned electric utilities. UNWMG is a group of 45 electric utilities providing active oversight of the implementation of the federal statutes and regulations related to radioactive waste management.

Last year, by letter dated June 29, 1987, EEI/UNWMG commented in favor of adopting the definition of high-level wastes (HLW) presented in the Commission's February 27, 1987 Advance Notice of Proposed Rulemaking (ANPR) (52 Fed. Reg. 5992). The effect of adopting that definition would have been to expand the meaning of the term HLW to encompass certain material currently classified as GTCC wastes.

The approach reflected in the current notice, however, is quite different. Instead of changing the definition of high-level waste, the proposed rule would -- in essence -- simply require disposal of GTCC waste in a geologic repository unless disposal elsewhere is otherwise approved by the Commission. EEI/UNWMG do not object to the basic approach to GTCC waste disposal reflected in the proposed rule. While the approach is different than that of the ANPR, it is generally a more straight-forward means of addressing GTCC disposal. We have two specific comments on the proposal, however.

First, proposed 10 CFR 61.55(a)(2)(iv) provides:

> Waste that is not generally acceptable for near-surface disposal is waste for which waste form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requirements in this part, waste must be disposed of in a geologic repository as defined in Part 60 of this chapter unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are submitted to the Commission for approval. (53 Fed. Reg. 17711 (emphasis added).)

There is no reason, however, to impose Part 61 requirements ipso facto on alternative methods of disposal (i.e. other than in a repository). Further, as noted in the Supplementary Information, the proposed rule is intended to leave "open the prospect that an intermediate disposal facility may prove attractive at some time in the future." (53 Fed. Reg. 17710.) Depending on the nature of an intermediate disposal facility, however, the appropriate site suitability, waste characteristics, and other requirements might differ considerably from those contained in 10 CFR Part 61. Accordingly, the words "licensed pursuant to this part" should be eliminated from proposed section 61.55(a)(2)(iv). This modification would better reflect the flexibility the Commission appropriately intends be available for future decisions on disposal of GTCC waste. At the same time, the clear notice in the section concerning the need for "Commission . . . approval" of alternative disposal methods would be preserved.

Second, had the approach originally supported by EEI/UNWMG in the 1987 ANPR been adopted in the proposed rule, not all GTCC would be presumed to require permanent isolation in a geologic repository. In particular, certain defense materials that are GTCC wastes would have gone to a geologic repository purely at DOE's option. Under the proposed amendment to Part 61, such wastes must be disposed of in a geologic repository unless: (1) DOE makes an affirmative decision to, and presents a proposal for, disposing of them elsewhere; and (2) the Commission approves DOE's proposal under Part 61.

This change in approach has subtle ramifications insofar as achieving the purposes of the Nuclear Waste Policy Act are concerned. By essentially requiring the disposal of many kinds of wastes in a geologic repository, the proposed amendment has the potential for increasing the complexity and cost of the geologic repository program. This is especially true given the limited data available on these wastes.

There is currently little reliable information concerning the amount of GTCC wastes that would be major candidates for repository disposal under the proposed rule. This is true for all waste, especially defense-related material. Nonetheless, it is clear that the disposal of such wastes in a geologic repository could significantly complicate the analysis of repository performance, and substantially increase the need for disposal capacity; possibly even to the point of necessitating a second repository. Although EEI/UNWMG are of the view that the fundamental issue of whether or not defense waste should be disposed of in a commercial repository is beyond the scope of this rulemaking, we believe it is important that -- in evaluating the proposed rule -- the NRC consider the ramifications of its adoption in terms of potential impacts on the current repository program.

We appreciate this opportunity to respond to the Commission's notice of proposed rulemaking, and hope that our comments are helpful. We would be pleased to respond to any questions or otherwise be of assistance to the Commission as it addresses this matter.

Sincerely yours,

Loring E. Mills

Loring E. Mills
Vice-President

LEM:bfm

(24)

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1671 Worcester Road, Framingham, Massachusetts 01701

July 14, 1988

Secretary of the Commission
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attention: Docketing and Service Branch

Subject: Notice of Proposed Rulemaking on Disposal of Radioactive Wastes (53FR17709)

Dear Sir:

Yankee Atomic Electric Company (YAEC) appreciates the opportunity to comment on the proposed rulemaking regarding disposal of radioactive wastes. YAEC owns and operates a nuclear power plant in Rowe, Massachusetts. Our Nuclear Services Division also provides engineering and licensing services for other nuclear power plants in the Northeast, including Vermont Yankee and Seabrook.

The EEI Utility Nuclear Waste Management Group (UNWMG) is filing a detailed response to the subject NRC proposed rule. YAEC is an active member of UNWMG and, in general, endorses its comments.

On February 27, 1987, the Commission published for comment an advance notice of proposed rulemaking regarding the definition of high level radioactive waste (HLW). YAEC submitted comments in response to that notice (June 19, 1987). In light of the Commission's most recent decision to take a different approach to classifying radioactive wastes than initially proposed, we would like to take this opportunity to reiterate and add to several of our earlier comments.

We supported the Commission's inital proposal to classify HLW as that which is highly radioactive and requires permanent isolation. In theory, such an approach had sound, technical merit. However, such an approach would have automatically created an intermediate class of radioactive wastes, thus demanding an alternative disposal facility and regulatory regime. Because the economic feasibility of developing such a solution within a reasonable time frame is questionable, we endorse the Commission's decision to classify greater than Class C waste for disposal in a geologic repository, absent an approved "intermediate" disposal facility. However, we do not support the use of the current Class C limits of 10 CFR Part 61 as the appropriate threshold for that classification.

The Commission's proposal to place all greater than Class C wastes in the geologic repository results in an increase in the volume and kinds of waste originally conceived for the repository. Such a change has the potential for complicating the design and operation of the repository and for using limited, expensive space for waste that really does not require such an extreme degree of isolation. Clearly, the definition of what constitutes Class C must be very carefully considered and justified.

The Class C limits of 10 CFR Part 61 were developed using extremely conservative assumptions. The migration pathway and other pathways resulting from more likely, natural events, such as wind or water erosion, were demonstrated to be of little consequence. In most cases, the limiting conditions were controlled by the "intruder" pathway scenario involving an individual digging into a waste site after the facility ceases operation and institutional control is lost. As a result, the relatively low concentration limits are overly conservative. Use of such conservative limits forces those wastes that are only marginally greater than Class C (and not in need of extreme isolation) into the "geologic repository" category.

We believe that assumptions more realistic than those incorporated in current Class C limits should be used in determining upper concentration limits, thereby increasing the threshold for greater than Class C wastes. We suggest that by doing so, those wastes which truly require the degree of isolation afforded by the geologic repository will be identified. We are convinced that Class C limits can be increased without jeopardy to the radiological health and safety of the public and environment. At the same time, the Commission will be acting to minimize the programmatic and financial impacts of the proposed rulemaking.

Finally, although the economic feasibility of an "intermediate" disposal facility is questionable at the present time, we support the Commission's proposal to give DOE the latitude to develop such a facility in the future. However, we urge the Commission to adopt a similar provision for its own use should it determine through future findings (absent a DOE proposal), that less stringent requirements are appropriate.

Sincerely,

John DeVincentis
Vice President

JMG/amd

TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
Bureau of Environment
T.E.R.R.A. BUILDING
150 NINTH AVENUE NORTH
NASHVILLE, TENNESSEE 37219-5404

July 14, 1988

Secretary
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTN: Docketing and Service Branch

Gentlemen:

Having reviewed your proposal dated Wednesday, May 18, 1988, FR Vol. 53 No. 96, concerning "greater-than-Class-C" low-level waste I have the following comments:

1. In the definition of HLW the phrase "in sufficient concentrations" must be defined.

2. The "primary reprocessing waste streams at DOE facilities" must be defined.

3. Define "commercially-generated greater-than Class C".

All three of the above items involve terminology that is vague. In the case of items 1 & 2 that vagueness has been utilized by the DOE to make what appears to be HLW, LLW. It is not clear what a "commercial waste stream" is at DOE facilities. What makes it necessary for the NRC to regulate this "commercial waste stream" but not other DOE waste streams? Does the radioactive material in those streams not present the same hazard?

It is very interesting to note that the NRC states explicitly there is no adequate technical basis to distinguish between HLW and non-HLW. This certainly supports the contention that some LLW actually represents a much greater hazard than some HLW since they are not now defined on a technical assessment of hazard potential. With the originally proposed redefinition of HLW the NRC missed an excellent opportunity to establish a technical basis.

Lastly the FR could use some good proofreaders.

Sincerely,

Michael H. Mobley
Commissioner, Southeast Low-Level Waste Compact
Director, Division of Radiological Health
Tennessee State Liasion to the Nuclear Regulatory Commission

MHM/E5038196

(27)

Nuclear Information and Resource Service
1424 16th Street, N.W., Suite 601, Washington, D.C. 20036 (202) 328-0002

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Proposed Rule: 10 CFR 61)
)
Disposal of Radioactive)
Wastes)
)
53 Fed. Reg. 96:17709)
May 18, 1988)

July 18, 1988

Nuclear Information & Resource Service

Diane D'Arrigo

1424 16th Street, NW, Suite 601
Washington, DC 20036 (202) 328-0002

Nuclear Information a
Comm

The Nuclear Information and Resou
to learn that the Nuclear Regulat
proposed rule on the redefinition
waste" (10 CFR 60, 52 Fed. Reg. 8
there is a portion of the so-called "low-level radioactive waste" stream that should be afforded the isolation intended for high level waste, however.

Of the options outlined in the Regulatory Analysis of the Proposed Part 61 Amendments in Lieu of Revision of the HLW (High Level Waste) Definition, the Nuclear Information and Resource Service would support Alternative 3: DEFINE HLW AS ALL REPROCESSING WASTE, AND ALL NON-REPROCESSING WASTE ABOVE CLASS C, BUT RETAINING FLEXIBILITY FOR FUTURE RECLASSIFICATION.

More accurately, our position is support for consideration of Greater than Class C (and other) radioactive waste as high level waste. It is not essential to define it as such as long as it is dealt with as such. Allowing the option for such waste to go to regional and state "low-level" radioactive facilities is not acceptable.

NIRS' position is that waste hazardous longer than the institutional control period of "low-level" radioactive waste dumps should be excluded from those facilities. Since NRC's institutional control period is 100 years [10 CFR 61.59 (b)], this would exclude a relatively small volume but large percentage of curies of radioactive waste from "low-level" waste facilities. (Percentage volume and curie estimate was made from analysis of

NUREG/CR-4730 and Rogers and Associates, Conceptual Design Report, Alternative Concepts for Low-Level Radioactive Waste Disposal, National Low-Level Radioactive Waste Management Program, June 1987.)

The remainder, Greater than Class C (GTCC) and those portions of Classes A, B and C that contain radionuclides that are hazardous for longer than 100 years, should be stored in a facility designed to isolate the waste for as long as it remains hazardous.

Hazardous Life

There has been some discussion about the hazardous life of wastes. Should we accept 10 or 20 half lives of the longest lived radionuclide as the hazardous life? Or should we use those as a rule of thumb followed by a measurement after that time to make sure the level is well below the NRC or EPA allowable release level? This would seem the prudent course of action but for the very long lived radionuclides such a procedure, although preferred is not realistic. Especially in those cases, the waste should be isolated in the most restrictive, highly regulated way possible. It should also be bourne in mind that there is growing discontent at the procedures and decisions being made by both NRC and EPA on what is "acceptable" exposure level, release level, and acceptable concentrations in air and water. (See NIRS comments, May 1, 1986 and October 27, 1986, on the Proposed Standards for Protection Against Radiation, 10 CFR 19, 20 et al. and NIRS comments March 2, 1987 on Advance Notice of Proposed Rulemaking on Radioactive Waste Below Regulatory Concern, 10 CFR 2 and 20.)

NIRS advocates zero-release and at minimum, a design goal of zero-release. The intent should be to isolate nuclear waste completely from the environment.

Since NRC prohibits dependance on institutional controls for longer than 100 years at "low-level" waste sites [10CFR61.59(b)], and the public, by and large, does not accept the (thus far, baseless) assurances that the form of the waste and the earth itself will isolate for long time periods after that, one logical conclusion would be to prohibit waste that will be hazardous longer the institutional control of the site from being stored (or "disposed") at the site.

NIRS questions the NRC's high level waste disposal regulations but supports inclusion of Greater than Class C (GTCC) and Classes A,B and C wastes with longer than 100 year hazardous lives in the ongoing discussions and debates on high level waste disposal.

Economic and other considerations must be made for waste other than the commercial irradiated fuel and the defense waste destined for a high level waste repository, along with a complete reevaluation of the adequacy of the criteria for high level waste

disposal.

In the interim, until a final technology and location for permanent isolation of GTCC and other long-lived "low-level" wastes and high level wastes is accepted, it will be necessary to store the waste at NRC-licensed facilities.

Greater than Class C (GTCC) Characteristics

DOE's report on GTCC (DOE/NE-0077 Recommendations for Management of Greater-Than-Class-C Low-Level Radioactive Waste, Report to Congress in Response to Public Law 99-240, US Department of Energy, February 1987) lists the type of waste included in the Greater than Class C waste stream along with the generators of such waste.

It appears from the DOE report that a large percentage of GTCC waste is mixed waste--a mixture of both radioactive and hazardous materials. This presents a problem for any radioactive waste storage or "disposal" facility because of the potential chemical destruction of facility integrity. Such material should not be allowed into a state or regional agreement state facility.

Further, there is a high degree of uncertainty in predicting the volume and curies that will be generated in GTCC waste in the years to come. No large nuclear power plant has ever been dismantled and despite efforts to deregulate the bulk of the decommissioning waste as "Below Regulatory Concern," there will be GTCC waste, unless it is somehow diluted to meet Class C concentration limits. This is if nuclear plants ever are dismantled.

Other Points

It would be a waste of money and an environmentally irresponsible step to attempt to set up another series of radioactive waste centers for GTCC waste. There are already too many sites being proposed for so-called "low-level" waste and a lack of acknowledgement that decommissioning nuclear power plants may not be technically or economically feasable. NRC should accept that even with the best design there is no way to guarantee isolation for the entire hazardous life of the waste and plan to use the maximum protection for all waste that cannot be institutionally monitored and maintained for as long as it is hazardous.

Thus we agree with NRC not to develop new sites for GTCC waste but disagree with the option of putting such waste at "low-level" radioactive waste facilities operated by the states. The states have an incentive to take more waste at their facilities because of the economy of scales, even though the technology has not been found that can isolate GTCC waste.

We further agree that GTCC commercial waste should not go to

Department of Energy sites for either storage or disposal. We oppose the unnecessary transport of any nuclear waste, unless the community to which it is going, the communities through which it travels and all affected communities are in approval. In addition, transportation casks should exceed the federal criteria and the necessity of the shipment should be fully explored and determined by democratic processes prior to shipment.

Respectfully submitted,

Diane D'Arrigo

Diane D'Arrigo

(28)

DOCKET NUMBER
PROPOSED RULE PR 61
(53FR17709)

DUKE POWER COMPANY
P.O. BOX 33189
CHARLOTTE, N.C. 28242

HAL B. TUCKER
VICE PRESIDENT
NUCLEAR PRODUCTION

TELEPHONE
(704) 373-4531

'88 JUL 21 P2:28

OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

July 18, 1988

The Secretary of the Commission
U.S. Nuclear Regulatory Commission
Washington, DC 20555
ATTENTION: Docketing and Service Branch

Subject: NRC Proposed Rule
Disposal of Radioactive Wastes
Duke Power Company Comments

Dear Sir:

In the Federal Register (53FR17709) date May 18, 1988, the Nuclear Regulatory Commission published for comment a proposed rule which requires disposal of "greater-than-class-C" low-level radioactive wastes in a deep geologic repository unless disposal elsewhere has been approved by the Commission.

Duke Power Company feels the proposed rule unnecessarily broadens the scope of radioactive waste required to be disposed of in a geologic repository by imposing Part 61 requirements on: 1) alternative methods of disposal (i.e. other than in a repository), and 2) DOE facilities waste. We feel that this additional scope could significantly complicate geologic repository capacity requirements resulting in the need for a second repository.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

DM/232/bhp

MARVIN LEWIS
7801 ROOSEVELT BLVD. #62
PHILA., PA 19152

DOCKET NUMBER
PROPOSED RULE PR 61
(53FR17709)

(29)

Secretary
U.S.N.R.C.
Washington, D. C. 20555

'88 JUL 22 A10:18

OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

Dear Mr. Secretary,

Federal Register Notice 10 CFR part 61 invited comments to a Proposed Rule on the Disposal of Radioactive Waste.

There are a lot of words in the Background published with the rule. These words do not carry the weight of regulation or law. The only part that is truly significant is the new 10CFR §61.55(2)(iv.) This new part allows the Commission to place the waste whereever the Commission so desires.

Essentially the Commission need not worry about anything, and could place very dangerous Greater than Class C wastes in a low level waste site or dump. The LLW sites are part of Compact agreements and were negotiated with the understanding that they would be used only for low level waste.

The rule gives the Commission power to endanger State perogatives, and does not provide that the GTCC will not endanger the public health and safety and abrogate State Compacts.

Respectfully submitted,

Marvin Lewis
7/7/88

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ENVIRONMENTAL COALITION ON NUCLEAR POWER

Co-Directors: Ms. Phyllis Zitzer—Box 761, Pottstown, Pa. 19464 215-326-9122
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July 18, 1988

Secretary of the Commission
ATTN: Docketing and Service
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: 53 FR 17709
Redefinition of High-Level Waste
and Greater Than Class C Waste

Dear Sir or Madam:

Due to illness of this commenter since early May, our organization has not submitted full comment on the Federal Register notice referenced above. I have, however, discussed the issues with Ms. Diane D'Arrigo, Nuclear Information and Resource Service (NIRS), on more than one occasion and am familiar with her draft comments.

The Environmental Coalition on Nuclear Power (ECNP), with this filing, concurs with NIRS' positions on redefinition of high-level radioactive waste and the disposition of Greater Than Class C wastes and wishes to join its comments with those of NIRS on the matters addressed in 53 FR 17709.

As a member of Pennsylvania's legislatively mandated Advisory Committee on Low-Level [Radioactive] Waste -- although I want to make very clear that I do not in any manner speak for that committee in these comments -- I have assisted in the development and review of the criteria for the siting, design, and licensing of the Appalachian States Regional Low-Level Radioactive Waste (LLRW) Disposal facility which is to be developed in Pennsylvania. The Commonwealth is now in process of becoming an Agreement State for certain related purposes. Draft regulations to govern the LLRW regional facility have just been published for public comments, and the Request for Proposal for a private operator has recently been re-published in the Pennsylvania Bulletin. Pennsylvania is proceeding to meet the milestones in the Federal law in good faith on the assumption that Greater Than Class C (GTCC) wastes will be a Federal, not a state, responsibility in accordance with the 1985 Low-Level Radioactive Waste Policy Act Amendments. Our state law and proposed design and siting criteria do not take into account the possibility that the LLRW facility might contain GTCC wastes, in terms of either their longevity or radioactivity.

