

March 5, 1998

FOR: The Commissioners

FROM: L. Joseph Callan /s/  
Executive Director for Operations

SUBJECT: FINAL RULE: REQUIREMENTS FOR SHIPPING PACKAGES USED TO TRANSPORT VITRIFIED HIGH-LEVEL WASTE

## PURPOSE:

To request Commission approval to publish in the *Federal Register* a final rule that would add vitrified high-level waste (HLW) to the forms of plutonium that are exempt from the double-containment transportation packaging requirements. This final rule is in response to a petition for rulemaking (PRM-71-11) submitted by the U. S. Department of Energy (DOE). The final rule would also make a minor correction regarding the usage of metric and English units, to be consistent with existing Commission policy on such uses.

## BACKGROUND:

This rulemaking is consistent with a Staff Requirements Memorandum (SRM) dated October 31, 1996, in which the Commission: (1) disapproved a staff recommendation, in SECY-96-215, to make a determination, under 10 CFR 71.63(b)(3), regarding canisters containing plutonium-bearing vitrified wastes; and (2) requested the staff to develop a rulemaking on an expedited basis to satisfy the timeliness requirements of DOE.

In the SRM dated April 4, 1997 (in response to SECY-97-047, dated February 26, 1997), the Commission approved publication of the proposed rule. The proposed rule was published in the *Federal Register* on May 8, 1997.

## DISCUSSION:

This rule change results from a petition for rulemaking (PRM-71-11) submitted by DOE. The purpose for the double-containment rule is to ensure safety by requiring plutonium to be shipped as a solid, under double containment, thereby minimizing the likelihood of leakage during transport, as a result of possible packaging errors. The staff believes that the plutonium within vitrified HLW, contained in a sealed container, is essentially nonrespirable and it provides a level of protection comparable to irradiated fuel elements, which are exempt from the double-containment requirement. Therefore, double containment is unnecessary for vitrified HLW contained in a sealed canister.

SECY-96-215, dated October 8, 1996; SECY-97-218, dated September 29, 1997; SECY-97-235, dated October 14, 1997; the proposed rule (published May 8, 1997); and the *Federal Register* notice for the final rule, provide: (1) a discussion of why the U.S. Atomic Energy Commission established a double-containment requirement for plutonium shipments; (2) a discussion of DOE's petition; (3) a discussion of the interaction with DOE to hold the petition in abeyance until a decision had been reached on an exemption request filed under 10 CFR 71.63(b)(3); (4) the staff's conclusion on the essential nonrespirability of vitrified HLW and the high degree of confinement provided by the stainless steel waste canister; and (5) the staff's review of public comments on the proposed rule.

The staff agrees that shipments of vitrified HLW in a sealed canister designed to maintain waste containment during handling activities associated with transport should be exempt from the double-containment requirements, as requested in DOE's petition. Additionally, the staff believes one method to meet the design requirements for handling is by use of appropriate American Society of Mechanical Engineers Boiler and Pressure Vessel Code criteria. The final rule change will allow an alternative means of transporting this waste, with no significant impact to public health and safety.

One of the commenters on the proposed rule subsequently submitted a petition for rulemaking to eliminate 10 CFR 71.63. This petition was discussed in SECY-97-235 and was noticed for public comment in the *Federal Register* (63 FR 8362, dated February 19, 1998). The staff believes that this petition is beyond the scope of this rulemaking and should be addressed separately.

In response to questions raised by the Vice Chairman of the Advisory Committee on Reactor Safeguards (ACRS), the staff briefed the ACRS on the final rule on March 2, 1998 (ACRS Meeting No. 449). The staff described the approach taken in evaluating DOE's petition and in comparing vitrified HLW to irradiated reactor fuel elements. The staff also discussed the process under Part 71 that is used to review applications submitted for certification of a Type B transportation package. This review includes evaluations of the package's design attributes (i.e., shielding, containment, sub-criticality) and of the package's ability to withstand the normal and hypothetical accident condition requirements in 10 CFR 71.71 and 71.73. This same process would be used to evaluate a DOE application for certification of a transportation package designed to contain vitrified HLW. A copy of the briefing slides from the staff's presentation are attached ([Attachment 7](#)).

## COORDINATION:

The Office of the General Counsel has no legal objection to the proposed rulemaking. The Office of the Chief Financial Officer has reviewed this Commission Paper for resource implications and has no objections. The Office of the Chief Information Officer concurs that there will be no information technology impacts.

## RECOMMENDATION:

That the Commission:



**EFFECTIVE DATE:** (30 days from date of publication in the *Federal Register*). The incorporation by reference of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII, editions through the 1995 Edition, is approved by the Director of the *Federal Register* as of (30 days from the date of publication in the *Federal Register*).

FOR FURTHER INFORMATION CONTACT: Earl Easton [telephone (301) 415-8520, e-mail EXE@nrc.gov] or Mark Haisfield [telephone (301) 415-6196, e-mail MFH@nrc.gov] of the Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

**SUPPLEMENTARY INFORMATION:**

Background

In 1974, the Atomic Energy Commission (AEC) adopted the special requirements in 10 CFR 71.63 that regulate the shipment of plutonium in excess of 0.74 terabecquerels (TBq) [20 Curies] per package. These requirements specify that plutonium must be in solid form and that packages used to transport plutonium must provide a separate inner containment (the "double-containment" requirement). In adopting these requirements, the AEC specifically excluded from the double-containment requirement plutonium in the form of reactor fuel elements, metal or metal alloys, and, on a case-by-case basis, other plutonium-bearing solids that the agency determines do not require double containment. The Statement of Consideration for the original rule (39 FR 20960; June 17, 1974), specifies that "solid forms of plutonium that are essentially nonrespirable should be exempted from the double-containment requirement."

On November 30, 1993, DOE/OCRWM petitioned the NRC to amend 71.63(b) to add vitrified HLW contained in a sealed canister to the forms of plutonium which are exempt from the double-containment packaging requirements of Part 71. The NRC published a notice of receipt for the petition, docketed as PRM-71-11, in the *Federal Register* on February 18, 1994 (59 FR 8143). Three comments were received on the petition.

Pursuant to the Nuclear Waste Policy Act of 1982, as amended (NWPA), DOE is the Federal agency responsible for developing and administering a geologic repository for the deep disposal of HLW and spent nuclear fuel. DOE plans to ship the vitrified HLW in sealed canisters from three storage locations: Aiken, South Carolina; Hanford, Washington; and West Valley, New York; directly to the geologic repository in transportation packages certified by the NRC. Currently, this HLW exists mostly in the form of liquid and sludge resulting from the reprocessing of defense reactor fuels. DOE proposes to encapsulate the HLW in a borosilicate glass matrix. The HLW is added to molten glass and the mixture is then poured into a stainless steel canister and allowed to solidify (i.e., vitrify). The canister is then seal-welded shut. The canisters will eventually be placed inside Type B transportation packages for transport to the geologic repository or an interim storage facility.

The beneficial aspect of this amendment would be the elimination of an unnecessary requirement that DOE transport vitrified HLW in a separate inner container (i.e., a second barrier which is subject to the leak testing requirements of 71.63(b)). The Commission believes that the vitrified HLW form in its sealed canister provides sufficient defense-in-depth for protection of public health and safety and the environment, when transported inside an NRC-certified Type B transportation package. The Commission agrees with DOE's assertion that shipments of this form of plutonium are comparable to shipments of (irradiated) reactor fuel elements which are exempt from the double-containment requirement. Therefore, the Commission agrees that the double-containment requirement is unnecessary. Additional beneficial aspects of this amendment would be a reduction in DOE's costs associated with the transportation of HLW from production sites to the geologic repository or an interim storage facility; and the simplification of the NRC staff's review of DOE's application for certification of a transportation package.

Although, in most other types of shipments, DOE is not subject to the requirements of Part 71, the NWPA requires that DOE's transport of spent nuclear fuel or HLW to a geologic repository or a monitored retrievable storage facility be in packages certified by the NRC. The packages used to transport vitrified HLW contained in sealed canisters will be certified by the NRC as Type B packages. Type B packages are designed to withstand the normal and hypothetical accident conditions specified in Part 71. The canistered vitrified HLW also will be subject to the special transport controls for a "Highway Route Controlled Quantity" pursuant to U.S. Department of Transportation regulations contained in 49 CFR Part 397. In addition, the NWPA requires DOE to provide technical assistance and funds to train emergency responders along the planned routes.

DOE asserted that shipments of vitrified HLW contained in a sealed canister will not adversely affect public health and safety and the environment if shipped without double containment. DOE stated that a separate inner container is unnecessary because of the high degree of confinement provided by the stainless steel waste canister and the essential nonrespirability of the solid, plutonium-bearing waste form. In addition, DOE argued that vitrified HLW in sealed canisters provides a comparable level of protection to that of irradiated reactor fuel elements, which the Commission previously determined should be exempt from the double-containment requirement (39 FR 20960).

On June 1, 1995, the NRC staff met with DOE in a public meeting to discuss the petitioner's request and the possible alternative of requesting an NRC determination under 71.63(b)(3) to exempt vitrified HLW contained in a sealed canister from the double-containment requirement. DOE informed the NRC in a letter dated January 25, 1996, of its intent to seek an exemption under 71.63(b)(3). The NRC received DOE's exemption request on July 16, 1996, in which DOE also requested that the original petition for rulemaking be held in abeyance until a decision was reached on the exemption request. In response to DOE's request, the NRC staff prepared a Commission paper (SECY-96-215, dated October 8, 1996) outlining and requesting Commission approval of the NRC staff's proposed approach for making an exemption under 71.63(b)(3). However, in a staff requirements memorandum (SRM) dated October 31, 1996, the Commission disapproved the NRC staff's plan and directed that this policy issue be addressed by rulemaking rather than by exemption.

The NRC published a proposed rule in the *Federal Register* on May 8, 1997 (62 FR 25146) in response to DOE's petition. The Statement of Considerations for the proposed rule contains a complete discussion of DOE's petition, comments received on the petition, and the NRC's analysis of those comments.

## Discussion

The NRC is amending 10 CFR 71.63 based on its evaluation of the petition submitted by the DOE; the attachment to the petition, "Technical Justification to Support the PRM by the DOE to Exempt HLW Canisters from 10 CFR 71.63(b)" (Technical Justification); the three public comments received on the petition after its publication in the *Federal Register*; and the seven comments on the proposed rule. In amending 71.63, the NRC is accepting, with modifications, the petition submitted by DOE, for the reasons set forth in the following paragraphs.

In the early 1970's, the AEC anticipated that a large number of shipments of plutonium nitrate liquids could result from the spent fuel reprocessing anticipated at that time. This raised a concern about leakage of liquids because of the potential for a large number of packages (probably of more complex design) to be shipped due to reprocessing and the increased possibility of human error resulting from handling this expanded shipping load.

In 1973, the AEC proposed a rule which would deal with this problem by (a) requiring that shipments of plutonium containing greater than 20 curies be shipped in solid form, and (b) requiring that the solid plutonium be shipped in an inner container which would meet "special form" requirements as they then existed; i.e., not only would the whole package have to meet Part 71 requirements but the inner container would separately have to meet stringent requirements. One alternative to the proposed rule the AEC considered was to require that shipments of plutonium be in nonrespirable form, either in a single or double containment. This alternative was rejected, apparently because fuel fabricators did not have the technology to use plutonium in a nonrespirable form.

In 1974, the AEC published a final rule which contained two significant changes from the proposed rule:

- (1) The AEC abandoned the "special form" requirement and instead simply required "double containment"; i.e., the inner container was required not to release plutonium when the whole package was subjected to the normal and hypothetical accident tests of Part 71, but no separate tests were required for the inner container. Double containment was required to take account of the fact that the AEC had decided not to require that the plutonium be in a nonrespirable form; and
- (2) The AEC exempted two forms of plutonium altogether--reactor fuel elements and metal or metal alloy--on the basis that these forms were "essentially nonrespirable" and therefore did not require double containment. The exemption provision placed in the regulation also indicates that the AEC saw the possibility that other forms of plutonium would be similar enough to these two forms to also qualify for exemption from the double-containment requirement because they were also essentially nonrespirable. In the statement of considerations accompanying the final rule, the AEC stated that "solid forms of plutonium that are essentially nonrespirable should be exempt from the double containment requirements" (39 FR 20960).

DOE's petition argues that a particular form of plutonium--vitrified high-level waste contained in a sealed canister--is similar enough to irradiated reactor fuel elements to qualify for its own exemption from the double-containment requirement. This is because of (1) the material properties of the vitrified HLW, (2) the high degree of confinement provided by the stainless steel waste canister, and (3) the NRC-approved quality assurance program implemented by DOE makes it highly unlikely that any plutonium would be released from an NRC-certified transportation package under the normal or hypothetical accident conditions of Part 71. The NRC is required to certify the transportation packages used for vitrified HLW pursuant to Section 180 of the NWPA and every transportation package for vitrified HLW will be required to meet the standards for accident-resistant packages (i.e., Type B packages) set forth in Part 71.

The tests described in DOE's Technical Justification demonstrate that the canisters containing the vitrified HLW provide an additional barrier to the release of radionuclides and compare favorably to the cladding surrounding spent fuel pellets in reactor fuel elements. The comparison is based upon physical drop tests, upon the material properties and dimensions of the sealed canisters, and the effects of radiation damage to materials.

DOE's analysis demonstrates much lower concentrations of plutonium in the HLW canisters than in irradiated reactor fuel elements. However, the DOE has not established an upper limit on plutonium concentration for these vitrified HLW canisters, and the NRC is not basing its decision to remove these canisters from the double-containment requirement based on the plutonium's concentration.

In its Technical Justification, DOE described the physical characteristics and acceptance standards of the canisters of vitrified HLW, including that the canistered waste form be capable of withstanding a 7-meter drop onto a flat, essentially unyielding surface, without breaching or dispersing radionuclides. This requirement is imposed by the DOE's "Waste Acceptance System Requirements Document (WASRD)," Rev. 0, which is referenced in the Technical Justification. This test should not be confused with the 9-meter drop test, onto an essentially unyielding surface, which is required by the hypothetical accident conditions of 71.73. The 9-meter drop test is performed on the entire transportation package under the Part 71 certification process. The 7-meter drop test standard only applies to the canistered HLW.