Whether or not the Pennsylvania Department of Environmental Resources Bureau of Radiation Protection has chosen to comment on this Federal Register Notice, there are persons in the public-interest sector here in Pennsylvania who have joined ECNP in closely following the progress of radioactive waste disposal. They share our concern that NRC may propose to permit or require Agreement States to take responsibility for the disposal of GTCC wastes, or that Congress will mandate that Agreement States do so, or that GTCC wastes may be allowed to be diluted or mixed with lower activity wastes and thereby be made eligible for disposal in this regional facility. We therefore urge that the Commission take no action which will have the effect of shifting the burden of management and disposal of GTCC wastes from the Federal government to the states. To do so would, in our opinion, violate the legislative intent of the 1985 Amendments and place an undue burden on those Agreement States that will have LLRW disposal sites.

All radioactive wastes that have a hazardous life in excess of the 100-year control period specified in 10 CFR 61 should be considered to be a Federal responsibility. NRC regulations should prohibit the use of dilution, mixing, dispersal, recycle, or deregulation as acceptable methods of altering waste categories. All GTCC wastes -- and, as Pennsylvania had earlier proposed, all Class C low-level wastes -- should be treated as high-level wastes and be the responsibility of the Federal government, which, by its preemptive authority over the licensing of nuclear power facilities, is ultimately responsible for permitting the vast majority of such wastes to be generated in the first place.

The need for conservatism and prudence in the disposal of radioactive wastes to assure their complete isolation from the biosystem for the full hazardous life of the wastes is all the more important in view of recent information that confirms the non-conservatism of existing and proposed NRC radiation protection standards.

* Recent re-evaluation by the Radiation Effects Research Foundation (RERF) of data on the survivors of the atomic bombing of Hiroshima indicates that doses had been markedly over-estimated and that therefore cancer risks have been under-estimated. U.S. radiation protection standards are based on the Hiroshima-Nagasaki data gathered and analyzed many years ago by the Atomic Bomb Casualty Commission, predecessor of the RERF. On the basis of these findings, the British National Radiological Protection Board has reportedly recommended drastic reductions in worker exposure limits and reduction by half of public exposures.

* The distinguished British epidemiologist and medical doctor, A.M. Stewart, and her colleagues have found a strong positive correlation between the incidence of childhood cancer deaths in the British Isles and the levels of terrestrial gamma background radiation measured by the British government. Analyzing data from the massive Oxford Survey of Childhood Cancer, Stewart, et al., suggest that early embryonic exposure to terrestrial gamma radiation appears to be the one common factor in the patterns of childhood cancer occurrence. They reason that the early fetal exposure results in immune system incompetence from birth onward, which in the past would have made those children more susceptible to infectious diseases. Removal of those competing causes of death in childhood -- now largely conquered by administration of vaccines and antibiotics -- allows us to observe the underlying incidence of childhood cancer and leukemia deaths following expiration of the latency period.

  This study showing the correlation of cancer deaths with background radiation levels, which have only about a four-fold variation in the area surveyed, raises very serious questions about our understanding of the effects of low levels of radiation exposure previously thought to be harmless. Obviously, releases to air and water of radioactivity from all man-made sources are additive and cumulative above naturally occurring levels of background radiation. The conclusions: the higher background radiation levels become, the higher the risks of cancer, leukemia, and other radiation-related health or genetic consequences; and the greater the need for excess conservatism in estimating the long-term health effects of radioactive wastes and for treating long-lived and highly active wastes as high-level radioactive waste requiring deep geologic disposal.

* The NRC Commission staff and the nuclear industry have suggested recently that background radiation levels in the U.S. appear to have risen dramatically. (Commission meeting on de minimis and Below Regulatory Concern wastes, Transcript, March 14, 1988.) At the earlier background radiation levels, several thousand premature deaths from spontaneous cancers, plus genetic defects, were estimated to have occurred each year. Any increases in background radiation levels from whatever sources may be expected to result also in increases in deleterious somatic and genetic effects.

* An additional source of emissions and releases of radioactivity to the environment without restriction exists in the categories of de minimis and Below Regulatory Concern low-activity radioactive wastes, which, with NRC approval, may be disposed of without regard for their radioactive content. Each such source constitutes a small, but unmonitored, increment to total background radiation; nuclear industry sources now state that they expect as much as 30-40% of all low-level radioactive waste to be disposed of in these categories. Such cumulative additive quantities of radioactive wastes in the biosphere from the lower activity end of the body of wastes add further to the need for conservatism in the disposal of GTCC wastes and argue for their inclusion with high-level wastes in permanent deep geologic disposal.

For all of the above reasons, combined with those cited in the NIRS comments, ECNP urges the Commission to adopt the most prudent stance with respect to both high-level and GTCC radioactive wastes, defining High-Level Waste to include all reprocessing and non-reprocessing wastes above Class C and disposing of these wastes in the most conservative mode of deep disposal. No arguments of heavy economic burden attendant upon this approach should be allowed to alter the NRC's decision to require that GTCC wastes be handled and disposed of as high-level radioactive wastes.

Thank you for giving consideration to these comments.

Respectfully submitted,

Judith H. Johnsrud

Judith H. Johnsrud, Ph.D.
Director

July 18, 1988

re: 53FR96:17709

Dear People;

I am writing to inform you of my position on two items:

1. I ask that you delete the option for states to take greater than class C waste
2. & include a requirement for any waste that takes more than 100 years to reach decay to be a continuing federal responsibility

Thank you for your consideration of these items.

Sincerely,

Donna Munro

Donna Munro
628 Parkwood NE #1
Grand Rapids, MI 49503
(616) 776-1108

FOOD and WATER, INC.

3 Whitman Drive • Denville, NJ 07834 • (718) 783-2146 / (201) 625-3111

(32)

'88 JUL 25 P3:13

July 19, 1988

Secretary of the Commission
Docketing and Service Branch
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

DOCKET NUMBER
PROPOSED RULE PR 61 (53FR17709)

Dear Madam or Sir:

I have been asked by the President of Food and Water, Inc., to submit a comment concerning 53 FR 17709, redefinition of high-level radioactive waste and the disposal of Class C+, or Greater Than Class C, radioactive wastes. Food and Water, Inc., which is a public-interest organization concerned about the safety of foods and water supplies with headquarters in New York and New Jersey, wishes to add its support to the comments on these matters previously submitted by the Nuclear Information and Resource Service and the Environmental Coalition on Nuclear Power.

We believe that Class C+ wastes, with concentrations of isotopes greater than the maximum concentrations permitted in the Class C low-level radioactive wastes, must be treated as high-level radioactive waste for which the Federal government bears responsibility, and that such wastes must be disposed of in the same manner as high-level spent fuel wastes and other high-activity wastes which the Commission declares to be high-level radioactive wastes.

Our particular interest in this issue derives from the Congressional directive to the Department of Energy to demonstrate the economic feasibility and efficacy of utilizing cesium-137, as well as cobalt-60, as the source material for the commercial irradiation of food. The food irradiation process for use on many kinds of whole foods was approved by the U.S. Food and Drug Administration in March, 1986, but has not yet come into general practice. Facilities for irradiation of food and possession of nuclear materials for that purpose are licensed by the NRC or Agreement States. DOE staff, in 1985 Congressional testimony, has stated that each commercial food irradiation facility may be expected to maintain a source material inventory of between one and ten million curies of cesium-137 or cobalt-60.

It is, however, the disposal of the radioactive wastes that may be generated thereby, including the potentially large numbers of curies of radioactive cesium or cobalt, that gives rise to this response to 53 FR 17709. Should widespread commercialization of food irradiation result in the operation of a large number of such facilities, as DOE projects to be the case within the next two decades, it seems likely that the spent cesium or cobalt, other than that to be supplied by DOE for proposed demonstration food irradiation facilities, would become eligible for disposal at state and regional low-level radioactive waste disposal sites.

At present, it appears that NRC's Part 61 regulations would permit the disposal of cesium and cobalt in quantities governed by concentration limits expressed in 10 CFR 61.55. Permitting Class C+ radioactive wastes to be disposed of in any manner other than as high-level waste in a permanent deep geologic repository would not provide adequate protection of the public health and safety. Moreover, it appears probable that such wastes with activity concentrations greater than Class C could be disposed of in state and regional low-level radioactive waste disposal facilities if the NRC makes the proposed regulatory change that would permit Greater Than Class C wastes to enter Agreement State low-level waste facilities.

For these reasons, we recommend that the Commission determine that Greater than Class C radioactive wastes be treated as high-level radioactive wastes for purposes of storage and disposal and that they be clearly prohibited from being diluted or mixed with other wastes for the purpose of reclassification to a lower category of protection.

Thank you for giving consideration to these comments submitted on behalf of Food and Water, Inc.

Sincerely,

Judith H. Johnsrud

Judith H. Johnsrud, Ph.D.

United States
Environmental Protection
Agency

External Affairs (A-100AE)
Washington DC 20460

DOCKET NUMBER
PROPOSED

(53FR17709)

EPA

Federal Activities

'88 AUG -4 A10:38

DOCKETING & SERVICE BRANCH

Mr. Samuel Chilk
Secretary of the Commission
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTN: Docketing and Service Branch

Dear Mr. Chilk:

In accordance with Section 309 of the Clean Air Act the U.S. Environmental Protection Agency (EPA) has reviewed the U.S. Nuclear Regulatory Commission's (NRC) proposed rule for the disposal of Radioactive Waste (53 FR 17709).

The proposed rule would modify 10 CFR 61 to require that all radioactive wastes with radionuclide concentrations "greater-than-Class-C" be disposed of in geologic repositories, unless the Commission determines that such isolation is not needed in specific cases. By taking this approach, the Commission has chosen to not develop a quantitative definition for "high level wastes" (HLW) in this rulemaking.

EPA is sympathetic with the Commission's reasons for not developing a quantitative HLW definition at this time. Enough information about the effectiveness of various disposal methods does not now exist to defend a numerical definition. However, the approach taken by NRC raises two problems that may ultimately call for a numerical approach to be taken:

1. This action by the Commission does nothing to resolve uncertainties regarding the disposition of large volumes of defense radioactive wastes that are derived from reprocessing of spent fuel, but that have relatively low concentrations of radionuclides.

2. By directing disposal of "greater than Class C" wastes in geologic repositories, without defining them as high level wastes, the Commission may create a situation where the different wastes disposed of in the same repository may be subject to different EPA standards (i.e., 40 CFR parts 191 and 193, when both are promulgated). This may complicate implementation and, in any case, will require careful examination of the possible duplication and/or conflict of technical, administrative and regulatory requirements. In addition the same dichotomy may exist relative to NRC's own rules (i.e., 10 CFR Parts 60 and 61).

Because of these remaining problems, a quantitative definition of "high-level" waste may be needed in the long run. Since the Commission has not been able to develop one yet, EPA may consider this issue when determining the applicability of 40 CFR Parts 191 and 193 through our rulemaking processes. We will, of course, continue consultation with the NRC in these rulemakings.

AUG 10 1988

Acknowledged by card.....

Finally, these wastes may contain a hazardous waste component, as defined under the Resource Conservation and Recovery Act (RCRA). If these wastes contain such a hazardous component, that component is subject to RCRA controls as well as NRC regulations. In addition, where wastes with a hazardous component subject to RCRA are in question, EPA probably would be involved in any decision about alternative disposal standards. General language to this effect should be included in the final rule.

If you have any questions concerning EPA's comments, please contact Dr. W. Alexander Williams (382-5909) of my staff.

Sincerely,

Richard E. Sanderson
Director
Office of Federal Activities

Department of Energy
Washington, DC 20585

AUG 30 1988

'88 AUG 31 P12:00

Secretary
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attention: Docketing and Service Branch

Dear Sir:

The Department of Energy (Department) has reviewed and offers its comments on the proposed amendment to 10 CFR Part 61, published on May 18, 1988, concerning the definition of high-level waste (HLW) and disposal of greater-than-Class-C waste (GTCC). The Department notes that there was a substantial change from the earlier Advanced Notice of Proposed Rulemaking (ANPR) to the proposed rule. The Department's first objection is that the proposed rule fails to acknowledge the comprehensive scheme for developing a policy for disposal of GTCC wastes which was created by Congress in the Low-Level Waste Policy Amendments Act of 1985, Public Law 99-240, (LLWPAA). This statute confers on the Department a long-range responsibility to identify disposal options, financing mechanisms, and the legislation needed to implement them, and further provides that no disposal shall be undertaken until the Department's recommendations have been submitted to Congress.

If this proposed rule is misinterpreted as a premature designation that all GTCC wastes shall be disposed of in a geologic repository (unless placed in some other licensed facility), the Nuclear Regulatory Commission (Commission) will disturb the deliberative process mandated by Congress before that process can be completed. This interferes with the Department's ability to perform an objective study unbiased by other regulatory initiatives.

By suggesting that the Department obtain legislation to implement the Commission's policy choice, the Commission is asking the Department to act without first having complied with its own responsibility under the LLWPAA. The Department believes that the proposed rule should be abandoned, and that the Commission should resume the course announced in the ANPR of developing a definition for HLW. This would be of great assistance to the Department in defining GTCC wastes--a prerequisite for evaluating policy options--and would be consistent with more conventional regulatory procedures. If this course is followed, then, once the Department has developed appropriate disposal options and has advised Congress of needed legislation, and Congress has acted on those recommendations, the Department will be in a position to work with the Commission regarding technical matters and licensing procedures.

This would be a far better approach to the problem of disposal of GTCC wastes in that it would not foreclose deliberations intended by Congress to be the responsibility of the Department.

If, however, the Commission does not accept the Department's recommendation concerning this matter, then, in the alternative, the Department recommends that the proposed rule be amended to preserve the Department's policy-making responsibility under the LLWPAA. In either case, the Department urges the Commission to proceed with developing an appropriate risk-based definition of waste streams, as initially proposed in the ANPR.

Also, in the alternative, the Department offers comments on the proposed rule in four areas: first, the proposed wording of section 61.55; second, the need for new legislative authority; third, the lack of criteria and guidance from the Commission; and, fourth, the lack of a risk-based definition for high-level waste.

The proposed wording for section 61.55(a)(2)(iv) states, in part, that "In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository . . . unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are submitted to the Commission for approval." The wording of the preamble and the proposed rule create confusion and might be misinterpreted to imply that the Commission is expressing a preference for disposal in a repository. GTCC wastes need better definition to determine whether, or which, GTCC wastes require the isolation of a geologic repository. Disposal in a geologic repository may be an unnecessarily expensive alternative for some GTCC wastes and for some low-activity wastes that may be considered HLW under a source-based definition while it may be the only appropriate alternative for others. The activity levels of the various forms of GTCC wastes and low activity HLW should be considered to assure an appropriately safe form of disposal without excessive costs to the generators and the public. Further, the addition of a new waste form for disposal in a geologic repository may well impact the design of such a repository and/or necessitate special treatment of the new waste form. Licensing and permitting of the repository may also be complicated by the inclusion of another form of waste.

The Department suggests that the wording of the rule be modified to allow the Department the clearest opportunity for maximum flexibility by changing the last sentence of 61.55(a)(2)(iv) to read as follows: "Such waste must be disposed of either in a disposal site or sites licensed pursuant to this Part or in a facility licensed pursuant to Part 60 of this Chapter."

The preamble further states that additional legislation may be needed by the Department to provide for payment of disposal costs of GTCC wastes or to authorize receipt of such wastes for disposal at a repository. Unless the Commission makes a determination under

section 2(12)(B) of the Nuclear Waste Policy Act (NWPA) that GTCC waste requires permanent isolation, the Department agrees that such legislation would be required. The Department has no authority to dispose of wastes other than high-level (as defined in the NWPA) and spent fuel in a repository authorized by the NWPA.1/

The Commission states that "Technical criteria to implement the performance objectives of [10 CFR 61] and [the Environmental Protection Agency] environmental standards would be developed by the Commission after the DOE [the Department] had completed its conceptual design and selected a site for a specific type of facility." The Department would like the opportunity to discuss the applicability of the existing repository technical criteria for spent nuclear fuel and HLW to the disposal of GTCC wastes in a repository.

While the Department appreciates the flexibility the Commission is making available in the proposed rule, the Department is concerned that the effort to define high level waste has been discontinued by the Commission. A risk-based definition of high-level waste, which is tied to adequate protection of public health and safety, is needed. The Department would like to see this effort resumed and is willing to assume a more active role in the effort, if requested by the Commission.

The Department has a number of other comments which are contained in the enclosure. However, we wished to bring these particular concerns to your special attention. Please feel free to contact Mr. Edward P. Regnier (586-4590) of my staff about any questions.

Sincerely,

Charles E. Kay

Charles E. Kay, Acting Director
Office of Civilian Radioactive
Waste Management

Enclosure

1/ It should be noted that "high-level radioactive waste" under section 2(12)(B) of the NWPA includes "other highly radioactive material that the Commission, consistent with existing law, determines by rule requires permanent isolation."

ENCLOSURE

Department of Energy Comments
On the Proposed Amendment to 10 CFR Part 61

General Comments

1. Nowhere in the proposed rule has the Nuclear Regulatory Commission (Commission) attempted to insure that its policy objectives are consistent with the Low-Level Waste Policy Amendments Act of 1985 (LLWPAA), Public Law 99-240, which at section 3(b)(3)-(4) provides that:

> "(3) Not later than 12 months after the date of enactment of this Act, the Secretary shall submit to the Congress a comprehensive report setting forth the recommendations of the Secretary for ensuring the safe disposal of all radioactive waste designated a Federal responsibility pursuant to subparagraph (b)(1)(D) [GTCC wastes]. Such report shall include--
>
> > "(A) an identification of the radioactive waste involved, including the source of such waste, and the volume, concentration, and other relevant characteristics of such waste;
> >
> > "(B) an identification of the Federal and non-Federal options for disposal of such radioactive waste;
> >
> > "(C) a description of the actions proposed to ensure the safe disposal of such radioactive waste;
> >
> > "(D) a description of the projected costs of undertaking such actions;
> >
> > "(E) an identification of the options for ensuring that the beneficiaries of the activities resulting in the generation of such radioactive wastes bear all reasonable costs of disposing of such wastes; and
> >
> > "(F) an identification of any statutory authority required for disposal of such waste.
>
> "(4) The Secretary may not dispose of any radioactive waste designated a Federal responsibility pursuant to paragraph (b)(1)(D) [GTCC waste] that becomes a Federal responsibility for the first time pursuant to such paragraph until ninety days after the report prepared pursuant to paragraph (3) has been submitted to the Congress.

Under this provision, the Department submitted a report to Congress in February 1987, DOE/NE-0077, "Recommendations for Management of Greater-Than-Class-C Low-Level Radioactive Waste." The report did not, at that time, contain a comprehensive assessment of disposal policy options because, to a large degree, the Department was hampered by the lack of a definition of greater-than-Class-C (GTCC) wastes. The Department urged the Commission to provide such a definition so that a disposal policy could be formulated, and, in the interim, the Department offered to store GTCC wastes until a more comprehensive recommendation could be developed. The Department fully intends to formulate these policies within the next 2 years, and to submit them to Congress for consideration. While the Department's efforts would be measurably advanced if the Commission resumed the initiative announced in the Advanced Notice of Proposed Rulemaking (ANPR), the Commission policy initiative towards disposal in a geologic repository only complicates the Department's efforts to provide a thorough review of all available options.

2. The Department of Energy believes it is inappropriate for the Commission to require that a particular type of waste be disposed of in a specified facility. The Commission should be concerned with disposal of radioactive waste without undue risk to the health and safety of the public.

3. As noted in the preamble, the Nuclear Waste Policy Act (NWPA) of 1982, as amended, would need to be amended in order for the Department to comply with the requirement of the proposed rule that GTCC waste be disposed of in a geologic repository, unless the Commission determines that GTCC waste requires permanent isolation in accordance with section 2(12)(B) of the NWPA.

4. The proposed change that would require commercial GTCC waste to be disposed of in a geologic repository unless a licensed intermediate disposal facility is available may still necessitate long-term storage of GTCC wastes by the Department.

Specific Comments

5. Pending the outcome of further evaluation of competing methodologies for GTCC low-level waste (LLW) disposal, the Department does not have a predisposition for or against competing disposal options. Technical analysis or institutional circumstances must be considered to justify one disposal method over another. Our concern with the proposed rule is that its interpretation and effect are unclear.

   The provision requires geologic repository disposal, "unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are submitted to the

Commission for approval." Taken literally, the rule would allow submission of proposals only for disposal of GTCC wastes at facilities that already had a disposal license. This wording should be clarified, or the Commission's interpretation explained in the commentary accompanying the rule.

Although the intent of the proposed rule is obvious, the wording indicates that alternative methods of disposal would be allowed at the time the request is "submitted" to the Commission, not once it is "approved." The proposed rule refers to a process by which the Commission would give its "approval" to methods of GTCC LLW disposal other than in a geologic repository. The timing of the approval process in relation to the site development process is unclear. The commentary in the Notice indicates that if the Department chose to develop a disposal site other than a repository, the Commission would evaluate the acceptability of such facility "in light of the particular circumstances, considering for example the existing performance objectives of 10 CFR Part 61 and any generally applicable environmental radiation protection standards . . . ."

There are at least two ways to interpret the proposed rule. Under the first, the rule has a significant impact on planning for GTCC LLW disposal; under the second the rule has no effect.

A. In defending a categorical exclusion of the proposed rule from the need to prepare an environmental assessment or environmental impact statement, the preamble indicates that the approval process for disposal methodologies other than a geologic repository would be the same as the approval process already in place. The Notice states that, ". . . as before, proposals for other methods of disposal may still be submitted to the Commission for approval. No substantial modification of existing regulations is involved."

If this refers to the existing process described in 10 CFR Part 61.58, which we believe has been cited in the past as the Commission's authority to grant case-by-case approval for disposal of GTCC LLW, then the process is much more restrictive than the description in the commentary section of the Notice. Such requests for disposal apparently must be site-specific, methodology-specific and waste stream-specific. Part 61.58 allows the Commission to--

> "authorize other provisions for the classification and characteristics of waste on a specific basis, if, after evaluation of the specific characteristics of the waste,

disposal site, and method of disposal, it finds reasonable assurance of compliance with the performance objectives in Subpart C of this part."

Moreover, the decision as to whether to exercise the approval authority at all under Part 61.58 is completely discretionary on the part of the Commission. This differs from the evaluation of a disposal license application, which the Commission would perform as a matter of course upon submission of an application. Because the Commission's decision whether to exercise the approval authority is not limited in any way, the decision could be based on policies and issues that would more properly rest with the Department, which has been charged under Federal law with investigating and recommending disposal options that meet the technical requirements for Commission licensing.

Therefore, the proposed rule, if it is to be coupled with the existing approval process in Part 61.58, could effectively foreclose serious investigation of disposal options other than a geologic repository.

B. Alternatively, the process for Commission approval of disposal methods other than a geologic repository may be intended by the Commission to be the licensing process itself. The Notice states that once the Department has proposed a disposal concept and selected a site, the Commission will develop applicable technical criteria for GTCC LLW to implement performance objectives in Part 61. However, because technical criteria for disposal of GTCC wastes would be required even if the disposal facility were a geologic repository, the proposed rule "requiring" GTCC LLW disposal in a geologic repository would provide no procedural preference at all for geologic disposal. The rule would have no practical effect and, therefore, would be unnecessary.

Absent a fuller description of the Commission's intent, preferably in the rule, we believe that the potential for changing interpretations of the rule over time may disrupt progress in developing new disposal capacity for GTCC LLW.

6. The proposed use of geologic repository space for GTCC waste deserves more thorough evaluation and consideration including the following:

   (a) Risk basis;

   (b) Systems analysis of alternative GTCC disposal methods versus deep geologic repository for safety and cost;

   (c) Accurate forecast of GTCC waste volume for repository planning;

(d) High unit disposal cost; and

(e) Suitable waste forms and canisters for GTCC that are amenable to the proposed repository design.

7. The Department strongly encourages the Commission to clarify the performance objectives to be used for the GTCC waste, whether it is to be disposed of in a geologic repository or in another facility, so as to facilitate the Department's decision on how to dispose of the GTCC wastes.

Placing GTCC waste in a geologic repository under the NWPA has impacts on repository design, cost, schedule, performance, and licensing. It is difficult for the Department to assess these impacts accurately without a realistic estimate of the composition and quantity of the waste and of the technical criteria and the performance objectives to be imposed on the waste. Consequently, the Department's decision whether to seek amendments to the NWPA to permit disposal of GTCC waste in a geologic repository under the NWPA or to propose another facility becomes even more difficult. Illustrative examples are described below.

(a) Character of GTCC Wastes

The largest uncertainty barring an assessment of the potential impacts of disposal of GTCC wastes in the repository concerns the character and quantities of the wastes involved. This includes the potential that these wastes might be classified as mixed wastes, therefore introducing permitting requirements under the Resource Conservation and Recovery Act (RCRA). Evaporator bottoms, spent resins, control rod shrouds, and portions of core barrels (from reactor decommissioning) have been mentioned as possible sources of GTCC wastes. In most cases, it is obvious that these wastes would be unsuitable for disposal of any kind without some processing to immobilize the wastes, reduce volumes, and provide desirable waste form characteristics. The definitions of processing requirements, locations where processing is to be performed, and how the costs of processing are to be borne are all large uncertainties which cannot be addressed until the nature of the wastes themselves is adequately defined, and waste acceptance criteria are developed by the repository.

(b) Waste Package Criteria for Geologic Repository Disposal

Criteria for the waste package and its components are contained in section 60.135. Specific criteria for waste other than high-level waste (HLW) are not provided and

section 60.135(d) states that "Design criteria for waste types other than HLW will be addressed on an individual basis if and when they are proposed for disposal in a geologic repository."

Overall, the requirements for disposal of GTCC wastes are not well defined, and no serious evaluation of the issues raised has been done. The regulations appear to permit proposal of waste packaging for GTCC wastes which is different from that for other wastes, but the acceptance by the Commission of such a proposal is not assured. However, for large quantities of GTCC wastes, there would appear to be a strong economic incentive to pursue a less elaborate packaging concept for these wastes.

(c) Repository Surface Facility

If waste packages other than those currently proposed for the disposal of HLW were acceptable to the Commission, the surface facilities could receive wastes directly in the hot cell areas and transfer them to the emplacement areas by means of shielded transport devices. However, supplemental shielding, greater than that needed for spent fuel and high-level wastes, may be required for certain types of GTCC wastes. Additionally, receipt of wastes in other configurations may require other arrangements and more elaborate processing. This could include additional hot cell handling operations, decontamination and inspection functions, which have the potential for increasing individual hot cell utilization ratios.

Alternatively, if waste packages similar to those currently proposed for the disposal of HLW are required, it will be necessary to provide hot cell facilities to process and package the waste to meet disposal requirements. The attendant increases in handling, decontamination, inspection and disposal container closure and nondestructive examination operations would significantly impact the hot cell utilization ratios, as presently designed. Additionally, if volume reduction for these GTCC wastes were performed at the repository, this would introduce further complexity into the hot cell equipment operations and future decommissioning.

(d) Repository Subsurface Facility

The design impact of emplacing GTCC wastes in the subsurface repository facility depends, in part, on which alternative subsurface design being considered. For the vertical emplacement mode, the lower heat output of GTCC wastes as compared to spent nuclear fuel could allow additional boreholes to be drilled between the 15 foot spacing of boreholes in those drifts which only contain spent fuel.

For the long horizontal emplacement alternative, GTCC wastes, in appropriately designed containers and appropriate radiation shielding, could be substituted for "dummy" containers to give the required standoff distance and to push the spent fuel containers into the borehole. This would, however, introduce complications into possible retrieval operations.

The short horizontal emplacement alternative is not yet sufficiently developed to allow the Department to suggest a possible solution for compatible GTCC emplacement.

Should a dedicated emplacement area be required for GTCC wastes, additional panels and emplacement rooms would be required. This could restrict what flexibility there presently exists to lay out the repository within the primary area.

(e) Testing

From the testing perspective of emplacement of GTCC wastes, the geochemical and waste package development programs could increase in scope in response to the Commission proposed reclassification. However, pending definition of disposal requirements, waste characterization, and processing requirements, it is not possible to estimate the scale of the change. Since planning for Commission licensing is presently occurring, the Department may find it difficult to incorporate studies or tests to characterize the waste, assess the waste form performance, and model waste form/environment interactions for the GTCC wastes in time to support the scheduled license application.

Comments on the Preamble

8. Footnote 1, page 5993 (ANPR) (51 FR 5992) from the February 27, 1987, proposed rule should have been included in the Background section of the Supplementary Information provided in the preamble at p. 17709. This footnote clarified that the waste generated in further treatment of HLW, such as decontaminated salt, at the Savannah River Plant was considered incidental wastes and not within the Appendix F definition.

9. The Department is concerned that the Commission has changed its longstanding plans to define radioactive material based on its hazardous characteristics rather than its source. We believe that a risk-based definition which distinguishes HLW from LLW is the most reasonable, technically sound, and appropriate basis for management of such material. We further believe that a waste stream should not be classified into a particular waste category until it is prepared for long-term storage and/or disposal. Until such time, it is more appropriately considered material in process which may produce several particular waste categories for long-term storage and/or disposal.

   The Department continues to favor the concept of classifying radioactive wastes on the basis of those characteristics of the material which pose hazards to humans and to their environment, thereby facilitating a close link between such waste and its cost-effective isolation. The Department urges the Commission to continue to develop the risk-based approach to defining HLW, an approach which was strongly endorsed by many agencies, organizations, and individuals who offered comments on the ANPR. A single risk-based definition of HLW based on radioactive concentrations is needed; the disparity of definitions among the NWPA of 1982, 40 CFR Part 191, 10 CFR Part 60, and DOE Order 5820.2A could lead to substantial difficulties. The Department recommends that an interagency task force be formed to develop a recommended HLW definition.

10. The responsible agencies should take steps to resolve questions regarding the appropriate definition of HLW for both the Energy Reorganization Act of 1974 and the NWPA.

(35)

Midwest Interstate Low-Level Radioactive Waste Commission

Room 588 • 350 N. Robert Street • St. Paul, MN 55101 • (612) 293-0126

September 9, 1988

Mr. Samuel Chilk
Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Chilk:

The Midwest Interstate Low-Level Radioactive Waste Commission reviewed the proposed rule notice on "Disposal of Radioactive Wastes" (Federal Register, May 18, 1988, p. 17709) and submitted comments to the NRC on July 8, 1988. We were recently informed that the proposed rule is still under consideration and that additional comments would be accepted.

In the comments submitted on July 8, the Midwest Compact Commission requested that the proposed rule be amended so that the only exception to disposal of greater-than-class C waste n a deep geologic repository would be a "Department of Energy intermediate" disposal site. We continue to advocate this limitation, but now request that the language in the proposed rule be amended to read as follows (insert underlined):

> Waste that is not generally acceptable for near surface disposal is waste for which waste form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository as defined in Part 60 of this chapter unless proposals for disposal of such waste in a federal intermediate disposal site licensed pursuant to this part are submitted to the Commission for approval.

Our reasons for requesting the amendment, as set forth in our July 8 letter, are unchanged. The Midwest Compact Commission continues to believe that Nuclear Regulatory Commission discretionary authority to approve such proposals should be limited to federal facilities.

Sincerely,

Teri Vierima

Dr. Teri Vierima
Chair

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
Post Office Box 2063
Harrisburg, Pennsylvania 17120

September 15, 1988

Bureau of Radiation Protection
(717) 787-2163

Secretary Samuel J. Chilk
Secretary of the Commission
U.S. Nuclear Regulatory Commission
ATTEN: Docketing and Service Branch
Washington, DC 20555

Dear Secretary Chilk:

The Pennsylvania Department of Environmental Resources, Bureau of Radiation Protection wishes to offer the following comments pursuant to the proposed rule making on "greater-than-class-C" low-level radioactive waste.

These comments are in addition to those sent to you in our letter of February 27, 1987, on the definition of "high-level radioactive waste". We still consider those comments germane.

We feel it would be unreasonable to consider disposal of the small volume of greater-than-class-C waste in any facility other than the deep geologic repository. Therefore, we would strongly recommend the modification of § 61.55 (a)(2)(iv) Waste Classification. The final sentence of this subsection concludes with "--- unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are submitted to the Commission for approval". We recommend the deletion of this text in recognition of the simple logic of deep geologic disposal for greater-than-class-C waste.

Additionally, members of the public have expressed concern to us about siting a low-level radioactive waste disposal facility near their communities that could someday become the disposal site for greater-than-class-C waste. It would greatly enhance our ability to site a disposal facility and thus comply with the Low Level Radioactive Waste Policy Amendments Act of 1985, if the Nuclear Regulatory Commission would amend Part 61 as we have suggested.

We hope you will take our comments into consideration.

Sincerely,

William P Dornsife

William P. Dornsife, Chief
Division of Nuclear Safety

ENCLOSURE H

VI

Radioactive Waste Disposal

AN EVALUATION OF OPTIONS FOR MANAGING GREATER-THAN-CLASS-C LOW-LEVEL RADIOACTIVE WASTE

Background Paper

October 1988

Congress of the United States
Office of Technology Assessment
Washington, D.C. 20510-8025

Office of Technology Assessment

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AN EVALUATION OF OPTIONS FOR MANAGING GREATER-THAN-CLASS-C LOW-LEVEL RADIOACTIVE WASTE

Background Paper

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Foreword

This evaluation of management options for greater-than-Class C (GTCC) low-level radioactive waste was undertaken at the request of the Senate Committee on Environment and Public Works. The Committee asked that OTA evaluate existing Federal and non-Federal options for GTCC waste storage and disposal. From its analysis, OTA was to develop an integrated management approach to protect public health and safety in the short- and long-term.

The most significant finding of this study deals with the storage of GTCC waste. Since a disposal facility for GTCC waste will not be available for at least fifteen to twenty years, GTCC waste will have to remain in storage in the meantime. This period of extended storage could be extremely difficult for many GTCC material users and waste generators. OTA has developed a possible approach for addressing these problems.

Other OTA documents covering radioactive waste issues are the reports, Managing the Nation's Commercial High-Level Radioactive Waste, (1985), Transportation of Hazardous Materials, (1986), and a staff paper, Subseabed Disposal of High-Level Radioactive Waste, (1986).

This Background Paper on GTCC waste was prepared as part of a broader study on the disposal of Class A, B, and C low-level radioactive waste that will be completed next year. This latter report will also deal with the disposal of mixed wastes that contain both low-level radioactive and hazardous wastes. The management of hazardous wastes has been addressed in several OTA reports, including Technologies and Management Strategies for Hazardous Waste Control, (1983) and Serious Reduction of Hazardous Waste, (1986).

OTA is grateful for the input from the many reviewers of this report; their comments were invaluable. As with all OTA studies, the content of this report is the sole responsibility of OTA.

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NOTE: OTA appreciates and is grateful for the valuable assistance and thoughtful critiques provided by all the reviewers of this Background Paper. The reviewers do not, however, necessarily approve, disapprove, or endorse this Background Paper. OTA assumes full responsibility for the Background Paper and the accuracy of its contents.

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CHAPTER 1

SUMMARY OF FINDINGS

BACKGROUND

Most commercial low-level radioactive waste (LLW) in the United States is classified as A, B, or C, with Class C being the most radioactive. Universities, hospitals, nuclear utilities, and various industries generate a small amount of LLW that is more radioactive than Class C waste, termed greater-than-Class-C (GTCC) waste. Several thousand GTCC material users and waste generators, most of which are small, such as academic laboratories and small radioagraphy firms, are currently forced to store this waste on-site because no options are available for off-site storage or disposal. Many generators argue that their on-site storage capacity is shrinking and that over the next decade or so they will have no capacity remaining. Although no deaths have been reported from accidents involving GTCC waste in this country, the relatively high levels of its radioactivity demand that management options be made available to ensure that public health and safety are protected.

In the Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLRWPAA), the Federal Government (presumably the Department of Energy (DOE)) is directed to develop a disposal plan for GTCC waste. No such plan, however, has been developed. In response to this legislative mandate, DOE issued a report in 1987 focusing primarily on GTCC waste characteristics, including present and projected volumes. DOE decided to defer proposing a disposal plan until it had completed analyzing various disposal options.

The Office of Technology Assessment (OTA) has evaluated options for managing GTCC waste and concludes that no disposal facility, regardless of the technology used, is expected to be available for GTCC waste for at least fifteen to twenty years. During this time, problems could arise if an off-site storage option is not made available for some GTCC waste generators that have limited on-site storage capacity.

In its 1987 report, DOE tentatively committed the Federal Government to accept GTCC waste for storage by 1989, presumably at an existing DOE facility. There are questions, however, about the propriety of storing commercial GTCC waste at an unlicensed DOE facility used primarily for defense waste. With few exceptions, commercial radioactive waste has been stored at facilities that are licensed by the Nuclear Regulatory Commission (NRC) or Agreement States. Legally, commercial GTCC waste must also be disposed of in an NRC-licensed facility. DOE is presently awaiting guidance from Congress on this licensing issue.

Congress has drafted some legislation dealing with the management of GTCC waste, but no hearings have been held. The following 3-step management approach was developed by OTA to supplement these efforts.

STEP 1 - EXTENDED STORAGE

Since a disposal facility for GTCC waste will require at least 15 to 20 years to develop, GTCC waste will have to remain in storage until at least 2010 and potentially much longer. The NRC may need to update its packaging and storage guidance for GTCC waste considering the likelihood of a few decades of extended storage.

It is likely that off-site storage capacity will be needed, especially for small and/or financially unstable GTCC waste generators. Given the open-ended period during which GTCC waste will have to be stored, it is unlikely that States (which under the LLRWPAA of 1985 are

not responsible for GTCC waste disposal) or private companies would be anxious to independently accept the liabilities associated with storing this waste. They would have to charge sufficiently high storage fees which may not be affordable to many generators. Therefore, the Federal Government (presumably DOE) will probably need to provide this off-site storage capacity for GTCC waste generators.

During the next three decades, between 10,000 and 20,000 cubic feet of packaged waste -- a volume equivalent to four to eight tractor trailers -- is projected to need off-site storage. OTA estimates that several years would be required to develop a storage facility for this waste, assuming that it would be NRC-licensed.

STEP 2 -- LIMITED-ACCESS STORAGE

Some generators of GTCC waste, especially small companies, may need access to a small amount of off-site storage capacity before an extended-storage facility could be available. Sufficient capacity may need to be only a few thousand cubic feet.

GTCC radioactive sealed sources pose a particular concern. Sealed sources are small radiation sources containing granules of radioactive material that are sealed inside capsules ranging from 0.3 inches to 20 inches long. Several thousand GTCC sealed sources are now being used in a wide variety of tools (e.g., gauges used to check pipe welds) and machines (e.g., cancer therapy machines) throughout the United States. Over the last 25 years the theft and improper handling of sealed sources has been responsible for about 15 deaths in foreign countries and several serious radiation burns in the United States.