The NRC agrees that the 7-meter drop test requirement is relevant to the demonstration that the canistered HLW represents an essentially nonrespirable form for shipping plutonium. The NRC believes that the 7-meter canister drop test is a more severe challenge than the 9-meter drop test for an NRC-approved Type B package. This is because the Type B package and the impact limiters will absorb much of the energy which would otherwise be expended against the canister.

In some of DOE's tests, the HLW canisters were dropped from 9 meters--2 meters above DOE's 7-meter design standard--and portions of the testing included deliberately introducing flaws (0.95 cm holes) in the canisters' walls. For those HLW canisters tested with the 0.95 cm holes, the quantity of respirable plutonium released through these holes was less than 0.74 TBq (20 curies). This review of DOE's Technical Justification has provided the NRC staff confidence that DOE's petition is supportable and that vitrified HLW in a sealed canister is essentially nonrespirable.

The NRC does not control the requirements in, or changes to, DOE's WASRD. Because of concerns that DOE's WASRD could be changed in the future, the NRC added the requirement in the proposed rule that vitrified HLW contained in a sealed canister meet the design criteria of 60.135(b) and (c).

However, in response to comments received on the proposed rulemaking, the Commission has reconsidered its proposed imposition of referencing Part 60 design criteria. The final rule, instead, incorporates one of the design requirements from Part 60 into this rule. The other Part 60 design requirements are satisfied by other existing Part 71 requirements and other language in the final rule. Additionally, the Commission has included one acceptable method for meeting these design requirements for handling by referencing appropriate American Society of Mechanical Engineers Boiler and Pressure Vessel Code criteria. The explanation for this change is discussed below. Further, the NRC staff does perform technical reviews to certify package designs. For a HLW package, the review would include the sealed canister as well as the radioactive contents in the form of vitrified HLW. It is expected that an application for approval of a HLW package design would include a canister design and vitrified HLW contents with characteristics and attributes comparable to those described in the Technical Justification.

#### Comments on the Proposed Rule

This section presents a summary of the principal comments received on the proposed rule, the NRC's response to the comments, and changes made to the final rule as a result of these comments. The Commission received seven comment letters from six commenters on the proposed rule. One was from a member of the public, two were from national laboratories, one was from a transportation cask designer, one was from a consulting company, and one was from DOE. In addition, DOE submitted a subsequent letter commenting on one of the other comments. Overall, five of the six commenters supported the proposed rule and the remaining commenter, while not specifically opposing the rule, proposed changes regarding the performance of the canister and limiting its contents. Copies of these letters are available for public inspection and copying for a fee at the Commission's Public Document Room, located at 2120 L Street, NW (Lower Level), Washington, DC.

**Comment.** DOE and another commenter objected to the proposed rule's use of design criteria from Part 60. DOE noted that basing canistered waste approved for transport under 71.63 upon the rules for disposal of HLW under 60.135(b) and (c) assumes that certification approval for transport packages will not take place until a repository or interim storage facility becomes available; and that this may not be the case. The commenters are concerned that if certification for transport packages under the proposed rule is sought before a license application for a repository or interim storage facility is submitted, this situation could complicate and impede progress on the HLW cask certification process. One commenter supported the use of Part 60 criteria.

**Response.** The Commission has reconsidered the need to reference Part 60 criteria for canistered vitrified HLW in the amended regulation. The Commission agrees that it is best to avoid incorporating into Part 71--which contains standards for the packaging and transportation of radioactive materials--requirements referenced from Part 60 which are intended for the permanent disposal of HLW in a geologic repository. The NRC staff has analyzed the requirements contained in 60.135(b) and (c) and has determined that the intended requirement--that the canistered vitrified HLW maintain its integrity--can be achieved by reliance on existing Part 71 requirements and language from the proposed rule for all of the Part 60 requirements, but one. That one requirement is to design the canister to maintain waste containment during handling activities associated with transport. This has been added to the final rule. Additionally, the Commission has included one acceptable method for meeting these design requirements by referencing appropriate American Society of Mechanical Engineers Boiler and Pressure Vessel Code criteria.

The design criteria in 60.135(b) require that the waste package shall not contain explosive, pyrophoric, or chemically reactive materials or free liquids in amounts that could cause harm; that waste packages shall be designed to maintain waste containment during handling; and that waste packages have unique identification numbers. The design criteria in 60.135(c) require that the waste be in solid form and placed in a sealed container; that any particulate waste forms be consolidated into an encapsulating matrix; and that any combustible radioactive waste be reduced to noncombustible form. As noted, the Commission believed that by referencing these criteria in the proposed rule, it could assure the integrity of the canistered vitrified HLW.

The Commission now believes that the integrity objective can be achieved by relying on requirements in the final rule and other requirements in Part 71. First, as stated above, the final rule has added language that the canister be designed to maintain waste containment during handling activities associated with transport. Second the rule requires that the HLW be vitrified, and thus be in a solid form for encapsulation. Vitrification of HLW uses molten glass and this high temperature process will reduce any combustible radioactive waste into a noncombustible form. Finally, the Part 60 requirement that a unique identification number be attached to the HLW canister is not relevant for transportation.

Third, the Commission believes the integrity objective can be achieved by relying on other requirements in Part 71. Part 71 already requires that the transportation packages must not contain explosive, pyrophoric, or chemically reactive materials or free liquids. Section 71.43(d) requires that:

A package must be made of materials and construction that assure that there will be no significant chemical, galvanic, or other reaction among the packaging components, among package contents, or between the packaging components and the package contents, including possible reaction resulting from leakage of water, to the maximum credible extent. Account must be taken of the behavior of materials under irradiation.

The existing requirement in 71.63(a) that the plutonium be in a solid form also will assure that the waste will be in solid form and that the waste package will be free of liquids.

Additionally, the Commission has included one acceptable method for meeting the canister design requirements for handling by referencing appropriate American Society of Mechanical Engineers Boiler and Pressure Vessel Code criteria. Use of the ASME Boiler and Pressure Vessel Code would ensure that the canister would be designed to maintain waste containment during handling, including normal loading and unloading activities. Certain criteria of the ASME Boiler and Pressure Vessel Code, Section VIII, are excluded because they are not appropriate for a sealed canister containing vitrified HLW. For example, the criteria to include a pressure relief device and openings to inspect the interior are unnecessary and could compromise the long term integrity of the canister. Specific alternatives to the ASME Boiler and Pressure Vessel Code criteria may be considered and approved without resorting to exemptions from the regulation.

**Final Rule.** The final rule has been revised to read as follows: Vitrified high-level waste contained in a sealed canister designed to maintain waste

containment during handling activities associated with transport. As one method of meeting this paragraph, the NRC will consider acceptable a canister which is designed in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII, editions through the 1995 Edition. However, this canister need not be designed in accordance with the requirements of Section VIII, Parts UG-46, UG-115 through UG-120, UG-125 through UG-136, UW-60, UW-65, UHA-60, and UHA-65 and the canister's final closure weld need not be designed in accordance with the requirements of Section VIII, Parts UG-99 and UW-11. Necessary language to incorporate by reference the ASME Boiler and Pressure Vessel Code has also been added.