Once a sealed source becomes obsolete, a user may try and return it to the manufacturer. The manufacturer will generally refuse to accept the sealed source unless it can be recycled economically. Many sealed source users, however, may not have appropriate facilities for extended, on-site storage. Furthermore, some companies possessing GTCC material and/or waste may go out of business before an extended storage or a disposal facility is available.

To reduce the potential for GTCC accidents in the United States, the Federal Government could provide limited access to existing storage capacity such as an unlicensed, DOE storage facility. Some accidents could also be avoided by adding a deposit-return fee to the price of sealed sources. For example, some portion of this fee would be returned to a user when it returned its obsolete sealed source to the manufacturer. The remainder of the fee would be kept by the manufacturer to fund its recycling or storage and eventual disposal of the sealed source.

Although it is impossible to predict whether a GTCC waste accident might occur in this country, the political repercussions of such an accident for the Federal Government could be especially significant if the accident were linked to the Government's inability to accept GTCC waste for storage or disposal.

STEP 3 - DISPOSAL

The longevity of risk and the radioactivity associated with most GTCC waste is similar to that of defense high-level waste (HLW). Furthermore, once utilities begin to refurbish or decommission their nuclear plants, more than half of GTCC wastes' activity will be contributed by radionuclides (primarily nickel-63) with half-lives 100 years or longer. The Federal Government is currently planning to use a deep-geologic repository for the disposal of defense HLW.

If a decision about the disposal of GTCC waste were required today, a conservative approach would be to permanently isolate the waste in a deep-geologic repository, as has been

proposed for commercial spent fuel and defense HLW. It is possible, however, that further research and analysis could demonstrate that other disposal alternatives would be acceptable, such as deep-augered holes or an intermediate-depth repository. Near-surface disposal alternatives, such as buried concrete vaults, would probably provide waste isolation for periods of a few hundred years but probably not for the few thousand years needed for much GTCC waste.

The volume of GTCC waste is probably not large enough to justify the economic or institutional costs associated with developing a separate disposal facility, regardless of the technology used. The projected volume of GTCC waste that will be generated through the year 2020 would probably occupy much less than 1 percent of the proposed repository for commercial spent fuel and defense HLW. Preliminary calculations also indicate that the costs associated with using this large repository for GTCC waste would be comparable to, or perhaps even less than, costs associated with developing a small disposal facility only for GTCC waste.

The proposed repository for commercial spent fuel and defense HLW could be operational in fifteen to twenty years if the site now being investigated at Yucca Mountain, Nevada, is found suitable and no unforeseen legal or procedural delays are encountered. This time estimate could be extended by another two decades if the Yucca Mountain site is found unsuitable and another repository site must be located. Even if another technology were chosen for GTCC waste disposal, history indicates that it would still require about five years to select that technology, and another ten to fifteen years to design, site, and license a separate facility.

Although a decision to use the Yucca Mountain repository for GTCC waste disposal could be made now, DOE must still determine whether such use of the repository would have unacceptable environmental or institutional impacts on the repository's overall operation and performance. DOE could concentrate its efforts on this analysis over the next year or two. If it appears that no such impacts would occur, DOE could decide to use the repository for GTCC waste. In contrast, if it appears that unacceptable impacts would occur or repository disposal would be more expensive than other disposal alternatives, DOE could then evaluate other disposal options for GTCC waste disposal. In weighing the advantages and disadvantages associated with using the Yucca Mountain repository, it is important to consider the institutional and political difficulties associated with siting a separate GTCC waste disposal facility, regardless of its size or type.

ISSUES REQUIRING CONGRESSIONAL CONSIDERATION

There are several issues that will need to be addressed by Congress. The first five issues may best be addressed through hearings and oversight; the last may require legislation. These issues involve:

- o Ensuring institutional control over sealed sources.
- o Ensuring the adequacy of packaging and storage guidance for extended storage at GTCC waste generation sites.
- o Verifying and reviewing the need for limited access to Federal storage capacity for GTCC waste, and clarifying DOE's role in providing such storage.
- o Verifying and reviewing the need for extended Federal storage for GTCC waste, and clarifying DOE's role in providing such storage.
- o Developing technical and non-technical criteria and specifications on the use of Federal storage capacity for GTCC waste.
- o Determining the need for NRC-licensing of any Federal facilities used to store commercial GTCC waste.

The sequence and possible activities involving GTCC waste management are presented in Appendix D.

Chapter 2
BACKGROUND

PURPOSE OF THE STUDY

No disposal facility is presently available for greater-than-Class-C (GTCC) low-level radioactive waste (LLW) and some waste generators claim to be running out of on-site storage capacity. Through the Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLRWPAA), the Federal Government (i.e., the U.S. Department of Energy (DOE)) was made responsible for disposing of GTCC waste. In accordance with this legislation, DOE published a report in February 1987 entitled Recommendations for Management of Greater-Than-Class-C Low-Level Radioactive Waste. This report focused primarily on the types and quantities of GTCC waste and regulatory needs; there was little analysis of disposal options for this waste. DOE plans to select a disposal technology within the next several years after evaluating disposal alternatives.

Without knowing disposal requirements or when a disposal facility will be available, GTCC waste generators have difficulty estimating their storage needs and designing waste packages for both storage and disposal. Congress therefore asked OTA to analyze different management options and to develop an integrated management approach for GTCC waste. Before presenting this analysis, we provide some background information on GTCC waste and the factors that are most important in safely managing it. Finally, we present an analysis of different management options by comparing them to technologies that are or will be used to store and dispose of other types of radioactive waste.

Since concerns about managing GTCC waste have been raised only within the last few years,[1] very little information on this type of LLW has been published. DOE's February 1987 report, cited above, is the only report published on the subject. A few papers on GTCC waste have also been presented at conferences on radioactive waste management. Additional information used in this analysis was obtained from reports and papers that deal with all types of radioactive waste, letters and memos from Federal agencies, and communications with personnel working in this and other related areas of radioactive waste management.

WHAT IS GTCC LOW-LEVEL RADIOACTIVE WASTE?

Low-level radioactive waste is defined in the LLRWPAA of 1985 by what it is not, rather than by what it is. LLW includes radioactive waste not classified as spent fuel, high-level waste (HLW) from reprocessing spent fuel or uranium mill tailings. These types of radioactive waste are defined generally in Appendix A; special terms relating to radioactive waste are defined generally in Appendix B.

The NRC has developed a classification system for commercial LLW based on its relative danger to human health and safety. This system establishes three classes of LLW -- A, B, and C -- with Class C being generally the most radioactive and/or long-lived of these three classes. Tables and procedures for classifying LLW are provided in Title 10 of the Code of Federal

[1] GTCC waste has only existed since 1983 when the U.S. Nuclear Regulatory Commission's classification system was established (10 CFR 61).

Regulations Part 61 (10 CFR 61).[2] LLW that is more radioactive and/or long-lived than Class C is called greater-than-class C (GTCC) waste.

GTCC WASTE TYPES AND GENERATORS

GTCC waste comes from the full range of typical LLW generators including: nuclear utilities, hospitals, universities, and various industries (e.g., pharmaceutical manufacturers and radiography firms). The GTCC waste produced by these generators is briefly described below.

A. Nuclear Utilities

GTCC waste can be generated during reactor operations and during reactor dismantling, called decommissioning. Operational waste can include non-fuel reactor core components (e.g., control rods), neutron sources required for reactor start-up, fission chambers, and spent ion-exchange resins and sludges containing high levels of radioactivity from coolant and fuel pool cleanup activities. When nuclear power plants wear out or become uneconomical to operate, they will be refurbished or shut down and eventually decommissioned. Most GTCC waste from refurbishing and decommissioning will be activated metals, such as stainless steel core shrouds that separate the reactor core from the reactor vessel (Knecht, 1988 and NRC, 1984a).

B. Fuel Manufacture and Test Facilities

In the past, fuel fabrication facilities used plutonium in advanced fuel research and development. All of these facilities have either been decommissioned or are in the process of being decommissioned. Since the Federal Government frequently sponsors the activities at these facilities, most facility operators have contractual arrangements to transfer much of their GTCC wastes to DOE for storage and disposal (NRC, 1984a).

Three companies currently operate test facilities that sample and examine reactor fuels. The wastes from these facilities consist of solidified aqueous waste; activated metals in the form of contaminated equipment, cladding, and metal cuttings; and other solid wastes such as glassware and resins (Knecht, 1988). Much of these wastes contain enough transuranic radionuclides to exceed Class C limits and, therefore, would be classified as GTCC. In addition, some GTCC wastes are likely to contain hazardous chemicals (NRC, 1984a; DOE, 1987a).

C. GTCC Sealed Source Manufacturers and Distributors

GTCC sealed sources are small radiation sources containing granules of radioactive material that are sealed inside capsules. Sealed sources are physically small; they range from 0.3 inches to 20 inches long. These sources are used in density and moisture gauges, well-logging equipment, radiography devices, X-ray fluorescence tubes, and static eliminators. For example, radiography firms check the integrity of pipe welds using instruments containing sealed sources. The activity of GTCC sealed sources can range from a few curies to several thousand curies. Common radionuclides used in GTCC sealed sources are americium-241, cesium-137, strontium-90, plutonium-238, and plutonium-239 (Knecht, 1988 and NRC 1984a).[3]

Some GTCC sealed sources can be recycled by their original manufacturer, especially if the user is willing to purchase a replacement source. A whole sealed source that was of high-activity can sometimes be reused in an instrument requiring a lower-activity source, or the material inside a sealed source can sometimes be recycled by repackaging it in a new source.

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[2] See 47 Federal Register 248 (Dec. 27, 1982).

[3] Sealed sources can also contain radium-226 -- a radionuclide that is not regulated by the Federal Government.

Lower-activity sources are generally more difficult to recycle. The 40 or so manufacturers of sealed sources in this country are unlikely to accept obsolete sealed sources from their customers if recycling is uneconomical (DOE, 1987a).

Manufacturers of sealed sources often possess contaminated equipment resulting from processing sealed sources. This equipment, which can exceed Class C limits, is often bulky and difficult for manufacturers to store.[4]

D. GTCC Sealed Source Users

GTCC sealed sources are used by industries, universities, colleges, hospitals, and other medical institutions conducting research and development. For example, GTCC sealed sources are used both to diagnose and to treat certain diseases, such as cancer. A NRC or Agreement State license[5] is required to manufacture, distribute, possess, and use GTCC sealed sources, but individual sources are not licensed.

The NRC estimates that there may be 25,000 to 30,000 GTCC sealed sources now in use in the United States (NRC, 1988b). Most of these sealed sources will be recycled rather than disposed. The NRC estimates that by the year 2020 there may be about 4,000 GTCC sealed sources being held for disposal by as many as 3,000 licensees (NRC, 1988b).[6]

E. Other Generators

Some companies use carbon-14 as a tracer in manufacturing specialty chemicals for biological and chemical research. Some waste from these processes is GTCC waste. GTCC waste can also result from decontaminating out-dated facilities from other commercial operations. Such clean-up activities can generate contaminated soil, trash, and ion-exchange resins.

GTCC WASTE VOLUMES AND RADIOACTIVITY

At the end of 1985, about 14,000 cubic feet of packaged GTCC waste had been generated; this waste is now in on-site storage.[7] For comparison, this volume is equivalent to about 6 tractor trailers. The present rate of GTCC waste production is about 1,400 cubic feet of packaged GTCC waste per year.[8] For comparison, about 1.8 million cubic feet of Class A, B, and C LLW was shipped for disposal to Barnwell, South Carolina; Richland, Washington; and Beatty, Nevada in 1987. This annual volume of A, B, and C waste is over 100 times greater than GTCC waste's annual volume.

By 2020, the total volume of packaged, untreated GTCC waste is projected to be about 170,000 cubic feet.[9] About 60 percent of this volume -- 105,000 cubic feet, which is equivalent to 40 tractor trailers -- is projected to be produced when nuclear power plants are

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[4] K. Amlauer, President of Isotope Products Laboratories (a small radioisotope producer in Burbank, California), personal communication, Sept. 1988.

[5] A State that wishes to regulate the radioactive material licensees in its state can apply to the NRC for Agreement State status. Such States have to demonstrate that their regulations are equivalent to or more restrictive than the NRC's regulations. There are 29 States that have received Agreement State status.

[6] About one-third are NRC licensees; about two-thirds are licensed by Agreement States.

[7] These are the most recent data on waste volumes from M. Knecht, EG&G (DOE contractor), personal communication, September 1988.

[8] M. Knecht, EG&G (DOE contractor), personal communication, September 1988.

[9] M. Knecht, EG&G (DOE contractor), personal communication, September 1988.

shut down and decommissioned or refurbished for use beyond their licensed operation period.[10] Reactor refurbishing will probably generate about the same amount of GTCC waste as decommissioning. The remaining 40 percent of the total volume -- about 65,000 cubic feet, which is equivalent to 25 tractor trailers -- will be generated by all activities other than the refurbishing or decommissioning of nuclear reactors.

According to DOE's 1987 GTCC report, decommissioning or refurbishing of reactors will begin around 2000 and increase significantly within the following decade (DOE, 1987a). For those reactors that are shut down, rather than refurbished, decommissioning may be delayed, perhaps until the middle of the 21st century (see Appendix C). Putting a reactor in storage for 30 to 50 years -- commonly referred to as SAFESTOR -- will significantly decrease both the volume and the radioactivity of LLW produced. GTCC waste generation, therefore, may peak around 2015, but the peak may not be as large as predicted by DOE (1987a). Furthermore, the GTCC waste volumes from decommissioning and/or refurbishing may be spread over a considerable period after 2015 (EPRI, 1987).

There is some uncertainty associated with GTCC waste volume projections. Due to packaging and treatment procedures, waste volumes can both increase and decrease. Waste generators, for example, could decide to melt down certain contaminated metals which would decrease voids in packaging containers and reduce volumes. Furthermore, some generators (e.g., utilities) may package a small volume of GTCC waste with very low-activity LLW, thus reducing the average activity of a package's volume to Class C, Class B, or even Class A limits. This technique greatly increases waste volumes, but may make it possible to generate very little GTCC waste during decommissioning or refurbishing of some nuclear power plants.

Given the expected long-term storage period, GTCC waste may need to be repackaged for further storage and/or disposal. Such repackaging may increase waste volumes significantly, but it is not clear. It is assumed in this report that packaging will generally increase waste volumes by about 7 for wastes generated by decommissioning or refurbishing nuclear power plants and by about 5 times for all other GTCC waste.

Even though the volume of GTCC waste that will be generated in the United States is small, its radioactivity is very high relative to other classes of LLW. By the end of 1985, the radioactivity of all GTCC waste in storage was about 4.5 million curies.[11] For comparison, this is more than three times the radioactivity of all other commercial LLW that was disposed of by the end of 1985.

Much radioactivity in GTCC waste is contributed by cobalt-60 which has a 5.3 year half-life. Cobalt-60, by itself, is never GTCC because of its short half-life. When cobalt-60 is associated with enough longer-lived radionuclides, the waste has to be classified as GTCC. Cobalt-60 cannot normally be separated out of this waste. The overall radioactivity of GTCC waste containing significant quantities of cobalt-60 will decay substantially in about 50-60 years.

The cumulative radioactivity of all GTCC waste generated by 2020 is projected to rise to 80 million curies. Over 99 percent of this activity (and the heat output from the waste) will be produced by nuclear power plants.[12]

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[10]M. Knecht, EG&G Idaho, Inc. (DOE contractor), personal communication, September 1988.
[11] M. Knecht, EG&G Idaho, Inc. (DOE contractor), personnal communication, September 1988.
[12] M. Knecht, EG&G (DOE contractor), personal communication, September 1988.

RISKS ASSOCIATED WITH GTCC WASTE

To safely manage GTCC waste, it is essential to understand the risks associated with the waste. These risks can be significant because of the thousands of potential GTCC waste generators and the waste's high concentrations of radioactivity. In determining whether a particular type of radioactive waste will pose significant risks to humans and the environment, a variety of interrelated factors can be considered: the overall concentration of the radionuclides per unit of waste relative to their concentration in the environment, the half-lives of the radionuclides in the waste, the types of radiation emitted, the heat generated by the waste, and potential pathways to human exposure.

Exposure pathways can be short-term or long-term; each affects humans differently. There is a great deal of uncertainty about the biological damage caused by a particular exposure to radiation, especially from long-term, low-level exposures (National Research Council, 1980). Short-term exposure of workers can occur during waste generation, processing, transportation, or disposal. Short-term exposure of the public can occur if there is an accident during any one of these management stages. Long-term exposure of the public can occur if there is any release and off-site migration of radionuclides from buried radioactive waste by ground water to a drinking water source. Inadvertent intruders of a disposal site could also suffer from short- or long-term exposure.

The NRC weighed all the interrelated factors mentioned above in establishing three classes of LLW (A, B, and C). Because of the different risks posed by various radionuclides, each of the three classes of LLW has different concentration limits for different radionuclides. Generally speaking, if the concentrations of radionuclides in a commercial generator's waste exceed the limits listed in Table 1 and the waste is not spent fuel, the waste is considered GTCC.[13] If waste contains alpha-emitting transuranic radionuclides that have half-lives exceeding 5 years and are in concentrations exceeding 100 nanocuries per gram, the waste is also considered GTCC.[14] There are no defined upper limits on the concentration of radionuclides for GTCC waste.

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[13] If there are two or more radionuclides in a waste, the sum of fraction rule [10 CFR 61.55(a)(7)] must be used to determine the class of the waste.

[14] Transuranic radionuclides with concentrations less than 100 nanocuries per gram are considered Class A or Class C LLW, depending on the radionuclide's concentration.

Table 1. Approximate Limits for Radionuclides in GTCC Waste

Radionuclide	Minimum Concentration (curies per cubic foot)	Half-Life (years)
Short-lived		
Strontium-90	200	30
Cesium-137	130	30
Nickel-63	20	100
Nickel-63 in activated metal	200	100
Long-lived		
Carbon-14	0.2	5,800
Carbon-14 in activated metal	2	5,800
Nickel-59 in activated metal	6	75,000
Niobium-94 in activated metal	0.006	20,000
Technetium-99	0.08	210,000
Iodine-129	0.002	16,000,000
Alpha emitting transuranic nuclides with half-life greater than 5 years	100 nanocuries per gram	
Plutonium-241	3,500 nanocuries per gram	
Curium-242	20,000 nanocuries per gram	

Source: Adapted from Tables 1 and 2 from 10 CFR 61.55

GTCC waste can be extremely dangerous, even lethal, if not handled properly. Although low radiation doses usually produce few if any short-term effects, the following examples illustrate the potential danger associated with higher radiation doses from radioactive material.

(1) In 1987, a sealed source -- the size of a paint can and containing 1400 curies of cesium-137 -- was stolen from a cancer therapy machine located in an abandoned clinic in Brazil. Within one month, four people had died and 54 others were hospitalized for varying lengths of time. People known to be contaminated were shunned by their communities. Contaminated buildings, vehicles, and furniture had to be decontaminated or taken into custody (Anderson, 1987 and Roberts, 1987).

(2) In 1962, a boy living in Mexico found an abandoned, pencil-sized radiography gauge containing a highly radioactive, broken, sealed source. The boy played with the gauge and took it home. The boy's mother then found the gauge and placed it on the kitchen shelf for several more weeks. The boy died shortly thereafter and over the next few months three other members of his family also died (Marshall, 1984 and West, 1984).

(3) A California man unknowingly exposed himself to excessive levels of radiation in 1979 when he placed a 29-curie sealed source in his back pocket for about 45 minutes. An initial

reddening of the skin under the pocket eventually became an open wound about 4 inches in diameter and almost an inch deep. Despite two subsequent skin grafts, the wound had still not healed completely nineteen months after the accident. In a similar accident in the 1970s, both legs of an Argentine man had to be amputated after receiving excessive doses of radiation from a sealed source he had been carrying in his front pant's pocket (NRC, 1986a).

In this country, protective measures (listed in Table 2), required to prevent such exposure to radioactive material over the short- and long-term are established by the EPA, NRC, and the U.S. Department of Transportation (DOT) in the form of standards, regulations, and guidance. Short-term risks are addressed through standards and regulations for worker exposure, packaging, storage, and transportation. For example, it is estimated that about 60 to 75 percent of all GTCC waste emits levels of radiation that warrant remote rather than contact handling by workers (Knecht, 1983).

Long-term risks are addressed through EPA standards and NRC disposal facility regulations that address environmental considerations, waste stability, and facility design. Table 2 lists some of these protective measures. Due to the magnitude and longevity of the risks associated with most GTCC waste, near-surface disposal used for Class A, B, and C LLW is generally not acceptable for GTCC waste.[15]

[15] 10 CFR 61.55(a)(4)(iv)

Table 2. Qualitative Description of Protective Measures for Managing Low-Level Radioactive Waste

Against short-term risks prior to disposal	Against long-term risks after disposal
1. Worker regulations and standards - limited exposure - film badges for measuring exposure	1. Environmental considerations: - minimize water infiltration (ground water depth & flow, amount of rainfall) - geologic stability
2. Packaging regulations - labels - protective shielding if needed	2. Waste stability & facility design - packaging requirements - barriers to environment (e.g., depth of disposal, an intruder barrier, and a stable cap on the facility) - environmental monitoring program - buffer zone
3. Storage guidelines	3. Institutional control factors (e.g., fences, signs, and a site closure plan) - Government ownership of sites
4. Transportation regulations and standards - packaging design (e.g.,labeling and stability and shielding if needed) - manifest forms for tracking waste packages - trucking and train transport regulations and standards (e.g., for routing and driver training)	

Sources: Adapted from:
10 CRF 20 (Standards for Protection Against Radiation)
10 CFR 61 (Licensing Requirements for Land Disposal of Radioactive Waste)
49 CFR 171,172,173,177 (Radioactive Materials; Routing and Driver Training Requirements)

To evaluate the management of GTCC waste, as compared to other types of radioactive waste, two primary factors were used: 1) the concentration of radioactivity in the waste, and 2) the length of time that the waste poses a significant risk to humans, or the longevity of risk. These two factors help policy makers to qualitatively understand the relationships between the various types of radioactive waste. Table 3 and Figure 1 are based on this analysis.

Table 3 illustrates that the average concentration of radioactivity in GTCC waste is closest to that of defense HLW and higher than any type of commercial radioactive waste except spent fuel. As of 1985, the average concentration of radioactivity in GTCC waste was 300 curies per cubic foot. If the activity from all short-lived radionuclides (e.g., cobalt-60) was ignored, this concentration would drop to about 50 curies per cubic foot. By 2020, GTCC waste's average concentration is projected to increase significantly to about 2500 curies per cubic foot. If all short-lived radionuclides were again ignored, this concentration would drop to about 1500 curies. This concentration of radioactivity will be much higher than it is today because by 2020 more than half of GTCC waste activity will be contributed by radionuclides (primarily nickel-63) with half-lives of 100 years or longer.[16]

[16] M. Knecht, EG&G Idaho, Inc. (DOE contractor), personal communication, September 1988.

Table 3. Relative Risks from Different Types of Radioactive Waste

Waste type	Average Concentration [a] (Ci/cubic foot) End of 1985	2020	Relative longevity of risk
Spent fuel	200,000(1)	100,000(1)	Ten thousand years[b]
High-level waste (defense)	100(1)	100(1)	Hundreds to few thousand years[b]
Transuranic waste (defense)	0.2(1)	1(1)	Few to several thousand years[c]
Greater-than-Class-C waste*	300(2)	2,500(2)	Hundreds to few thousand years[c]
Low-level waste			
Total commercial	0.1(1)	0.1(1)	
Class C	7 (1&3)		Few 100 to 500 years[d]
Class B	2 (1&3)		Few 100 years[d]
Class A	0.1(1&3)		Less than 100 years[d]

* Much of the initial radioactivity associated with GTCC waste is due to short-lived radionuclides (e.g., cobalt-60). By 2020, more than half of its radioactivity will be contributed by long-lived radionuclides (e.g., nickel-63).

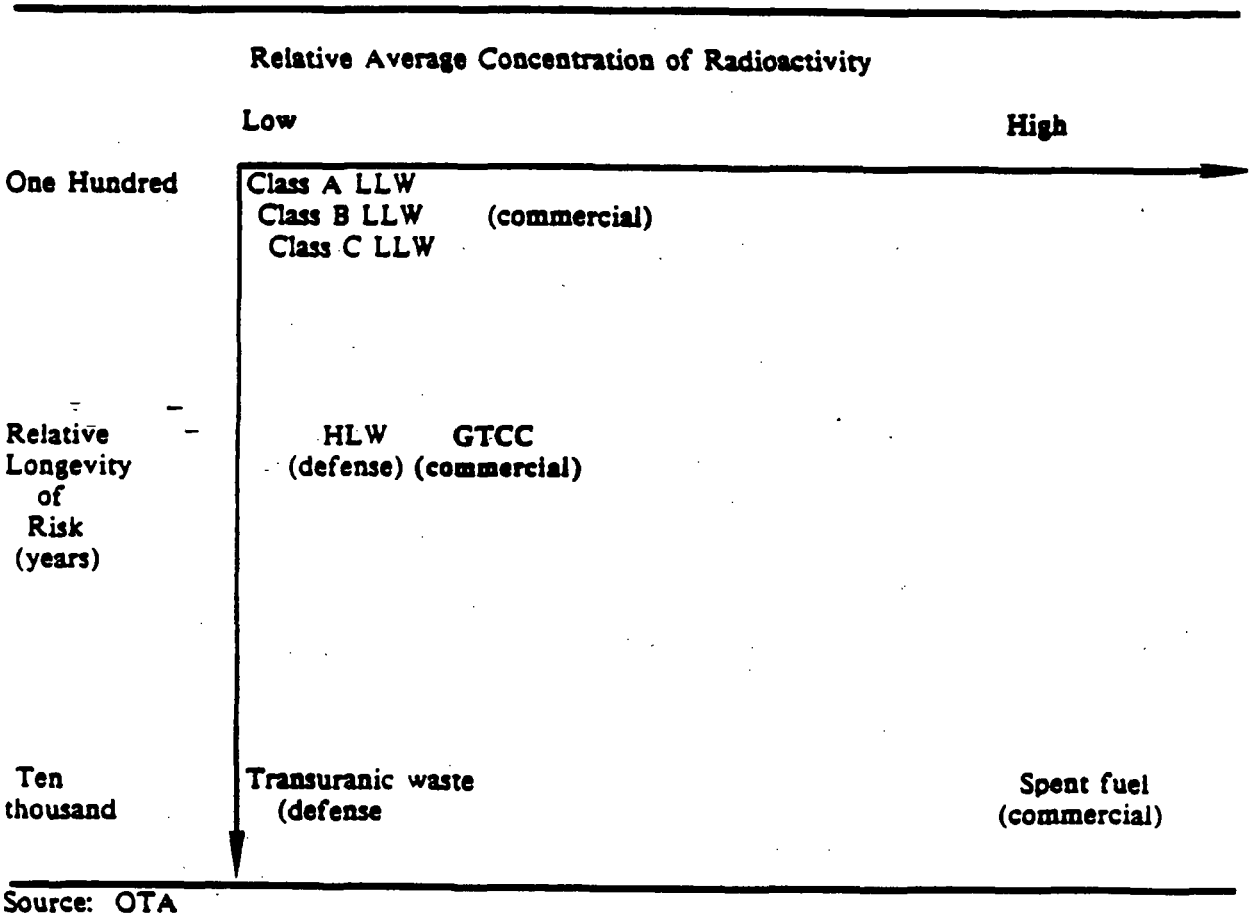
[a] Average concentrations for waste in storage or shipped for disposal.
[b] Semi-quantitative approximation of longevity of risk based on the half-life of the radionuclides in the waste, and EPA standards for radioactive waste disposal.
[c] Semi-quantitative approximation of longevity of risk based on the half-life of radionuclides in the waste relative to EPA standards for radioactive waste disposal.
[d] Semi-qualitative approximation of longevity of risk based on NRC 10 CFR 61 regulations for LLW.

Sources:

1) U.S. Department of Energy, Integrated Data Base for 1987: Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, DOE/RW-0006, Rev. 3 (Washington, D.C.: September 1987).
2) Knecht, M., EG&G (DOE contractor), personal communication, September 1988.
3) U.S. Department of Energy, The 1986 State-by-State Assessment of the Low-Level Radioactive Waste Received at Commercial Disposal Sites, National Low-Level Radioactive Waste Management Program, DOE/LLW 66T, December 1987.

Figure 1 shows a qualitative plot of Table 3. The average concentration of radioactivity is plotted against the average longevity of risk associated with different categories of radioactive waste. With regards to these two factors, GTCC waste shares characteristics that are most similar to defense HLW. One important difference between these two wastes is that much of GTCC waste activity will be from long-lived nickel-63, which is slow to migrate because it will be contained in activated metals, while defense HLW activity is from shorter-lived radionuclides (e.g., cesium-137 and strontium-90), which are generally more mobile.

Figure 1. Qualitative Comparison of Relative Risks from Different Types of Radioactive Waste



Source: OTA

PRESENT PROBLEMS ASSOCIATED WITH GTCC WASTE MANAGEMENT

The DOE has deferred a decision about GTCC waste disposal pending further analysis of various disposal technologies. The NRC staff has published a proposed amendment to 10 CFR 61 that would require the disposal of GTCC waste in a deep-geologic repository, unless the DOE develops another licensable option (Federal Register, May 1988). The deep-geologic repository for commercial spent fuel and defense HLW will not be available, however, for fifteen to twenty years. If another disposal technology were chosen, it would require a similar length of time to develop a separate facility for GTCC waste disposal.

The major concern is the storage of this waste until a disposal facility can be made available. Specifically, potential storage problems include: 1) the management of sealed sources, 2) GTCC material users phasing out operations that use this material and needing off-site storage capacity, 3) the increasing number of GTCC waste generators that expect to exhaust their on-site storage capacity during this period, 4) the potential for waste packages to degrade during this period.

In its 1987 report on GTCC waste, DOE tentatively committed the Federal Government to accept GTCC waste within the next two years for storage at an as yet unspecified facility. Considering this time frame, this facility would presumably be an existing, DOE storage facility, all of which are unlicensed to ensure national security of defense operations. There is some question in Congress whether an unlicensed facility would be appropriate for commercial GTCC waste.

These problems and options for managing GTCC waste are discussed in the following section.

Chapter 3

MANAGEMENT OPTIONS

Since some GTCC waste remains potentially dangerous for a few thousand years, it must be safely disposed of in a manner that protects future populations and the environment. The analysis provided in this section indicates that an appropriate disposal facility for GTCC waste will not be available for at least 15 to 20 years. Furthermore, GTCC waste generators cannot prepare their waste for disposal because no disposal technology has been chosen. Instead, they must prepare their waste for storage, and may have to repackage it later for disposal. Until a disposal facility is available, GTCC waste must be safely stored to avoid unnecessary worker exposure and handling accidents that could subsequently contaminate the environment and harm the general population.

Since GTCC waste storage is the most immediate problem now facing waste generators and policy makers, several storage options are analyzed to determine their ability to accommodate GTCC waste over the next two decades. Disposal options for GTCC waste are then analyzed by comparing them with the disposal technologies chosen for other types of radioactive waste. Finally, an integrated approach for managing GTCC waste over the short- and long-term is presented.

The technical and institutional factors listed in Table 4 are used to compare various storage and disposal options in a qualitative manner. The factors within each of the two categories are generally ranked according to their relative importance, but no attempt was made to weight them. These factors are used in somewhat different ways for storage and disposal.

STORAGE: The analysis in the storage discussion indicates that GTCC waste can be safely stored for several decades if it is safely packaged and stored under appropriate conditions. Thus, the major issue for the Federal Government does not involve determining what technologies to use, but which sites to use: a facility constructed and maintained on-site by the waste generator or some other off-site facility. The technical and institutional factors listed in Table 4 are used to qualitatively compare on- and off-site storage facilities.

DISPOSAL: Since the long-term safety associated with GTCC waste disposal depends largely on the disposal technology chosen, technical factors are given primary emphasis and used to evaluate three generic disposal technologies: near-surface disposal, intermediate-depth disposal, and disposal in a deep-geologic repository. Economic and institutional factors are then used to evaluate disposal of GTCC waste either at a separate facility for GTCC waste or at a currently proposed facility (e.g., the deep-geologic repository for spent fuel and defense HLW).

Table 4. Primary Factors for Comparing Waste Management Options

TECHNICAL FACTORS:
* Public health and safety risks
* Worker safety risks
* Environmental risks
* Transportation risks
INSTITUTIONAL FACTORS:
* Timeliness in meeting the general intent of LLRWPAA -- having the Federal Government responsible for finding a safe disposal option for all GTCC waste
* Availability of adequate funding and institutional stability to ensure safe storage and disposal
* Ease of facility siting (e.g., acquiring land and finding local support)
* Cost

Source: OTA

AN EVALUATION OF STORAGE OPTIONS FOR GTCC WASTE

There is a rather wide spectrum of facilities having varying levels of protection that can be used to store GTCC waste. The most appropriate storage technology depends primarily on the type and radioactivity of GTCC waste, and the expected storage time.

A. Description of Storage Technologies

The most basic storage facilities for radioactive waste are unshielded prefabricated-fabricated structures or fenced-in outdoor concrete or asphalt pads, which are sometimes covered to shed precipitation. Some companies simply store their GTCC material and waste in the basements of their buildings. Shielded concrete storage modules or bunkers with removable covers may also be located on company property at a distance from workers. The most elaborate storage facilities are permanent steel frame buildings or reinforced concrete structures. To prevent corrosion of the waste containers, some of these facilities are equipped to monitor and strictly control the indoor storage conditions, such as temperature and humidity (Siskind, 1985; Siskind, 1986).

To ensure public health and safety, GTCC waste must be properly prepared for extended storage. In choosing packaging materials, for example, a generator needs to assume that the waste may remain in storage for at least two decades. Like other types of packaged LLW, GTCC waste containers may corrode externally if indoor climatic conditions are not controlled during extended storage. Chemical reactions within the waste can produce liquids that could internally corrode containers; degrading organic wastes can generate pressurized gases, and cause unvented containers to breech or explode. If individual unvented containers are breached, stacked containers could collapse (Siskind, 1985; Siskind, 1986).

While GTCC waste is in extended storage, an adequate monitoring system will be needed to detect packages that may be deteriorating. Once degradation occurs, the GTCC waste will need to be repackaged, which could elevate worker exposures and contaminate the environment.

Inadequate administrative practices during extended storage can also result in contamination problems. For example, a combination of poor record keeping, illegible packaging labels and personnel changes, can result in loss of control over GTCC waste.

Since the controls required for radiation protection and accident prevention tend to increase as the intended storage periods increase, the storage conditions, and monitoring and administrative procedures now used for most GTCC waste may have to be upgraded to accommodate extended storage. To ensure public health and safety in light of current uncertainties over the availability of a disposal facility the NRC and Agreement States may need to update their packaging guidance and storage regulations assuming several decades of extended storage.

B. Optional Storage Sites

Options for providing on-site extended storage, off-site extended storage, and limited-access to off-site storage are analyzed in the following discussion. The technical and institutional factors listed in Table 4 are used in this analysis.

1. GTCC waste storage at its generation sites

At present, GTCC materials and wastes are being stored on-site by a few thousand users and generators, the majority of which are small companies. On-site storage places the financial burden and liability for waste storage on the users and waste generators. The main concerns about on-site storage involve human health and safety and the potential for environmental contamination if storage is not conducted properly. This is especially true for the small GTCC material users and waste generators that possess sealed sources.

Surveys mailed to some 14,000 potential GTCC waste generators by a DOE-contractor and an informal telephone survey by OTA indicate that GTCC waste generators will have increasing problems developing on-site storage capacity over the next few decades. Some generators, especially small companies, argue that their present on-site storage capacity cannot be expanded because of costs and limitations on the physical size of their property. Although such claims by waste generators seem reasonable, they are difficult to verify. Some generators may have overestimated their storage problems with the hope that more attention would be focused on their need for a disposal facility. Nonetheless, the availability of unused on-site storage capacity for GTCC waste will decrease as the length of time required to develop a disposal facility increases.

The problem of diminishing on-site storage capacity for GTCC waste may also be much worse than it now appears for several reasons. First, thousands of users of GTCC material and sealed-source were not included in the DOE-contractor survey. Second, some generators that may be nearing the limits of their material licenses may have underreported their projected inventories. Third, some generators, especially small companies, may go out of business over the next few decades before a disposal facility is available to accept their waste. In such a situation, the Federal Government could be left responsible for storing the waste and protecting public health and safety and the environment.

2. Off-site extended storage

Over the next 30 years about 65,000 cubic feet -- equivalent to about 25 tractor trailers -- of GTCC waste is projected to be generated.[17] The DOE-contractor survey indicated that by 2020 generators will posses about 14,000 cubic feet -- equivalent to about 5 tractor trailers -- of packaged GTCC waste that cannot be stored on-site.[18] Since not all generators responded to the survey, and the survey did not include sealed source users, this figure may be low. OTA estimates that the volume of waste that may require off-site storage could be as much as 20,000

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[17] M. Knecht, EG&G (DOE contractor), personal communication, September 1988.
[18] M. Knecht, EG&G (DOE contractor), personal communication, September 1988.

cubic feet of packaged waste.[19]

For several reasons, it is unlikely that a State or private company would be willing to independently develop an extended-storage facility for GTCC waste. First, given the uncertainty about the availability and timing of the Yucca Mountain repository or an alternative disposal facility for GTCC waste, it is unlikely that any State or private company would be willing to accept the open-ended liability associated with GTCC waste storage. Second, because no decision has been made on which disposal option will be chosen or how much it will cost, no State or private company would know what to charge for storage and the eventual disposal of the waste.[20] Third, if a State or private company decides to wait and charge a second fee when a disposal decision is made, a company whose waste it is holding may go out of business in the meantime, placing all liability on the State or private company hosting the storage facility. Fourth, siting a storage facility for GTCC waste would undoubtedly involve many political difficulties, in addition to current State problems siting facilities for Class A, B, and C wastes. Fifth, the large uncertainties about the needed amount of storage capacity may make such a storage facility a risky investment. Through a notice in the Federal Register, DOE plans to solicit comments on the willingness of any non-Federal entity to provide storage capacity for GTCC waste.