**Comment.** Four of the six commenters stated that the NRC should evaluate the technical bases for 71.63, or referred to a Commission SRM to SECY-96-215, dated October 31, 1996, which directed the NRC staff to "address whether the technical basis for 10 CFR 71.63 remains valid, or whether a revision or elimination of portions of 10 CFR 71.63 is needed to provide flexibility for current and future technologies." One of the commenters noted that the International Atomic Energy Agency standards do not impose a double-containment requirement. Four of the commenters recommended that if the NRC retained the double containment provision, that the rule use performance-based criteria for dispersibility and respirability as a basis for exemption, or that double containment only be required for "highly dispersible materials." One of the commenters recommended that 71.63 be eliminated entirely. One commenter expressed an interest in any Commission action on 71.63, and recommended that the evaluation of 71.63 take the form of an Advanced Notice of Proposed Rulemaking.

**Response.** The Commission believes that those comments to evaluate the technical basis for 71.63, to revise 71.63 (other than for vitrified HLW in canisters), or to eliminate the rule, are beyond the scope of this rulemaking. The NRC staff recently reviewed the technical bases for 71.63, as directed in the SRM to SECY-96-215. The NRC staff concluded, in SECY-97-218, dated September 29, 1997, that the technical bases remain valid, and that the provisions provide adequate flexibility for current and future technologies. Except for the changes made in this rulemaking for vitrified HLW in canisters, the NRC staff concluded that the provisions in 71.63 should remain unchanged. The NRC staff will further consider potential modifications to 71.63 in its response to a petition for rulemaking, dated September 25, 1997, (Docket No. PRM-71-12). The NRC published a notice of receipt for the petition in the *Federal Register* (63 FR 8362, dated February 19, 1998).

**Comment.** One commenter suggested that the proposed rule be changed to require that HLW canister design, fabrication, test, and fill be conducted under a quality assurance program that meets, to the satisfaction of the NRC, the requirements of Part 71, Subpart H.

This commenter also suggested that the proposed rule be changed to require that the exemption will only apply to canisters of HLW in shipping packages which have been demonstrated by analysis or test to adequately contain the HLW canisters without allowing canister failure under the hypothetical accident conditions of Part 71, Subpart F, when considered as a transportation system.

**Response.** The technical basis given in the DOE petition for an exemption is that a separate inner container is unnecessary because of the high degree of confinement provided by the stainless steel waste canister and the non-respirability of the solid, plutonium-bearing waste form. In support of its petition, DOE submitted a Technical Justification which included a description of a representative HLW canister together with the results of 7-meter and 9-meter drop testing of the canisters and a description of the standards used for canister fabrication and filling.

The technical review performed by the NRC staff to certify a HLW package would include the sealed canister as well as the radioactive contents in the form of vitrified HLW. It is expected that an application for approval of a HLW package design would include a canister design and vitrified HLW contents with characteristics and integrity comparable to those described in the DOE petition. The DOE HLW canisters will be subject to an NRC approved quality assurance plan.

The final rule has been revised to specify that the vitrified high-level waste be contained in a sealed canister designed to maintain waste containment during handling activities associated with transport. These standards would apply to all canisters containing vitrified HLW transported under this provision and will provide reasonable assurance that the package design adequately protects public health and safety.

**Comment.** One commenter suggested that the proposed rule be changed to require that the exemption will only apply to vitrified HLW from which plutonium has been removed prior to transfer to HLW storage tanks. The commenter suggested the vitrified HLW be restricted to no more than 3.7 TBq (100 Ci) of plutonium.

**Response.** The Statement of Considerations for the original rule (39 FR 20960) did not discuss activity limits (quantity limits); nor did the Commission adopt activity limits on the other forms of plutonium that are exempt from 71.63(b). Rather, any limitations on the quantity of plutonium that can be shipped in a transportation package--for any exempt form of plutonium--are due to the inherent design features of the specific transportation package being used. These design features are reviewed by the NRC as part of the package certification process. The commenter has not provided any technical basis for requiring activity limits on this form of plutonium. The final rule does not specify a quantity limit for this exemption.

#### Regulatory Action

The NRC is amending 10 CFR 71.63 based on its evaluation of the petition submitted by DOE; the attachment to the petition, "Technical Justification to Support the PRM by the DOE to Exempt HLW Canisters from 10 CFR 71.63(b)," the three comments received on the petition; and the seven comments received on the proposed rule. Section 71.63(b) specifies special provisions for shipping plutonium in excess of 0.74 TBq (20 curies) per package, including a separate inner containment system, except when plutonium is in solid form of reactor fuel elements, metal, or metal alloys. In amending 71.63(b), the NRC is granting, with modification, the petition submitted by DOE to eliminate these special provisions when transporting vitrified HLW contained in a sealed canister designed to maintain waste containment during handling activities associated with transport. The final rule completes NRC action on PRM-71-11. In the proposed rule, the NRC would have required that the HLW canister meet design criteria contained in 60.135(b) and (c). The final rule, instead, incorporates these requirements into Part 71.

In addition, the NRC has corrected the usage of units in 71.63. The metric units are used first with the English units in parenthesis.

#### Criminal Penalties

For the purposes of Section 223 of the Atomic Energy Act (AEA), the Commission is issuing the final rule under one or more of sections 161b, 161i, or 161o of the AEA. Willful violations of the rule will be subject to criminal enforcement.

#### Compatibility of Agreement State Regulations

Under the "Policy Statement on Adequacy and Compatibility of Agreement State Programs" approved by the Commission on June 30, 1997 (62 FR 46517), this rule is classified as compatibility category "NRC." This regulation addresses areas of exclusive NRC authority. However, a State may adopt these provisions for the purposes of clarity and communication, as long as the State does not adopt regulations or program elements that would cause the State to regulate these areas.

#### Finding of No Significant Environmental Impact: Availability

The Commission has determined under the National Environmental Policy Act of 1969, as amended, and the Commission's regulations in Subpart A of 10 CFR Part 51, that this rule will not be a major Federal action significantly affecting the quality of the human environment, and therefore, an environmental impact statement is not required. The final rule change exempts shipments of vitrified HLW contained in a sealed canister designed to maintain waste containment during handling activities associated with transport. The purpose of the double containment rule is to ensure safety by requiring plutonium to be shipped as a solid, under double containment, thereby minimizing the likelihood of leakage during transport as a result of possible packaging errors. The Commission believes that the plutonium within vitrified HLW contained in a sealed canister is essentially nonrespirable and this form of plutonium provides a level of protection comparable to irradiated reactor fuel elements--which are exempt from the double-containment requirement. Therefore, double containment is unnecessary for vitrified HLW contained in a sealed canister designed to maintain waste containment during handling activities associated with transport.

The final environmental assessment and finding of no significant impact on which this determination is based are available for inspection at the NRC Public Document Room, 2120 L Street NW. (Lower Level), Washington, DC. Single copies of the environmental assessment and the finding of no significant impact are available from Mark Haisfield, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, telephone (301) 415-6196.