Considering the situation described above, it may be necessary to provide extended storage capacity for some GTCC waste at a Federal facility.[21] In its GTCC waste report (1987a), DOE tentatively committed the Federal Government to accept GTCC waste for storage by 1989. Centrally storing GTCC waste at a well-designed facility would likely enable a more effective and efficient monitoring and enforcement program and minimize the potential for accidents and container failure at scattered GTCC waste generating sites. In the absence of political or legal intervention, the Federal Government, in particular DOE, could quickly expand an existing facility or construct a new facility at one of its national laboratories.

Political resistance toward a Federal extended-storage facility is likely to come from any State in which the DOE storage facility is located. States have consistently expressed concerns about the added risk of any new radioactive waste management activity to its citizens and the environment. States would be worried that if activities to develop the Yucca Mountain repository or an alternative disposal option were to stall, any storage facility could evolve into a de facto disposal facility. Public trust in DOE programs has been severely eroded during past Federal efforts to site a deep-geologic repository. These State concerns may be tempered by appropriate Federal legislation (e.g., mandating that the facility only be used for GTCC storage and limiting the volume and duration of stored waste).

There is some question as to whether a Federal extended-storage facility would have to be

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[19] This figure assumes that most decommissioned nuclear power plants will be placed in storage for 30 to 50 years. Under this scenario, decommissioning waste will not be generated until the middle of the 21st century. (See Appendix C.)

[20] A commercial waste service company accepts GTCC sealed sources for extended storage. If it accepts the responsibility of eventually disposing of the waste, the company charges rates generally above those for Class C waste disposal. For example, one-half curie of americium-241 would cost $23,000 for storage and disposal. This company receives many inquiries about GTCC waste disposal, but few customers because of the high costs.

[21] To ensure that such a facility would be used by generators with on-site storage problems, the Federal Government may need to decide whether such storage should be in some way subsidized.

licensed by the NRC.[22] All storage and disposal facilities for commercial LLW are today licensed by NRC or Agreement States. Furthermore, the LLRWPAA of 1985 already requires licensing of any disposal (not storage) facility for GTCC waste. The Senate passed a bill during the 100th Congress -- that would require any storage facility for GTCC waste to be NRC-licensed.[23] To allay some State concerns and to bolster public confidence, Congress may decide *to require that any Federal extended-storage facility for commercial GTCC waste be licensed* by NRC.

To ease potential problems associated with developing a licensed storage facility, DOE could parcel off a site adjacent to or within one of its national laboratories, such that the activities occurring at the licensed facility would not interfere with unlicensed defense-related activities. Two of the three commercial LLW disposal facilities are located in such a fashion.[24] Even if this made siting easier, it would still require probably several years to select a site, to conduct the required environmental assessments, and to construct a licensed storage facility for GTCC waste.

Due to economics, it is unlikely that all GTCC waste generators would choose to use the extended-storage facility. Generators who have adequate on-site storage capacity (e.g., utilities) would likely not want to pay for off-site storage. Some generators may wish to defer paying disposal costs for their GTCC waste as long as possible. This facility would, therefore, have to be designed in a modular fashion with a great deal of flexibility in its capacity and use storage technologies that would provide several decades of safe isolation. This facility would also have to accommodate a wide variety of GTCC wastes -- 60 to 75 percent of which must be handled remotely even after packaging (Knecht, 1988).

3. Limited access to an off-site storage facility

Before an extended-storage facility is available, some generators of GTCC waste may need limited access to an existing commercial or Federal storage facility. Of particular concern is the fate of the several thousand sealed sources now being used in a wide variety of tools and machines throughout the United States. Some portion of these will become obsolete and will not be returnable to their manufacturers during the period before an extended-storage facility

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[22] DOE can legally accept and store commercial radioactive material generated by health and safety emergencies (e.g., accidents) at its unlicensed facilities. In addition, DOE can accept sealed sources containing plutonium, if the plutonium concentrations are economically recoverable. Users of such sources (e.g., universities and the military) pay for packaging and transportation (but not disposal) of the sources, which are donated to DOE. DOE also has accepted transuranic waste from the decommissioning of facilities operated by Monsanto (Dayton, Ohio), Nuclear Fuel Services (Erwin, Tennessee), and Babcox and Wilcox (Lynchberg, Virginia) under research and development contracts. Negotiations have stalled on a fourth contract with Exxon on a fuel fabrication facility in Richland, Washington. It has not been decided where this transuranic waste will be disposed.

[23] See Section 303, Title III, entitled the Nuclear Regulation Reorganization and Reform Act of 1988 (H.R. 1315), reported by the Senate Committee on Environment and Public Works' Subcommittee on Nuclear Regulation on February 22, 1988. The Committee feels that this requirement is a logical extension from the LLRWPAA language that requires any GTCC disposal facility to be NRC-licensed. As of September 1988, The House of Representatives had not acted on this amended bill.

[24] The commercial facility at Barnwell, South Carolina is adjacent to the DOE Savannah River Laboratory. The commercial site near Richland, Washington, is inside the DOE Hanford Reservation.

would become available.

The theft and improper handling of sealed sources have been responsible for four major accidents and 14 deaths in foreign countries over the last 25 years. In the United States the 40 or so sealed source manufacturers and the thousands of sealed sources users are regulated, but individual sealed sources are not registered. Institutional controls tend to diminish as equipment containing sealed sources is transferred to other users over time.

The impacts associated with sealed source accidents often go well beyond any immediate deaths and can be difficult to detect. For example, in 1983, a stored radiotherapy machine containing a large sealed source was illegally sold as scrap to a junkyard in Juarez, Mexico. Contaminated scrap metal was subsequently sold to two Mexican foundries, where it was melted down, made into table legs and reinforcing steel, and shipped to the United States. This accident was discovered five weeks later when a truck carrying contaminated reinforcing steel made a wrong turn at the Los Alamos Laboratory in New Mexico and tripped a radiation sensor. By this time, contaminated steel had been shipped to 40 states throughout the United States, and about 200 Mexicans were exposed to very high levels of radiation (West, 1984; Marshall, 1984; Stengel, 1984).

The International Atomic Energy Agency (IAEA) held a meeting in June 1988 on the problems associated with regulating sealed sources. The IAEA acknowledges the potential for accidents occurring if sealed sources are poorly regulated (IAEA, 1988).

Although fatal accidents involving sealed sources have not been recorded in the United States, they would be more likely to occur if tight regulatory control of licensed material and sealed sources is not maintained, especially when on-site storage is unfeasible. Even though the amount of radioactive material in many sealed sources is small, some are highly radioactive. Moreover, there are several thousands in use or in storage. In response to recent accidents involving sealed sources and mishandling of radioactive materials, the NRC issued a Notice in March 1988 to material licensees, alerting them of the need to control the handling and transfer of their licensed material to reduce the risk of an accident or its loss. Specifically, licensees are to periodically inventory and test for leaks in their sealed sources. Furthermore, the NRC encourages licensees to avoid long-term storage of surplus radioactive material.

Until an off-site storage option is available, generators have no choice but to store their GTCC waste on site. The political repercussions for the Federal Government if a GTCC waste accident were to occur could be especially significant if the accident were linked to the Federal Government's inability to accept this waste for disposal or long-term storage.

It is possible that a private company would be interested in storing a limited amount of GTCC waste at an existing commercial facility until a Federal extended-storage facility or disposal facility is available. Such a company would most likely only store GTCC waste if acceptance fees were sufficiently high to cover its potential liabilities, which are several. First, the period that GTCC waste would need to remain in storage is presently open-ended. There is no assurance when or if an extended-storage facility will be developed. Second, the availability of a disposal facility for GTCC waste is far from guaranteed. Third, it is unclear who would pay for extended-storage and disposal if a company were to go out of business while its waste was being held at private company's limited-access storage facility. DOE's planned Federal Register notice on the availability of non-Federal storage facility may also solicit comments on limited access to such a facility.

It appears that the most effective option for reducing the potential for GTCC accidents and ensuring adequate storage capacity for GTCC waste is to provide limited access to an

existing, unlicensed DOE storage facility. To ensure that such a facility were used only when necessary, acceptance criteria may need to be developed. Determinations of need would probably be made on a case-by-case basis by the DOE or NRC. OTA estimates that the total storage capacity needed would probably be a few thousand cubic feet -- less than 2 tractor trailers. Any GTCC waste in limited access storage could be transferred to the licensed, extended-storage facility, once it is available.[25]

To minimize the amount of GTCC waste requiring limited-access storage, manufacturers of new sealed sources could be required to repossess obsolete sources. Several mechanisms could be emplaced to further help the management of sealed sources. (See section on Funding Mechanisms beginning on page 32.)

AN EVALUATION OF DISPOSAL OPTIONS FOR GTCC WASTE

The goal of disposal is to isolate GTCC waste during the few hundred to few thousand years when its radioactivity poses a risk to humans and the environment. The technology chosen for GTCC waste disposal is critical to ensure long-term safety. The technical factors listed in Table 4 are used to qualitatively evaluate the acceptability of the following disposal technologies:

* near-surface disposal
* intermediate-depth disposal
* disposal in a deep-geologic repository

After this analysis, the economic and institutional factors listed in Table 4 are used to qualitatively evaluate GTCC waste disposal.

A. Description of Disposal Technologies

1. Near-surface disposal

Near-surface disposal is the technology that is presently used for the disposal of Classes A, B, and C LLW. Waste packages are disposed of in near-surface earthen trenches that are generally 20 to 30 feet deep, 20 to 100 feet wide, and several hundred to 1,000 feet long. As the waste is emplaced, the trench is backfilled with dirt and then covered with a compressed earthen cap. To reduce subsidence of the cap, Class B and C LLW must be packaged to remain structurally stable for at least 300 years. Class B and Class C waste are segregated from structurally unstable Class A waste. In addition, Class C waste must be disposed of at least 16 feet below ground or covered with a barrier (usually made of concrete) that will last at least 500 years.[26] The purpose of this barrier -- called an intruder barrier -- is to prevent people from digging into the waste once the site is closed and the institutional period has ended. During the institutional period, monitoring and surveillance of the site must be maintained for at least 100 years. This period begins after a site has closed and its license has been transferred to the State or a Federal Custodial agency.

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[25] According to Knecht (1988), the unpackaged volume of obsolete sealed sources that is expected to accumulate by the year 2020 is less than 35 cubic feet. In the several years or so before an extended-storage facility could become available, there will likely be significantly less than 35 cubic feet. How these sources are packaged will determine how much storage capacity will be needed. It is also likely that during the period before an extended-storage facility could become available, some small companies that possess GTCC material could go out of business, requiring their facilities to be decontaminated and decommissioned. This waste could also require limited storage.

[26] 10 CFR 61.52(a)(2)

Three near-surface disposal sites which were used in the 1960s and 1970s experienced significant problems with subsidence and failure of overlying caps, infiltration of water, and the subsequent migration of radionuclides from the trenches. These sites have subsequently been closed. Although the more stringent 1983 NRC regulations (10 CFR 61) on near-surface disposal have thus far eliminated these kinds of problems, many States and Compact regions are very interested in using structurally enhanced near-surface disposal alternatives for their future LLW disposal sites (DOE, 1987c and NRC, 1984b).

Among the most discussed enhanced disposal alternatives are: concrete-lined trenches, above- and below-ground concrete vaults, and earth-mounded concrete bunkers (which combine several LLW disposal technologies). Concrete would be used in the construction of all of these enhanced facilities. Many other features (e.g., waterproof coatings, internal and external drainage, etc.) can be incorporated into facility designs to minimize the infiltration of surface water and to keep the waste as dry as possible.

It is possible to increase the degree to which GTCC waste can be isolated beyond that provided by near-surface facilities, by disposing of the waste at an intermediate depth of a few hundred feet. At such a depth, there is greater assurance that humans will not inadvertently come into contact with the waste. If concrete were used at this depth it would have to withstand the pressures of deep burial over the long-term and resist degradation due to the disposal environment. The primary risk of radionuclide migration at this depth would stem from unforeseen ground water movement. Such risks would be minimized if waste were far removed from potential ground water.

2. Intermediate-depth disposal

Several different technologies could be used to place waste at an intermediate depth of between 100 and 500 feet below the earth's surface. The use of augered holes is one such technology. It involves boring a hole, typically measuring 8 or more feet in diameter, into the ground and pouring a concrete foundation in the bottom of the hole. A smaller diameter steel or fiberglass liner is then lowered into the hole until it rests on the concrete foundation. This liner is then surrounded on the outside with a layer of concrete or cement grout, typically measuring about one-foot thick. After the liner has been filled with waste, grout is poured around the waste to form a solid cement-waste matrix inside the liner. A concrete cap is then placed on top of the hole, and any remaining part of the hole is backfilled with soil (Cook, 1987).

Augered holes with depths of 20 to over 100 feet have been used over the last several years at DOE's national laboratories for the disposal of some defense LLW similar in radioactivity to Class B, C, and some GTCC waste. For example, unpackaged reactor fuel cladding and well-packaged tritium have been disposed of at the Nevada Test Site in a few unlined augered holes measuring about 120 feet deep.[27] These holes are unlined because the yearly precipitation is low and ground water is about 800 feet deep.

Another technology that could be used at an intermediate depth (100 to 500 feet deep) is a geologic repository. Repositories are described in the following section, with respect to deep disposal, but could also be constructed at an intermediate depth. Sweden has developed an intermediate-depth repository under the Baltic Sea, about half a mile offshore and 200 feet below the sea floor. The facility, which has been operating since April 1988, is excavated into

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[27] R. Dodge, Reynolds Electric Company (DOE contractor at the Nevada Test Site), personal communication, June 1988.

granite. It is designed with 4 large rooms to hold LLW and a concrete silo, about 200 feet high and 100 feet in diameter, to contain intermediate-level waste.

3. Disposal in a deep-geologic repository

Deep-geologic repositories, located at depths of 2,000 to 3,000 feet, are viewed by the scientific community worldwide as generally the most favored technology for disposing of highly radioactive waste. The geologic formations surrounding a repository will provide major natural barriers to the migration of radionuclides by ground water over the long-term. Engineered barriers, such as the waste form and surrounding package, enhance the isolation of the waste during the first few thousand years. During this time, heat from the waste could increase the migration of radionucides if the waste were to contact with any flowing water (OTA, 1985).

According to the Nuclear Waste Policy Act of 1982 and subsequent studies by DOE (1985d and b, 1987d, and 1988), all spent fuel and defense HLW will be permanently isolated in one deep-geologic repository. Yucca Mountain in Nevada is now being evaluated to determine its suitability for such a facility. If this site found to be suitable, waste canisters will be emplaced along a widely spaced grid within the repository beginning in about 20 years. Waste emplacement will continue for about 50 years (DOE, 1987d). The repository may remain accessible for a few decades after the waste has been emplaced to allow for monitoring and continued cooling of the waste. The repository will then be backfilled. About 67 percent of the repository's volume is projected to be used for commercial spent fuel and 33 percent for defense HLW.[28]

Another deep-geologic repository will be used for the disposal of transuranic waste generated by defense activities. Over the last decade DOE has been developing such a facility, called the Waste Isolation Pilot Plant (WIPP). This repository is situated at a depth of about 2,200 feet in a bedded salt formation near Carlsbad, New Mexico. DOE plans to dispose of some defense transuranic waste in WIPP on a demonstration basis in late 1988.[29] If this 5-year demonstration is successful, much of DOE's remaining transuranic waste will be disposed of in this repository over the next 20 years.

Although there are as yet no licensed deep-geologic repositories for radioactive waste in the United States, or elsewhere in the world, decades of extensive scientific study have revealed no insurmountable technical obstacles for developing such repositories, provided suitable sites are found (OTA, 1985).

B. Technical Comparison of Disposal Technologies

Near-surface disposal facilities, which are licensed by NRC (under 10 CFR 61) or by Agreement States, can be used for the disposal of Class C LLW which requires isolation for periods of about 500 years. Since the longevity of risk for GTCC waste greatly exceeds this time period, near-surface disposal technologies would generally not be appropriate. Such a position is stated in NRC's Part 61 regulation.

Reinforced concrete is widely used in enhanced near-surface disposal technologies for long-term structural integrity. To evaluate the suitability of concrete for near-surface enhancements, DOE's Brookhaven National Laboratory conducted an in-depth analysis for the

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[28] M. Komar, DOE, personal communication, June 1988.

[29] C. Fankey, DOE, personal communication, May 1988. As of September 1988, it appeared that this demonstration phase would not begin until 1989.

NRC on historical and recent experience with concretes throughout the world (NRC, 1986b). This study found that some ancient concretes have performed adequately for 2,000 years or more. Although modern concretes have not been in use for much more than a century, there are many examples of excellent performance for periods of several decades and a few for periods on the order of 100 years (MacKenzie, 1987).

Considering the lack of deterioration of ancient concretes that have been subjected to harsh conditions and the relatively benign conditions expected at near-surface LLW disposal facilities, it should be possible to formulate concrete with enough durability to perform satisfactorily as a structural material for a few hundred years (MacKenzie, 1987). It is unclear, however, that enhanced near-surface disposal alternatives using concrete would prove adequate for the few thousand years necessary to isolate most GTCC waste.

As mentioned in the background section of this report, GTCC waste characteristics are most similar to defense HLW. Furthermore, by the year 2020 more than half of the activity of GTCC waste will be contributed by radionuclides (primarily nickel-63) with half-lives of 100 years or longer. In accordance with the Nuclear Waste Policy Act of 1982 and its 1987 amendments, defense HLW is planned for disposal in the Yucca Mountain repository; defense transuranic waste is planned for disposal in WIPP. **If a decision about the disposal of GTCC waste were required today, its permanent isolation in a deep-geologic repository would be technically acceptable.**

The NRC staff, in a letter response to DOE's report to Congress on GTCC waste (NRC, 1987), recommended that GTCC waste be disposed of in a deep-geologic repository. In this letter the NRC estimated that roughly 85 percent of GTCC waste had enough long-lived radionuclides to require permanent isolation in a deep-geologic repository (NRC, 1987). As mentioned earlier, the NRC has also published a proposed amendment to 10 CFR 61 in the Federal Register (May 18, 1988) that would require all GTCC waste to be disposed of in a deep-geologic repository, "unless disposal elsewhere has been approved by the Commission."

It is possible that further research and analysis over the next several years could demonstrate the acceptability of non-repository disposal alternatives, such as intermediate-depth augered holes or an intermediate-depth repository. These technologies, if used in areas of low rainfall and deep ground water, might be found acceptable for some GTCC waste, especially the portion of waste composed of short-lived radionuclides. It is unclear, however, whether any disposal alternatives other than a deep-geologic repository would be acceptable for isolating the long-lived radionuclide portion of GTCC waste.

C. Preliminary Economic Comparison of Disposal Options

Due to significant economies of scale associated with constructing large facilities, it is possible that waste disposal in a large repository may be less expensive than using a smaller facility only for GTCC waste. In the following discussion, the costs of GTCC waste disposal in the Yucca Mountain repository are analyzed, to the extent possible, before examining possible costs for a smaller, separate disposal facility for GTCC waste only. It must be emphasized that these calculations are preliminary and will have to be verified when more accurate estimates become available.

Disposal costs are calculated below in terms of the volume of disposed waste rather than considering the various factors used for commercial near-surface disposal facilities. Among others, these factors include: concentration of radioactivity (i.e., curie content per unit volume), the half-life of the waste's radionuclides, and the type of radiation emitted by the waste. Site operators use these factors to determine the waste package's longevity of risk and whether it must be handled remotely. Since repository disposal costs will probably be based on waste

volumes, the following analysis uses only waste volumes to estimate disposal costs.

1. Large, deep-geologic repository

The approximate cost of GTCC waste disposal in a repository is highly dependent on the mode of waste emplacement. One potential mode involves stacking the packaged waste from floor to ceiling in dedicated rooms excavated specifically for GTCC waste. If waste packages could be packed tightly together[30], the total volume of GTCC waste generated by 2020 would fill a room approximately 15 feet wide, 20 feet high, and 570 feet long. This volume -- about 170,000 cubic feet -- would occupy about 0.1 percent of the 115 miles of tunnels and waste emplacement rooms[31] now planned for the Yucca Mountain repository. According to very preliminary DOE estimates, constructing the Yucca Mountain repository is now projected to cost about $15 billion.[32] Constructing 0.1 percent of the repository for GTCC waste would cost about $15 million (not including waste repackaging and loading costs), or about $90 per cubic foot of GTCC waste.[33]

A potentially less expensive disposal mode involves using GTCC waste as backfill material when the repository rooms and/or connecting tunnels are sealed off and the repository is closed. This mode would eliminate the cost of excavating dedicated rooms. If this second mode were used, GTCC waste disposal would probably not begin for at least a decade after the first (and presumably the coolest) spent fuel was emplaced. In other words, the emplacement of some GTCC waste could begin around 2020.

Although the backfill option is likely to be less expensive than GTCC waste disposal in dedicated rooms, the backfill option has a couple disadvantages. First, if the small section of repository containing GTCC waste were ever reexcavated, the waste in the backfill material could make this operation significantly more difficult due to worker exposure. Second, if the entire repository were left open for about 50 years to allow further cooling and continued monitoring of the spent fuel, disposal of GTCC waste as backfill could not begin until after the middle of the 21st century.

2. Separate GTCC waste disposal facility

The costs associated with developing a separate facility for GTCC waste using intermediate-depth disposal facilities have not been calculated. Cost estimates, however, have been made by DOE for several near-surface disposal technologies for LLW, with near-surface disposal being the least expensive and earth-mounded concrete bunkers being the most (DOE,

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[30] The majority of non-utility GTCC waste and a great deal of utility GTCC waste could be tightly packed into repository rooms. Some utility waste (e.g., core shrouds) may have to be emplaced along a widely spaced grid, like spent fuel, or further cooled by storing the waste for two or three more decades. NRC staff believe that the overall packaging requirements for most GTCC waste need not be more stringent than those provided in 10 CFR Section 61.55 for 300-year stability of Class B and C LLW (NRC, 1988b).

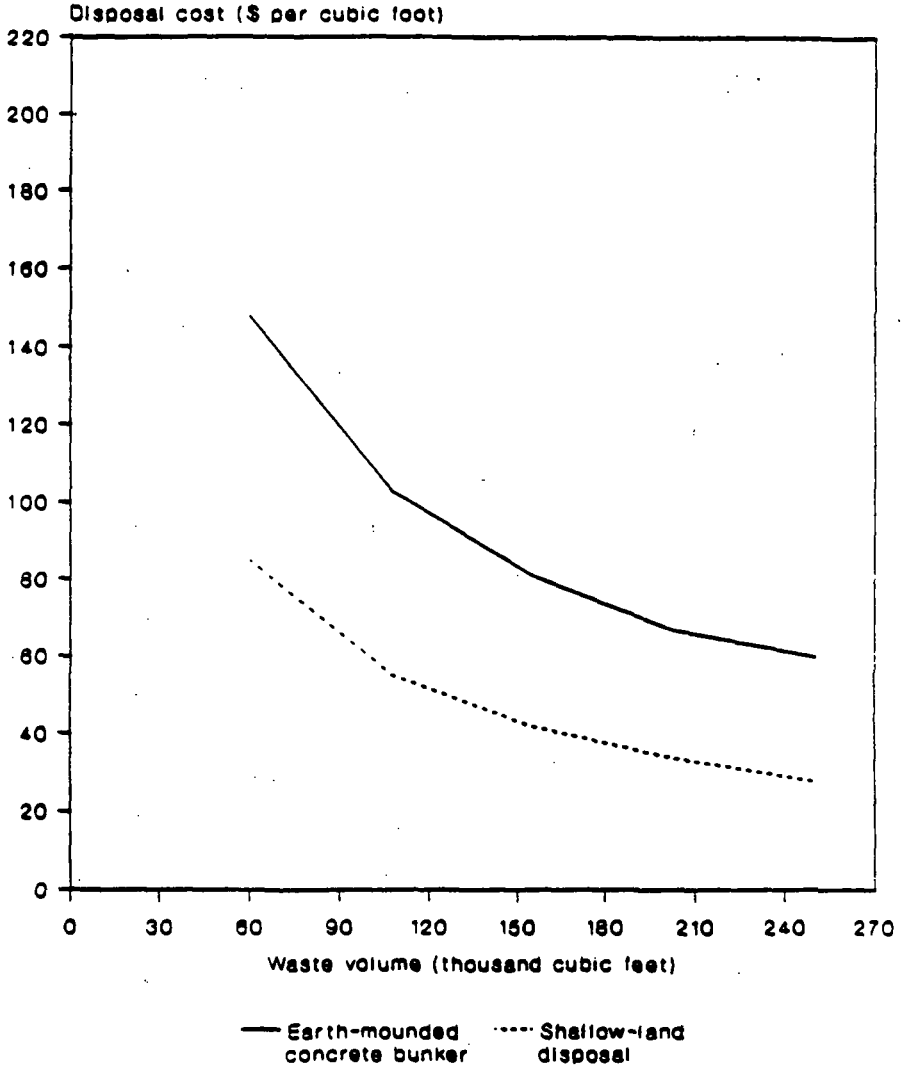
[31] M. Komar, DOE, personal communication, June 1988.

[32] C. Conner, DOE, personal communication, May 1988. DOE has already spent several tens of millions of dollars screening sites for a HLW repository and an additional $1 to $2 billion will be required to characterize the presently proposed site at Yucca Mountain in Nevada.

[33] This assumes that the cost of space occupied by GTCC waste would include a proportion of the overall cost of siting and developing the repository. Some people would argue that the repository must be developed anyway, under the Nuclear Waste Policy Act of 1982, and that GTCC costs should be based only on the incremental cost of adding the space used for GTCC waste disposal.

1987c). Disposal costs for a near-surface facility accepting about 60,000 cubic feet of waste per year, which was the smallest facility evaluated, were estimated to average $120 per cubic foot (DOE, 1987c). The projected annual rate of GTCC waste generation around the year 2020 is only about 6,000 cubic feet per year.[34] As suggested in Figure 2, the disposal costs for a near-surface facility with a capacity of only 6,000 cubic feet per year could be significantly more than $120 per cubic foot due to its smaller size. These preliminary cost figures are summarized in Table 5.

Figure 2.-Near-Surface Disposal Costs for a Range of LLR Volumes (calculated using the EG&G economic model for a 30-year facility)



[34] This figure is substantially higher than the generation rate today because of waste that will come from decommissioning and refurbishing of nuclear power reactors.

Table 5. Preliminary Estimates of GTCC Waste Disposal Costs

Disposal technology	Estimated cost *
Yucca Mountain repository (assuming tight packing of waste)	$ 90/ft^3 [a]
Separate near-surface facility	$ 120/ft^3 [b]

* The disposal costs for both of these options will probably be higher than those indicated above. Repository disposal costs, which are still being developed by DOE, probably do not include the full range of operating costs. Unit disposal costs for using a separate facility for GTCC waste could be significantly higher due to its intermediate depth, its small size, and other additional operational costs for handling highly radioactive GTCC waste.

Source:
[a] C. Conner, DOE, personal communication, May 1988.
[b] EG&G Idaho, Inc., "Costs and Consequences of Site Proliferation: Per Unit Disposal Costs," Low-Level Radioactive Waste Forum, Toronto, July 1988, unpublished conference notes;

The preliminary calculations provided above indicate that the costs of GTCC waste disposal in the Yucca Mountain repository could be comparable to, or perhaps even less than, costs associated with developing a smaller, separate disposal facility only for GTCC waste. The level of long-term isolation provided by the Yucca Mountain repository would also presumably be as great or greater than the isolation provided by an intermediate-depth facility.

D. Institutional Considerations in Choosing a Disposal Option

A disposal facility for GTCC waste could, theoretically, either be developed and operated by a non-Federal entity or by the Federal Government. For several reasons, it does not appear likely that a non-Federal entity would be interested in developing and operating such a facility. As mentioned earlier, DOE plans to issue a notice in the Federal Register to determine whether any such non-Federal interest exists.

It is possible, though unlikely, that a State or regional Compact would accept GTCC waste for disposal.[35] During the passage of the LLRWPAA, States argued that the Federal Government should take responsibility for GTCC waste because of the long-term risks associated with much of the waste. In fact, one State opposed taking responsibility for Class C LLW.[36] Thus, States would probably not be interested in developing a separate disposal facility

[35] The Low-Level Radioactive Waste Policy Act of 1980 and the Low-Level Radioactive Waste Policy Amendments Act of 1985 encouraged States to form multi-state Compacts with each Compact region hosting one disposal facility. States that have not joined a Compact may be planning to host a facility only for waste generated in their State. Economically, some States and Compacts may have difficulty supporting their facilities, given the 50 percent decrease in volume of LLW shipped for disposal over the last 7 years. It is, however, unclear whether the economic gain from disposing of such a small amount of waste would outweigh the added risks.

[36] Representative Kostmeyer from Pennsylvania introduced an amendment to the Low-Level Radioactive Waste Policy Amendments Act of 1985 to transfer the responsibility of Class C

for GTCC waste. It is unlikely that they would be interested in accepting GTCC waste at an existing or planned near-surface LLW disposal facility, which would probably not provide adequate long-term isolation for much GTCC waste.

Private companies are also unlikely to be interested in independently developing and operating a GTCC waste disposal facility without Federal sponsorship. In addition to the inevitable political difficulties associated with siting and potential delays with licensing such a facility, private industry may have considerable concerns about potential long-term liability of holding title to waste that remains hazardous for a few thousand years. The fact that a commercial waste disposal facility for GTCC waste has never been constructed or licensed would make such a business venture extremely risky.

Given the increasing difficulty in siting nuclear waste facilities[37], it is unlikely that the Federal Government, presumably DOE, would choose to develop a new, separate facility for GTCC waste. At this time, the most likely disposal option appears to be the Yucca Mountain repository. Congress, the DOE, and the State of New Mexico have agreed that the WIPP facility will be only for defense waste, and defense facilities are not licensed by the NRC. The LLRWPAA of 1985 explicitly requires GTCC waste, which is commercial waste, to be disposed of in a NRC-licensed facility.

If DOE decides to dispose of GTCC waste in the Yucca Mountain repository, the State of Nevada will likely object to GTCC waste being funneled into this disposal facility. Furthermore, if fees for GTCC waste disposal in the Yucca Mountain repository are comparable to, or less than, disposal fees for Class C waste at commercial near-surface disposal sites, waste generators would have an incentive to compact Class C waste such that its radioactivity were increased to GTCC levels. In addition, it is still unclear how the country will dispose of GTCC defense waste that is not transuranic.

It could be argued that the National Environmental Policy Act of 1970 (NEPA) would require an evaluation and comparison of alternatives prior to selecting a disposal option. Such a process normally involves balancing costs and benefits associated with a particular project or a major Federal action. In most cases, environmental and public health and safety risks associated with projects can be decreased by adding features to the project that would increase its development costs. The situation involving GTCC waste disposal, however, appears to be quite different. From a public health and safety standpoint, it is highly unlikely that any disposal alternative would provide more isolation than the Yucca Mountain repository. It also appears unlikely that a small, separate GTCC waste disposal facility of any type would be as economical as the repository.

E. Summary

From a public health and safety standpoint, deep-geologic repositories are likely to provide the greatest isolation of GTCC waste based on information available today. In fact, repository disposal is believed to be sufficient for isolating spent fuel which is many times more dangerous than GTCC waste. Since the projected volume of GTCC waste would probably occupy much less than 1 percent of the planned Yucca Mountain repository, this option would

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waste to the Federal Government.

[37] Prior to May 1986, DOE had plans to develop a second repository in the East. DOE Secretary, Herrington, postponed these plans, arguing that volumes of spent fuel and defense HLW were insufficient to justify two repositories. This decision also defused a great deal of political opposition associated with this siting program.

likely be less expensive than developing a small, separate facility for only GTCC waste using any technology. Institutionally, using the Yucca Mountain repository would eliminate having to site, develop, and license a new separate disposal facility for GTCC waste.

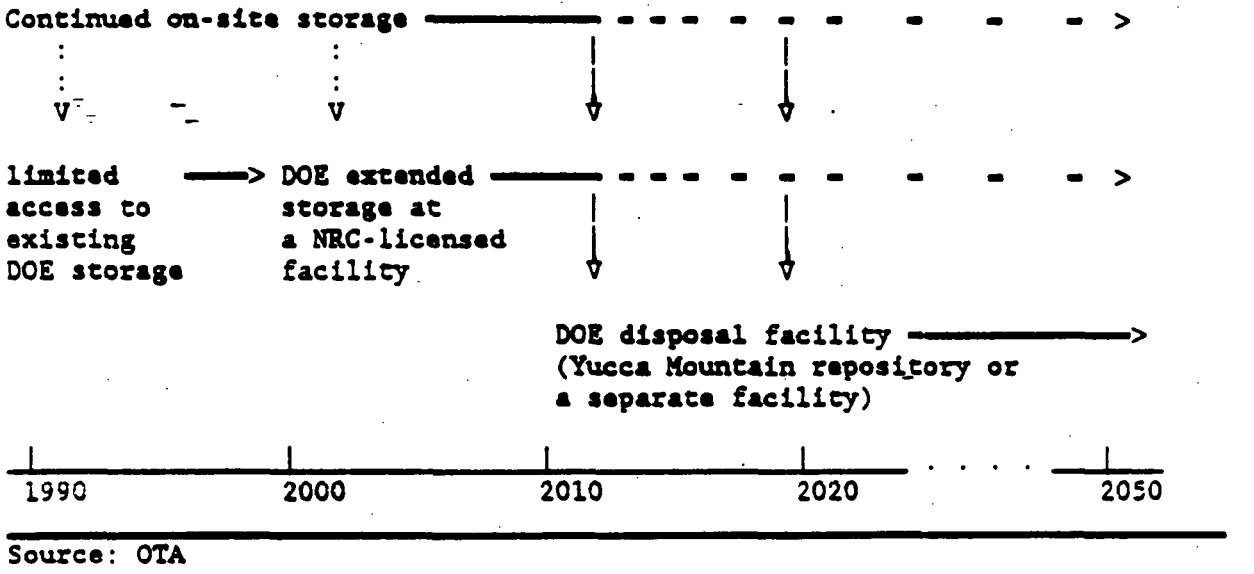
If a decision about the GTCC waste disposal were required today, permanently isolating GTCC waste in a deep-geologic repository would be an acceptable option. It is possible, however, that further research of alternative disposal technologies could indicate that an intermediate-depth disposal facility used only for GTCC waste (e.g., augered holes) would provide an acceptable level of isolation. DOE could spend the next couple of years evaluating the impacts associated with disposing of GTCC waste in the Yucca Mountain repository on the repository's overall operation and performance. If this disposal option proved to be acceptable from an environmental, economical, and institutional standpoint, DOE could use the Yucca Mountain repository as a basis in designing its GTCC waste management approach. If this option proved to be unacceptable, DOE could then evaluate other disposal technologies. Making a disposal decision will help resolve many storage uncertainties and enable necessary guidance and regulations to be developed.

Chapter 4

A MANAGEMENT APPROACH FOR GTCC WASTE

As indicated in the previous chapters, GTCC waste will have to be stored for at least 15 to 20 years while a disposal facility is being developed. Many large generators will probably store GTCC waste on-site; some generators, especially small ones, claim that they will exhaust their on-site storage capacity and that this capacity cannot be expanded. Off-site storage for an extended period could be available in several years at an NRC-licensed, DOE storage facility. While such a facility is being developed, GTCC waste generators could be given limited access to an existing unlicensed DOE storage facility on a case-by-case basis, determined by DOE or NRC. Once the extended-storage facility is available, all GTCC waste in limited-access storage could be transferred to it. Figure 3 portrays this integrated management approach.

Figure 3. A Management Approach for GTCC Waste



Source: OTA

If the above approach for managing GTCC waste over the next two decades is implemented, then the Federal Government needs to make several decisions and undertake many activities regarding storage, disposal, and funding. These decisions and activities are summarized in the following discussion. The sequence and minimum timing of these activities are further developed in Appendix D.

Limited-Access Storage

During the next several years while an extended storage facility is being developed, DOE could provide limited access to an existing, unlicensed, storage facility at one of its national laboratories. This would reduce the potential for GTCC accidents, especially those involving sealed sources, and ensure adequate storage capacity for those generators who do not have adequate on-site storage capacity for their GTCC waste. DOE and/or NRC could determine technical criteria for accepting GTCC waste; DOE, NRC, and possibly Congress could establish additional technical and non-technical specifications (e.g., waste volume limits, generator eligibility, and a decision on fee subsidization). DOE could then estimate the required storage capacity as well as storage costs prior to adapting one of its existing facilities.

State concerns about the permanence of such a facility could be allayed by requiring that any GTCC waste in limited-access storage be moved to the extended storage facility when it becomes available.

Extended Storage

DOE's estimate of the time required to develop an acceptable disposal facility for GTCC waste will indicate the time that this waste will have to remain in storage. NRC and/or DOE could then determine performance objectives and technical criteria for waste packaging and extended storage. DOE, NRC, and possibly Congress could establish non-technical specifications on use of this facility, as were made for the limited-access storage facility. With this information, DOE could better design the extended-storage facility and determine storage costs. Considering the probable uncertainties in waste volumes that will require off-site storage, a modular storage facility could be incrementally developed as storage needs become more apparent.

Disposal

If a decision about the disposal of GTCC waste were required today, permanently isolating GTCC waste in a deep-geologic repository would be an acceptable option. It is possible, however, that further research of alternative disposal technologies could indicate that an intermediate-depth disposal facility used only for GTCC waste would provide an acceptable level of isolation. Such research could commence in a couple of years if DOE determines that GTCC waste disposal in the repository would produce unacceptable environmental or institutional impacts or would be more expensive than other disposal alternatives.

Funding Mechanisms

The LLRWPAA of 1985 states that the beneficiaries of the activities generating GTCC waste should bear all reasonable costs associated with its disposal. Since GTCC waste cannot be disposed of immediately, it could be argued that the beneficiaries should also bear the cost of pre-disposal management. However, there are some who argue that the delays in selecting a disposal option, which make GTCC waste storage necessary, are the fault of the Federal Government even though the Federal Government was made responsible for GTCC waste disposal only in 1985. When, how, and how much money is collected from generators for the disposal of their GTCC waste may depend in part on when the waste is accepted for storage and/or disposal. Funding mechanisms are discussed below for several groups of GTCC waste generators.

For waste accepted for limited-access storage, estimated costs for extended storage and disposal could be collected at the time of waste acceptance. Given the current uncertainties about disposal costs, however, acceptance fees could be quite high if full-cost recovery is a primary goal. Unreasonably high costs would discourage the use of the limited-access facility, yet some waste generators may need use of it to protect public health and safety; unrealistically low costs would leave the Federal Government with an obligation to pay the balance of future disposal costs.