#### Paperwork Reduction Act Statement

This final rule does not contain a new or amended information collection requirement subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). Existing requirements were approved by the Office of Management and Budget, approval number 3150-0008.

#### Public Protection Notification

If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

#### Regulatory Analysis

The Commission has prepared a final regulatory analysis on 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. (Lower Level), Washington, DC. Single copies of the analysis may be obtained from Mark Haisfield, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, telephone (301) 415-6196.

#### Regulatory Flexibility Certification

As required by the Regulatory Flexibility Act of 1980 (5 U.S.C. 605(b)), the Commission certifies that this rule does not have a significant economic impact on a substantial number of small entities. DOE is the only transporter of vitrified HLW. No other entities are involved. DOE is not a small entity as defined in 10 CFR 2.810.

#### Small Business Regulatory Enforcement Fairness Act

In accordance with the Small Business Regulatory Enforcement Fairness Act of 1996, the NRC has determined that this action is not a major rule and has verified this determination with the Office of Information and Regulatory Affairs, Office of Management and Budget.

#### Backfit Analysis

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

#### List of Subjects in 10 CFR Part 71

Criminal penalties, Hazardous materials transportation, Incorporation by reference, Nuclear materials, Packaging and containers, Reporting and

recordkeeping requirements.

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. 552 and 553; the NRC is adopting the following amendments to 10 CFR Part 71.

## PART 71--PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIAL

1. The authority citation for Part 71 continues to read as follows:

**AUTHORITY:** Secs. 53, 57, 62, 63, 81, 161, 182, 183, 68 Stat. 930, 932, 933, 935, 948, 953, 954, as amended, sec. 1701, 106 Stat. 2951, 2952, 2953 (42 U.S.C. 2073, 2077, 2092, 2093, 2111, 2201, 2232, 2233, 2297f); secs. 201, as amended, 202, 206, 88 Stat. 1242, as amended, 1244, 1246 (42 U.S.C. 5841, 5842, 5846).

Section 71.97 also issued under sec. 301, Pub. L. 96-295, 94 Stat. 789-790.

2. Section 71.63 is revised to read as follows:

### 71.63 Special requirements for plutonium shipments.

- (a) Plutonium in excess of 0.74 TBq (20 Ci) per package must be shipped as a solid.
- (b) Plutonium in excess of 0.74 TBq (20 Ci) per package must be packaged in a separate inner container placed within outer packaging that meets the requirements of Subparts E and F of this part for packaging of material in normal form. If the entire package is subjected to the tests specified in 71.71 ("Normal conditions of transport"), the separate inner container must not release plutonium as demonstrated to a sensitivity of  $10^{-6}$  A<sub>2</sub>/h. If the entire package is subjected to the tests specified in 71.73 ("Hypothetical accident conditions"), the separate inner container must restrict the loss of plutonium to not more than A<sub>2</sub> in 1 week. Solid plutonium in the following forms is exempt from the requirements of this paragraph:
  - (1) Reactor fuel elements;
  - (2) Metal or metal alloy;
  - (3) Vitrified high-level waste contained in a sealed canister designed to maintain waste containment during handling activities associated with transport. As one method of meeting this paragraph, the NRC will consider acceptable a canister which is designed in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII, editions through the 1995 Edition. However, this canister need not be designed in accordance with the requirements of Section VIII, Parts UG-46, UG-115 through UG-120, UG-125 through UG-136, UW-60, UW-65, UHA-60, and UHA-65 and the canister's final closure weld need not be designed in accordance with the requirements of Section VIII, Parts UG-99 and UW-11. The Director of the *Federal Register* approves this incorporation by reference in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51. Copies of the ASME Boiler and Pressure Vessel Code, Section VIII, editions through the 1995 Edition, may be purchased from the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th St., New York, NY 10017. It is also available for inspection at the NRC Library, 11545 Rockville Pike, Rockville, MD 20852-2738 or at the Office of the *Federal Register*, 800 North Capitol Street, NW., Suite 700, Washington, DC.; and
  - (4) Other plutonium bearing solids that the Commission determines should be exempt from the requirements of this section.

Dated at Rockville, Maryland, this day of , 1998.

For the Nuclear Regulatory Commission.

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John C. Hoyle  
*Secretary of the Commission.*

ATTACHMENT 2

## Regulatory Analysis for Rulemaking on Requirements for Shipping Packages Used to Transport Vitrified High-Level Waste

### 1. Statement of the Problem and Objectives

#### BACKGROUND

In 1974, the Atomic Energy Commission (AEC) adopted special requirements in 10 CFR 71.63 for shipments of plutonium in excess of 0.74 terabecquerels (20 Curies) per package. These requirements specify that plutonium must be in solid form and that packages used to ship plutonium must provide a separate inner containment (the "double-containment" requirement). In adopting these requirements, the Commission specifically excluded plutonium in the form of reactor fuel elements, metal or metal alloys, and other plutonium-bearing solids that the Commission determines, on a case-by-case basis, should be exempt from the double-containment requirement because these solid forms of plutonium are essentially nonrespirable.

On November 30, 1993, the Department of Energy (DOE) petitioned the NRC to amend 71.63(b) to add vitrified high-level waste (HLW) contained in a



sealed canister to the forms of plutonium which are exempt from the double-containment packaging requirements. DOE's main arguments were the high degree of confinement provided by the stainless steel waste canister and the essential nonrespirability of the solid, plutonium bearing waste form, and that, together, this provides a level of protection comparable to reactor fuel elements. The NRC published a notice of receipt for the petition, docketed as PRM-71-11, in the *Federal Register* on February 18, 1994, requesting public comment by May 4, 1994. The public comment period was subsequently extended to June 3, 1994, at the request of the Idaho National Environmental and Engineering Laboratory (INEEL) Oversight Program of the State of Idaho.

Comments were received from three parties: the U.S. Environmental Protection Agency (EPA); Nye County, Nevada (the site for the proposed spent fuel and high-level waste (HLW) repository at Yucca Mountain); and the INEEL Oversight Program of the State of Idaho. EPA reviewed the petition in accordance with its responsibilities under Section 309 of the Clean Air Act, and had no specific comments. Nye County agreed with the rationale and arguments advanced by DOE, and had no objection to DOE's petition. The State of Idaho commented that the petition was premature because it did not specify the parameters or performance standards that HLW must meet.

On June 1, 1995, the NRC staff met with DOE in a public meeting to discuss the petitioner's request and the possible alternative of requesting an NRC determination under 71.63(b)(3) to exempt vitrified HLW from the double-containment requirement. DOE informed the NRC in a letter dated January 25, 1996, of its intent to seek this determination and the NRC received DOE's request on July 16, 1996. The original petition for rulemaking was requested to be held in abeyance until a decision was reached on the exemption request.

In response to DOE's request, the NRC staff prepared a Commission paper (SECY-96-215, dated October 8, 1996) outlining and requesting Commission approval of the NRC staff's proposed approach for making a determination under 71.63(b)(3). In a staff requirements memorandum dated October 31, 1996, the Commission disapproved the NRC staff's plan and directed that this policy issue be addressed by rulemaking. In response, the NRC staff reactivated DOE's petition, developed a proposed rule, and published it in the *Federal Register* on May 8, 1997 (62 FR 25146), with public comments requested by July 22, 1997.