Alternatively, an initial fee for limited-access storage could be collected when GTCC waste is accepted for storage. Once a disposal option is chosen and the costs of extended storage and disposal are better known, a second fee could be calculated. This second fee could be collected when GTCC waste in limited-access storage is transferred to the extended storage-facility.

Utilities, which generate about 60 percent of all GTCC waste, will probably be able to develop sufficient on-site storage capacity for this waste to last until a disposal facility is available. If the Yucca Mountain repository were chosen as the disposal facility for GTCC waste, utility fees paid into the Nuclear Waste Trust Fund could be increased to cover GTCC waste disposal costs.

Due to the problems associated with controlling the fate of many thousand sealed sources, it may be desirable to add a materials management fee into the initial cost of all sealed sources. This type of arrangement could be used for sealed sources sold after disposal costs have been estimated (within the next several years). When the user is finished with a source, this fee could be partially or entirely refunded depending on the costs that would be required to subsequently manage the source. If the source could be recycled, the user would receive a larger refund. This type of "deposit-return" funding arrangement would encourage the proper management and disposal of sealed sources.

For all other non-utility GTCC waste or GTCC material now in use, including sealed sources, waste management fees could most easily be collected in one lump sum or in periodic installments when the waste is accepted for extended storage and/or disposal by the Federal Government. Collecting "deposit-return" management fees prior to waste acceptance may be more difficult, but not impossible, due to the large number of present generators. As with limited-access storage, unless extended-storage and disposal fees are reasonable, waste generators may delay transferring their waste to a waste management facility, which could jeopardize public health and safety. Furthermore, if a waste generator goes out of business before its GTCC waste has been stored or disposed, the Federal Government may have to accept the waste and pay for its storage and subsequent disposal in order to maintain public health and safety.

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APPENDICES

Appendix A. Types of Radioactive Waste

The following types of radioactive waste are differentiated by the nature and intensity of the emitted radiation, as well as their physical and chemical form. They are listed roughly in order of decreasing risk to humans.

Spent fuel consists of fuel rods that have been "burned" (irradiated) in commercial, defense, or research nuclear reactors to the point where they no longer contribute efficiently to the nuclear chain reaction. Spent fuel is thermally hot, highly radioactive, and requires heavy shielding. Commercial spent fuel is being stored at nuclear power plants pending the availability of a Federal monitored retrievable storage facility or a deep-geologic repository for disposal.

High-level waste (HLW), as the term is used in this report, is generated when spent fuel is reprocessed to recover plutonium and unused uranium. The vast majority of HLW in this country has been generated in support of national defense programs. HLW is highly radioactive, generates some heat, and requires heavy shielding. Most HLW is now stored at Richland, Washington; Aiken, South Carolina; and Idaho Falls, Idaho pending availability of a deep-geologic repository.

Transuranic (TRU) waste is produced from the production of plutonium for nuclear weapons, from the manufacturing of sealed radioactive sources, and from the refurbishing or decommissioning of nuclear power plants. Transuranic waste contains radionuclides that have atomic numbers greater than 92, which is uranium. Defense TRU wastes are currently being stored at seven DOE national laboratories pending disposal in a deep-geologic repository called the Waste Isolation Pilot Project (WIPP), located near Carlsbad, New Mexico. Commercial transuranic waste is defined as low-level radioactive waste. If the concentration of transuranic radionuclides is greater than 100 nanocuries per gram, the waste is greater-than-Class-C low-level radioactive waste.

Low-level radioactive waste (LLW) includes radioactive waste not classified as uranium mill tailings, high-level waste, or spent fuel. About 95 percent of all LLW -- Class A -- has relatively low levels of radioactivity. Class A waste remains hazardous for about 100 years, Class B and C waste remains hazardous for a few hundred years, while GTCC waste remains hazardous for a few hundred to a few thousand years.

Uranium mill tailings are the earthen residues -- coarse sand and a "slime" of clay-like particles -- that remain after extracting uranium from mined uranium ore. These tailings contain low concentrations of radioactive material, but tailing volumes are very large.

Byproduct Material is material contaminated or made radioactive during the production or use of special nuclear material.

Source: Adapted from the League of Women Voters Education Fund, 1985

Appendix B. Definitions

Curie: A measure of the rate of radioactive decay essentially equal to the radioactivity of one gram of radium. A **microcurie** is one millionth (or 10^{-6}) of a curie. A **nanocurie** is one billionth (or 10^{-9}) of a curie.

Half-life: Time required for a radioactive substance to lose 50 percent of its radioactivity by decay. For example the radioactivity of cobalt-60 with a half-life of 5.3 years will drop by one-half in 5.3 years.

Ion-exchange resins: Sand-like materials that chemically remove radionuclides from wastewater and concentrate them in a solid form.

Isotope: Isotopes are different forms of the same chemical element, having different numbers of neutrons but the same number of protons in the nucleus of their atoms. A single element may have many isotopes. For example, uranium naturally appears in three forms: uranium-234 (142 neutrons), uranium-235 (143 neutrons), and uranium-238 (146 neutrons); each uranium isotope has 92 protons.

Radiation: Radiation is emitted in the form of alpha particles, beta particles, gamma rays, or x-rays -- each affecting human health differently. For example, alpha particles cannot penetrate a person's skin, therefore can only harm a person if inhaled or ingested. Gamma rays, in contrast, can pass through a person's body.

Radioactivity: The spontaneous emission of radiation from the nucleus of an atom.

Radionuclide: Any species of atom whose nucleus emits radiation. Transuranic radionuclides have an atomic number greater than 92 (uranium).

Sealed sources: Sealed sources are sources of radiation that contain granules of radioactive material typically sealed inside double-walled, stainless steel capsules. Large sources can measure up to 20 inches long and 2 inches in diameter, but generally are about 3 inches long and 0.5 inch in diameter. Sealed sources are primarily used in industrial and medical applications (e.g., density and moisture gauges, well logging sources, and radiotherapy machines).

Waste form: Waste form is the matrix in or on which radionuclides are contained. The waste from of GTCC waste maybe metal, ceramic, paper, etc.

Source: Adapted from the League of Women Voters Education Fund, 1985

Appendix C. Decommissioning of Nuclear Power Plants

Although most nuclear power plants are licensed by NRC to operate for 40 years, there is no absolute age at which they become unsafe or uneconomical to operate. In fact, it may be possible to economically refurbish and extend the operating lifetime of many reactors by replacing aging internal components (EPRI, 1987). Once a plant has been shut down, it can be decommissioned (e.g., dismantled) within a few years, placed in safe storage for 30 to 50 years prior to decommissioning, or permanently entombed (NRC, 1981). Reactor refurbishing will probably generate about the same amount of GTCC waste as plant decommissioning.

There are two reasons for delaying decommissioning once a reactor has been shut down. First, the overall radioactivity of the LLW from decommissioning (at least 95 percent of which is contributed by GTCC waste) will decrease by 30 to 45 times, if decommissioning is deferred five decades (see Table 6). Deferral could therefore reduce worker risks and decrease dismantling costs. Second, the volumes of Class A, B, and C LLW generated from immediate decommissioning (97% of which is Class A waste) can be reduced by about 10 times if decommissioning is deferred five decades, thereby significantly decreasing LLW disposal costs unless these costs rise dramatically over this time (See Table 6).

Table 6. Effects of Delayed Decommissioning on the LLW Generated by Commercial Nuclear Power Plants

Plant type [1.175 GW(e)]	Radioactivity of all LLW in thousands of curies		
	No delay	30-year delay	50-year delay
Boiling-water	6,600	180	140
Pressurized-water	4,900	210	160
	Volume of all LLW in thousands of cubic feet		
	No delay	30-year delay	50-year delay
Boiling-water	670	670 *	60 *
Pressurized-water	630	630 *	65 *

* Includes wastes from both preparation for SAFESTOR and decommissioning.

Source: U.S. Department of Energy, "Integrated Data Base for 1987: Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics," DOE/RW-0006, Rev. 3, September 1987, p. 279.

For these reasons, many of the existing 110 nuclear plants, especially the 71 plants that are co-located with other units, could likely be placed in "SAFESTOR" for 5 decades prior to decommissioning. It is not clear, however, that decommissioning of all nuclear plants will be deferred. If costs for LLW disposal continue to rise as they have over the last 15 years, it may be more economical to immediately decommission some plants. Older plants (i.e., constructed prior to 1970) without well-documented designs and plants that are not co-located with multiple units may require decommissioning before plant engineers are reassigned or retired.

The NRC issued its final rule on decommissioning nuclear facilities in June 1988 (53 Federal Register 123).

Appendix D. Possible Schedule for Managing GTCC Waste

The following tight schedule lists possible activities that may be needed to manage GTCC waste. These activities are listed generally in the sequence in which they would occur. Even if the activities actually take longer than indicated here, the relationship among them should generally remain the same. If any activity requires additional time to complete, the remaining activities will have to be delayed the same amount of time.

	Minimum time in years				
	0	1	2	3	4
Disposal					
DOE evaluates the technical, economic, and institutional advantages and disadvantages associated with: 1) disposing of GTCC waste in the Yucca Mtn. repository, or 2) developing a separate intermediate-depth facility.					
DOE decides either to use the Yucca Mtn. repository, or to further evaluate intermediate-depth disposal options.					
DOE estimates disposal fee.					
DOE finalizes disposal fee.	year 7				

Storage continued on the following pages.

	Minimum time in years
	0 : 1 : 2 : 3 : 4
Extended-storage regulatory guidance: (regardless of disposal option chosen)	
NRC reviews storage technologies and analyzes its storage guidance.	:———: : : :
DOE develops estimates of storage time until disposal.	: :— : : :
NRC drafts preliminary revisions of added guidance for GTCC waste packaging and storage.	: :——— : : :
NRC finalizes guidance.	year 3
DOE extended-storage facility: (assuming NRC licensing)	
Congress mandates development of NRC-licensed facility.	:——— : : : :
DOE/NRC determine general technical criteria for accepting GTCC waste.	: ———:——— : : :
DOE estimates storage fee and facility capacity.	: _ _:——— : : :
DOE, NRC, and possibly Congress determine non-technical specifications for facility use (e.g., waste volume limits, generator eligibility, and a decision on fee subsidization).	: : ——— : : :
DOE designs facility.	: : _ _ _:——— : :
DOE sites facility.	: : _ _:_ _ ———:——— :
DOE constructs facility.	years 4 and 5
NRC grants operating license.	year 6
DOE finalizes storage/repackaging/ disposal fee.	year 7
DOE begins accepting waste and extended storage/disposal fee.	year 7 to year 20

	Minimum time in years				
	0	1	2	3	4
Limited-access storage at existing DOE facility:					
Congress mandates DOE to provide limited-access storage, and expresses intention to transfer waste in limited-access storage to an extended-storage facility.	———				
DOE/NRC determine technical criteria for accepting GTCC waste.	———				
DOE estimates required storage capacity.	———	———			
DOE estimates fee for limited-access storage.		———			
DOE, NRC and possibly Congress determine non-technical specifications for facility use (e.g., waste volume limits, generator eligibility, and a decision on fee subsidization).		———			
DOE adapts existing facility.			———		
DOE finalizes limited-access storage fee.			———		
DOE accepts waste and collects fee for limited-access storage	year 2 to year 7				
Waste is transferred to extended-storage facility and an additional fee is collected for extended storage/repackaging/disposal.	year 7				
Other:					
Congress considers additional controls on the distribution and/or use of sealed sources	———				

ENCLOSURE I

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20555

February 24, 1989

The Honorable Lando W. Zech, Jr.
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Zech:

SUBJECT: FINAL RULEMAKING ON 10 CFR PART 61 RELATIVE TO DISPOSAL OF GREATER-THAN-CLASS-C LOW-LEVEL RADIOACTIVE WASTES

During its seventh meeting, February 21-23, 1989, the Advisory Committee on Nuclear Waste (ACNW) met with members of the Office of Nuclear Regulatory Research to discuss the proposed amendment to 10 CFR Part 61 relative to final rulemaking for disposal of greater-than-Class-C low-level radioactive wastes. A representative from the U.S. Department of Energy (DOE) participated in this meeting.

The NRC staff discussed the proposed rule (referenced), public comments on the rule, and the draft final rule. On the basis of these discussions, we recommend that the NRC staff:

(1) Explicitly state that DOE can exercise a range of options in selecting methods for disposing of such wastes in NRC-licensed facilities; and

(2) Specify the performance requirements for the waste package in order to assist DOE in selecting an appropriate option.

Subject to these qualifications, we agree with the rule as proposed.

Sincerely,

Dade W. Moeller

Dade W. Moeller
Chairman

Reference:
Nuclear Regulatory Commission, Proposed Rule, 10 CFR Part 61, "Disposal of Radioactive Wastes," published in the Federal Register, Vol. 53, No. 96, Wednesday, May 18, 1988

Attachment

MAR 3 0 1989

Dr. Dade W. Moeller, Chairman
Advisory Committee on Nuclear Waste
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Moeller:

Your February 24, 1989 letter to Chairman Zech on final rulemaking relative to disposal of Greater Than Class C Wastes (GTCC), 10 CFR 61, requested the staff to address two points: (1) Explicitly state that DOE can exercise a range of options in selecting methods for disposing of GTCC wastes in NRC-licensed facilities, and (2) Specify the performance requirements for the waste package in order to assist DOE in selecting an appropriate option.

Regarding the first point, Enclosure A contains highlighted text showing where DOE flexibility is explicitly stated in the draft Federal Register notice.

Enclosure B contains text which will be included in the draft Federal Register notice to accommodate the second point.

The staff believes this is responsive to the ACNW comments. Please let me know if I can provide the ACNW with any additional information.

Sincerely,

Original signed by
Victor Stello, Jr.

Victor Stello, Jr.
Executive Director
for Operations

Enclosures:
As stated

cc: Chairman Zech
Commissioner Roberts
Commissioner Carr
Commissioner Rogers
Commissioner Curtiss
SECY

	RES:WMB	DE:WMB	DE:WMB	D/D:DE
	CPrichard	JRandall	MSilberberg	RBosnak
	3/17/89*	3/17/89*	3/21/89*	3/23/89*

*SEE PREVIOUS CONCURRENCE

OFC	:D:DE	:RES	:RES	:EDO	:EDO	:
NAME	:GArlotto*	:DRoss*	:EBeckjord*	:JTaylor	:VStello	:
DATE	:3/23/89	:3/24/89	:3/24/89	:3/ /89	:3/30/89	:

- page 2 of Federal Register notice)

Background

On May 18, 1988, the Nuclear Regulatory Commission published proposed amendments to Part 61 to require geologic repository disposal of greater-than-Class-C (GTCC) low level radioactive waste (LLW) unless an alternative means of disposal was approved by the Commission (53 FR 17709). The [proposal to require geologic repository disposal, or an approved alternative,] was aimed at insuring that GTCC waste would be disposed of in a manner consistent with the protection of public health and safety. This action was taken in lieu of a revision of the definition of high level radioactive waste (HLW). In proposing the amendments the Commission outlined its rationale for not proceeding with a revision of the definition of HLW along the lines proposed in the advance notice of proposed rulemaking (ANPRM) published on February 27, 1987 (51 FR 5992).

It is the Commission's view that intermediate disposal facilities may never be available, in which case a repository would be the only type of facility generally capable of providing safe disposal for GTCC wastes. [At the same time, the Commission wishes to avoid foreclosing possible use of intermediate disposal facilities by the Department of Energy (DOE).] If DOE chooses to develop one or more intermediate disposal facilities, the Commission anticipates that the acceptability of such facilities would be evaluated in the light of the particular circumstances, considering for example the existing performance objectives of 10 CFR Part 61 and any generally applicable environmental radiation protection standards that might have been established by the U. S. Environmental Protection Agency. Technical criteria to implement the performance objectives and environmental standards would be developed by the Commission after DOE had selected a specific disposal technology and decided to pursue development of an intermediate facility.

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(c) Effects on Repository Program

There were a number of comments, including those of DOE, that expressed concern over the possible impacts on the geologic repository program of emplacement of GTCC waste along with HLW in the repository. Specific concerns were over the potential for additional costs, GTCC waste taking up valuable repository space, and the burden for DOE of having to include GTCC waste in its performance assessment of the repository.

The Commission believes that these impacts would be negligible. [First, the proposed amendments allow for a range of GTCC disposal methods to be used by DOE.] Under present regulations on land disposal of LLW (10 CFR Part 61), GTCC waste is specifically identified as "not generally acceptable" for near-surface disposal. Disposal methods for GTCC waste must generally be "more stringent" than near-surface disposal. The proposed amendments to Part 61 specified that one "more stringent" method would be geologic repository disposal. [Other methods are not specified but are also left open to DOE, subject to Commission approval.] The proposed amendments were not what prevented DOE from routinely using near-surface disposal; that is already prohibited by 10 CFR Part 61. Thus, relevant cost impacts of the amendments do not involve a comparison between costs of geologic repository disposal vs. costs of near-surface disposal. Cost comparisons involve geologic repository disposal vs. other

- page 8 of Federal Register notice

considerations are involved. However, if DOE found that it did pose such an obstacle,
[these amendments would permit DOE to choose an acceptable alternative disposal method.]

- page 12 of Federal Register notice

Final Rule

Following its review and analysis of the public comments, the Commission believes that the course of action it had proposed [--requiring geologic repository disposal of GTCC waste, or approved alternative]-- should be adopted. Therefore, these final amendments to Part 61 deviate little from those proposed. By them, the Commission is providing DOE with the regulatory framework DOE needs to proceed with plans for management of GTCC waste. The

[rule identifies one approved method of disposal for GTCC waste, but allows DOE to plan and develop an alternative method if DOE so desires,] subject to Commission approval. It is now up to DOE to evaluate its options for GTCC waste disposal, and to proceed with GTCC disposal.

- proposed §61.55

§ 61.55 Waste classification.

(a) * * *
(2) * * *
(iv) Waste that is not generally acceptable for near-surface disposal is waste for which waste form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository as defined in Part 60 of this chapter unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are approved by the Commission.

* * * * * *

Enclosure A

ENCLOSURE B

(to be inserted in draft Federal Register Notice)

For all wastes disposed of in a repository, Part 60 now requires:

(1) waste disposal operations shall be conducted in compliance with the radiation protection requirements of Part 20 of the NRC's regulations (section 60.111(a).

(2) the option of waste retrieval shall be maintained for a period up to 50 years after the start of waste emplacement operations (section 60.111(b), and

(3) "... any release of radionuclides from the engineered barrier system shall be a gradual process which results in small fractional releases to the geologic setting over long times ... The release rate of any radionuclide from the engineered barrier system following the containment period shall not exceed one part in 100,000 per year of the inventory of that radionuclide calculated to be present at 1,000 years following permanent closure ... (section 60.113).

Also implicit in Part 60 is a requirement that any GTCC wastes disposed of in a repository not prevent HLW or spent fuel from meeting the specific performance objectives for those types of wastes.

These general objectives can be achieved in various ways for different wastes. For example, containment within a durable waste canister might be appropriate for short-lived wastes (half-lives about 30 years or less), while processing of wastes to reduce leachability of use of retardant backfill materials might be more appropriate for longer-lived wastes. The NRC is initiating an effort, as contemplated by section 60.135(d) of Part 60, to specify in more detail the waste form and packaging criteria appropriate for specific types of GTCC wastes. The Commission anticipates that DOE will develop specific waste form and packaging alternatives for consideration by the NRC in that rulemaking, and the Commission would welcome similar suggestions from other interested parties.

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