## DISCUSSION

The NRC is amending 10 CFR 71.63 based on its evaluation of the petition submitted by the DOE; the attachment to the petition, "Technical Justification to Support the PRM by the DOE to Exempt HLW Canisters from 10 CFR 71.63(b)" (Technical Justification); the three public comments received on the petition after its publication in the *Federal Register*; and the seven comments on the proposed rule. In amending 71.63, the NRC is accepting, with modifications, the petition submitted by DOE, for the reasons set forth in the following paragraphs.

In 1973, the AEC proposed a rule which would (a) require that shipments of plutonium containing greater than 20 curies be shipped in solid form, and (b) require that the solid plutonium be shipped in an inner container which would meet "special form" requirements as they then existed; i.e., not only would the whole package have to meet Part 71 requirements but the inner container would separately have to meet stringent requirements. One alternative to the proposed rule the AEC considered was to require that shipments of plutonium be in nonrespirable form, either in a single or double containment. This alternative was rejected, apparently because fuel fabricators did not have the technology to use plutonium in a nonrespirable form.

In 1974, the AEC published a final rule which contained two significant changes from the proposed rule:

- (1) The AEC abandoned the "special form" requirement and instead simply required "double containment"; i.e., the inner container was required not to release plutonium when the whole package was subjected to the normal and hypothetical accident tests of Part 71, but no separate tests were required for the inner container. Double containment was required to take account of the fact that the AEC had decided not to require that the plutonium be in a nonrespirable form; and
- (2) The AEC exempted two forms of plutonium altogether--reactor fuel elements and metal or metal alloy--on the basis that these forms were "essentially nonrespirable" and therefore did not require double containment. The exemption provision placed in the regulation also indicates that the AEC saw the possibility that other forms of plutonium would be similar enough to these two forms to also qualify for exemption from the double-containment requirement because they were also essentially nonrespirable. In the statement of considerations accompanying the final rule, the AEC stated that "solid forms of plutonium that are essentially nonrespirable should be exempt from the double containment requirements" (39 FR 20960).

DOE's petition argues that a particular form of plutonium--vitrified high-level waste contained in a sealed canister--is similar enough to reactor fuel elements, particularly irradiated reactor fuel elements, to qualify for its own exemption from the double-containment requirement. This is because of (1) the material properties of the vitrified HLW, (2) the high degree of confinement provided by the stainless steel waste canister, and (3) the NRC-approved quality assurance program implemented by DOE makes it highly unlikely that any dispersible or respirable plutonium would be released from an NRC-certified transportation package under the normal or hypothetical accident conditions of Part 71. The NRC is required to certify the transportation packages used for vitrified HLW pursuant to Section 180 of the NWPA and every transportation package for vitrified HLW will be required to meet the standards for accident-resistant packages (i.e., Type B packages) set forth in Part 71.

The tests described in DOE's Technical Justification demonstrate that the canisters containing the vitrified HLW compare favorably to the cladding surrounding spent fuel pellets in reactor fuel elements. The comparison is based upon physical drop tests, upon the material properties and dimensions of the sealed canisters, and upon the effects of radiation damage to materials.

DOE's analysis demonstrates much lower concentrations of plutonium in the HLW canisters than in irradiated reactor fuel elements. However, the DOE has not established an upper limit on plutonium concentration for these vitrified HLW canisters, and the NRC is not basing its decision to remove these canisters from the double-containment requirement based on the plutonium's concentration.

In its Technical Justification, DOE described the physical characteristics and acceptance standards of the canisters of vitrified HLW, including that the canistered waste form be capable of withstanding a 7-meter drop onto a flat, essentially unyielding surface, without breaching or dispersing radionuclides. This requirement is imposed by the DOE's "Waste Acceptance System Requirements Document (WASRD)," Rev. 0, which is referenced in the Technical Justification. This test should not be confused with the 9-meter drop test, onto an essentially unyielding surface, which is required by the hypothetical accident conditions of 71.73. The 9-meter drop test is performed on the entire transportation package under the Part 71 certification process. The 7-meter drop test standard only applies to the canistered HLW.

The NRC agrees that the 7-meter drop test requirement is relevant to the demonstration that the canistered HLW represents an essentially nonrespirable form for shipping plutonium. The NRC believes that the 7-meter canister drop test is a more severe challenge than the 9-meter drop test for an NRC-approved Type B package. This is because the Type B package and the impact limiters will absorb much of the energy which would otherwise be expended against the canister.

In some of DOE's tests, the HLW canisters were dropped from 9 meters--2 meters above DOE's 7-meter design standard--and portions of the testing included deliberately introducing flaws (0.95 cm holes) in the canisters' walls. For those HLW canisters tested with the 0.95 cm holes, the quantity of respirable plutonium released through these holes was less than 0.74 TBq (20 curies). This review of DOE's Technical Justification has provided the NRC staff confidence that DOE's petition is supportable and that vitrified HLW in a sealed canister is essentially nonrespirable.

The NRC does not control the requirements in, or changes to, DOE's WASRD. Because of concerns that DOE's WASRD could be changed in the future, the NRC added the requirement in the proposed rule that vitrified HLW contained in a sealed canister meet the design criteria of 60.135(b) and (c). However, in response to comments received on the proposed rulemaking which are discussed below, the Commission has reconsidered its proposed imposition of Part 60 design criteria. The final rule, instead, incorporates the Part 60 handling requirements into Part 71 and relies upon other existing sections of Part 71 for assurance that the canistered vitrified HLW form will maintain its physical integrity. The NRC review of an application for transportation package approval would include a review of the characteristics and integrity of the canister design and its vitrified HLW contents.

DOE and another commenter objected to the proposed rule's use of design criteria from Part 60. DOE noted that tying canistered waste approved for transport under 71.63 to the rules for disposal of HLW under 60.135(b) and (c) assumes that certification approval for transport packages will not take place until a repository or interim storage facility becomes available and that this may not be the case. The commenters are concerned that if certification for transport packages under the proposed rule is sought before a license application for a repository or interim storage facility is submitted, this situation could complicate and impede progress on the HLW cask certification process. One commenter supported the use of Part 60 criteria.

The Commission has reconsidered the need to reference Part 60 criteria for canistered vitrified HLW in the amended regulation. The Commission agrees that it is best to avoid incorporating into Part 71--which contains standards for the packaging and transportation of radioactive materials--requirements from Part 60 which are intended for the permanent disposal of HLW in a geologic repository. The NRC staff has analyzed the requirements contained in 60.135(b) and (c) and has determined that the assurance of the integrity of the canistered vitrified HLW, that these requirements were intended to achieve, can instead be achieved by relying on new language in the final rule, unchanged language from the proposed rule, and other existing sections of Part 71.

The design criteria in 60.135(b) require that the waste package shall not contain explosive, pyrophoric, or chemically reactive materials or free liquids in amounts that could cause harm; that waste packages shall be designed to maintain waste containment during handling; and that waste packages have unique identification numbers. The design criteria in 60.135(c) require that the waste be in solid form and placed in a sealed container; that any particulate waste forms be consolidated into an encapsulating matrix; and that any combustible radioactive waste be reduced to noncombustible form. As noted, the Commission believed that by referencing these criteria in the proposed rule, it could assure the integrity of the canistered vitrified HLW.

The Commission now believes that the integrity objective can be achieved, in part, by relying on criteria already required by other language in the amended rule. The requirement in the rule that the HLW be vitrified will provide for a solid form and for waste encapsulation. Vitrification of HLW uses molten glass and this high temperature process will reduce any combustible radioactive waste into a noncombustible form. The amended rule language already requires that the vitrified HLW be in a sealed container. Finally, the Part 60 requirement that a unique identification number be attached to the HLW canister is not relevant for transportation.

Further, the Commission believes the integrity objective can be achieved by relying on other requirements in Part 71. Part 71 contains requirements that radioactive material contained in the packages not contain explosive, pyrophoric, or chemically reactive materials or free liquids. Section 71.43(d) requires that:

A package must be made of materials and construction that assure that there will be no significant chemical, galvanic, or other reaction among the packaging components, among package contents, or between the packaging components and the package contents, including possible reaction resulting from leakage of water, to the maximum credible extent. Account must be taken of the behavior of materials under irradiation.

The existing requirement in 71.63(a) that the plutonium be in a solid form also will assure that the waste will be in solid form and that the waste package will be free of liquids.

Assuring that the package will be designed to maintain waste containment during handling and transportation will be provided by specifying this requirement in the final rule. Additionally, the Commission has included one acceptable method for meeting these design requirements for handling by referencing appropriate American Society of Mechanical Engineers Boiler and Pressure Vessel Code criteria.

## 2. Identification and Analysis of Alternative Approaches

There are three alternatives to resolving the petition from DOE:

**ALTERNATIVE 1:** Deny the petition. This would require DOE to use a double-containment system for shipping vitrified HLW in sealed canisters or attempt to use alternative 2. The NRC agrees that vitrified HLW contained in a sealed canister is essentially nonrespirable. Consequently, the NRC agrees that there are no significant health and safety impacts to exempting vitrified HLW contained in a sealed canister from the double-containment packaging requirements of 71.63(b). Therefore, denying the petition would impose an unnecessary regulatory burden on DOE.

**ALTERNATIVE 2:** Make a determination under 71.63(b)(3) on whether sealed canisters containing vitrified HLW should be exempt from the double-containment packaging requirements. In SECY-96-215, dated October 8, 1996, the NRC staff proposed this approach to the Commission. In the staff requirements memorandum, dated October 31, 1996, the Commission stated that this was a policy issue which should be addressed through rulemaking.

**ALTERNATIVE 3:** Change the regulations in 71.63(b) to add vitrified HLW contained in a sealed canister to the forms of plutonium which are exempt from the double-containment packaging requirements. As discussed above, the NRC agrees that shipment of vitrified HLW contained in a sealed canister should be exempt from the double-containment requirements. This alternative would allow an alternative means of transporting this waste with no significant impact to public health and safety and the environment.

### 3. Estimate and Evaluation of Values and Impacts

DOE has not quantitatively evaluated the cost savings of exempting vitrified HLW contained in a sealed canister from the double-containment requirements. However, they have identified potential benefits. Because the NRC agrees with DOE that there are no significant health and safety issues, a detailed quantitative analysis is not necessary. Based on DOE documents, it is estimated that there will be 3,500 shipments of vitrified HLW by 2030. These shipments are not expected to start until a geologic repository or an interim storage facility for HLW becomes available. However, DOE's statement of 3,500 shipments is based on loading two HLW canisters in each use of the intended shipping cask.

Adopting this rule could result in reducing the total number of shipments of vitrified HLW. Since a separate inner containment vessel would not be required, the quantity of vitrified HLW per package could, in some instances, be increased. Increasing the quantity per package could result in fewer shipments. Therefore, the rule could have the following benefits: (1) reducing the occupational dose associated with loading, unloading, decontaminating, and handling the shipping casks; (2) reducing the dose to the public during normal transport by decreasing the total number of shipments; (3) decreasing total loading and unloading time (and resultant expense); and (4) reducing the cost of the containment system.

### 4. Decision Rationale

The NRC is amending 71.63(b). This section imposes special requirements when shipping plutonium in quantities in excess of 0.74 TBq (20 Ci) per package. This section requires that plutonium be shipped inside a separate inner container. Two exemptions to this requirement are defined for plutonium in the form of reactor fuel elements and metal or metal alloys. For the reasons presented under the heading "Discussion," the NRC agrees that plutonium contained in sealed canisters of vitrified HLW should be exempt from the double-containment packaging requirements. The rule change would allow an alternative means of transporting this radioactive material with no significant impact to public health and safety and the environment.

In addition, the NRC is making a minor correction to the usage of units in 71.63 to be consistent with existing NRC policy. Metric units are reported first with English units in parenthesis.

### 5. Implementation

This final rule, as modified by the NRC in response to public comments on the proposed rule, should be implemented 30 days from the date this rule is published in the *Federal Register*.

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ATTACHMENT 3

Final Environmental Assessment and Finding of  
No Significant Environmental Impact

Final Rule: Requirements for Shipping Packages Used  
to Transport Vitrified High-Level Waste

### BACKGROUND

In 1974, the Atomic Energy Commission (AEC) imposed special requirements in 10 CFR 71.63 on licensees who ship plutonium in excess of 0.74 terabecquerels (20 curies) per package. These requirements specify that plutonium must be in solid form and that packages used to ship plutonium must provide a separate inner containment (the "double-containment" requirement). In adopting these requirements, the Commission specifically excluded plutonium in the form of reactor fuel elements, metal or metal alloys, and other plutonium-bearing solids that the Commission determines, on a case-by-case basis, are exempt from the double-containment requirement because these solid forms of plutonium are essentially nonrespirable.

On November 30, 1993, the Department of Energy (DOE) petitioned the NRC to amend 71.63(b) to add vitrified high-level waste (HLW) contained in a sealed canister to the forms of plutonium which are exempt from the double-containment packaging requirements. DOE's main arguments were the high degree of confinement provided by the stainless steel waste canister and the essential nonrespirability of the solid, plutonium bearing waste form, and

that, together, this provides a level of protection comparable to reactor fuel elements. The NRC published a notice of receipt for the petition, docketed as PRM-71-11, in the *Federal Register* on February 18, 1994, requesting public comment by May 4, 1994. The public comment period was subsequently extended to June 3, 1994, at the request of the Idaho National Environmental and Engineering Laboratory (INEEL) Oversight Program of the State of Idaho.

Comments were received from three parties: the U.S. Environmental Protection Agency (EPA); Nye County, Nevada (the site for the proposed spent fuel and high-level waste (HLW) repository at Yucca Mountain); and the INEEL Oversight Program of the State of Idaho. EPA reviewed the petition in accordance with its responsibilities under Section 309 of the Clean Air Act, and had no specific comments. Nye County agreed with the rationale and arguments advanced by DOE, and had no objection to DOE's petition. The State of Idaho commented that the petition was premature because it did not specify the parameters or performance standards that HLW must meet.

On June 1, 1995, the NRC staff met with DOE in a public meeting to discuss the petitioner's request and the possible alternative of requesting an NRC determination under 71.63(b)(3) to exempt vitrified HLW contained in a sealed canister from the double-containment requirement. DOE informed the NRC in a letter dated January 25, 1996, of its intent to seek this determination and the NRC received DOE's request on July 16, 1996. The original petition for rulemaking was requested to be held in abeyance until a decision was reached on the exemption request.

In response to DOE's request, the NRC staff prepared a Commission paper (SECY-96-215, dated October 8, 1996) outlining and requesting Commission approval of the NRC staff's proposed approach for making a determination under 71.63(b)(3). In a staff requirements memorandum dated October 31, 1996, the Commission disapproved the NRC staff's plan and directed that this policy issue be addressed by rulemaking. In response, the NRC staff reactivated DOE's petition, developed a proposed rule, and published it in the *Federal Register* on May 8, 1997 (62 FR 25146), with public comments requested by July 22, 1997.

## DISCUSSION

The NRC is amending 10 CFR 71.63 based on its evaluation of the petition submitted by the DOE; the attachment to the petition, "Technical Justification to Support the PRM by the DOE to Exempt HLW Canisters from 10 CFR 71.63(b)" (Technical Justification); the three public comments received on the petition after its publication in the *Federal Register*; and the seven comments on the proposed rule. In amending 71.63, the NRC is accepting, with modifications, the petition submitted by DOE, for the reasons set forth in the following paragraphs.

In 1973, the AEC proposed a rule which would (a) require that shipments of plutonium containing greater than 20 curies be shipped in solid form, and (b) require that the solid plutonium be shipped in an inner container which would meet "special form" requirements as they then existed; i.e., not only would the whole package have to meet Part 71 requirements but the inner container would separately have to meet stringent requirements. One alternative to the proposed rule the AEC considered was to require that shipments of plutonium be in nonrespirable form, either in a single or double containment. This alternative was rejected, apparently because fuel fabricators did not have the technology to use plutonium in a nonrespirable form.

In 1974, the AEC published a final rule which contained two significant changes from the proposed rule:

- (1) The AEC abandoned the "special form" requirement and instead simply required "double containment"; i.e., the inner container was required not to release plutonium when the whole package was subjected to the normal and hypothetical accident tests of Part 71, but no separate tests were required for the inner container. Double containment was required to take account of the fact that the AEC had decided not to require that the plutonium be in a nonrespirable form; and
- (2) The AEC exempted two forms of plutonium altogether--reactor fuel elements and metal or metal alloy--on the basis that these forms were "essentially nonrespirable" and therefore did not require double containment. The exemption provision placed in the regulation also indicates that the AEC saw the possibility that other forms of plutonium would be similar enough to these two forms to also qualify for exemption from the double-containment requirement because they were also essentially nonrespirable. In the statement of considerations accompanying the final rule, the AEC stated that "solid forms of plutonium that are essentially nonrespirable should be exempt from the double containment requirements" (39 FR 20960).

DOE's petition argues that a particular form of plutonium--vitrified high-level waste contained in a sealed canister--is similar enough to reactor fuel elements, particularly irradiated reactor fuel elements, to qualify for its own exemption from the double-containment requirement. This is because of (1) the material properties of the vitrified HLW, (2) the high degree of confinement provided by the stainless steel waste canister, and (3) the NRC-approved quality assurance program implemented by DOE makes it highly unlikely that any dispersible or respirable plutonium would be released from an NRC-certified transportation package under the normal or hypothetical accident conditions of Part 71. The NRC is required to certify the transportation packages used for vitrified HLW pursuant to Section 180 of the NWPA and every transportation package for vitrified HLW will be required to meet the standards for accident-resistant packages (i.e., Type B packages) set forth in Part 71.

The tests described in DOE's Technical Justification demonstrate that the canisters containing the vitrified HLW compare favorably to the cladding surrounding spent fuel pellets in reactor fuel elements. The comparison is based upon physical drop tests, upon the material properties and dimensions of the sealed canisters, and upon the effects of radiation damage to materials.

DOE's analysis demonstrates much lower concentrations of plutonium in the HLW canisters than in irradiated reactor fuel elements. However, the DOE has not established an upper limit on plutonium concentration for these vitrified HLW canisters, and the NRC is not basing its decision to remove these canisters from the double-containment requirement based on the plutonium's concentration.

In its Technical Justification, DOE described the physical characteristics and acceptance standards of the canisters of vitrified HLW, including that the canistered waste form be capable of withstanding a 7-meter drop onto a flat, essentially unyielding surface, without breaching or dispersing

radionuclides. This requirement is imposed by the DOE's "Waste Acceptance System Requirements Document (WASRD)," Rev. 0, which is referenced in the Technical Justification. This test should not be confused with the 9-meter drop test, onto an essentially unyielding surface, which is required by the hypothetical accident conditions of 71.73. The 9-meter drop test is performed on the entire transportation package under the Part 71 certification process. The 7-meter drop test standard only applies to the canistered HLW.

The NRC agrees that the 7-meter drop test requirement is relevant to the demonstration that the canistered HLW represents an essentially nonrespirable form for shipping plutonium. The NRC believes that the 7-meter canister drop test is a more severe challenge than the 9-meter drop test for an NRC-approved Type B package. This is because the Type B package and the impact limiters will absorb much of the energy which would otherwise be expended against the canister.

In some of DOE's tests, the HLW canisters were dropped from 9 meters--2 meters above DOE's 7-meter design standard--and portions of the testing included deliberately introducing flaws (0.95 cm holes) in the canisters' walls. For those HLW canisters tested with the 0.95 cm holes, the quantity of respirable plutonium released through these holes was less than 0.74 TBq (20 curies). This review of DOE's Technical Justification has provided the NRC staff confidence that DOE's petition is supportable and that vitrified HLW in a sealed canister is essentially nonrespirable.

The NRC does not control the requirements in, or changes to, DOE's WASRD. Because of concerns that DOE's WASRD could be changed in the future, the NRC added the requirement in the proposed rule that vitrified HLW contained in a sealed canister meet the design criteria of 60.135(b) and (c). However, in response to comments received on the proposed rulemaking which are discussed below, the Commission has reconsidered its proposed imposition of Part 60 design criteria. The final rule, instead, incorporates the Part 60 handling requirements into Part 71 and relies upon other existing sections of Part 71 for assurance that the canistered vitrified HLW form will maintain its physical integrity. The NRC review of an application for transportation package approval would include a review of the characteristics and integrity of the canister design and its vitrified HLW contents.

DOE and another commenter objected to the proposed rule's use of design criteria from Part 60. DOE noted that tying canistered waste approved for transport under 71.63 to the rules for disposal of HLW under 60.135(b) and (c) assumes that certification approval for transport packages will not take place until a repository or interim storage facility becomes available and that this may not be the case. The commenters are concerned that if certification for transport packages under the proposed rule is sought before a license application for a repository or interim storage facility is submitted, this situation could complicate and impede progress on the HLW cask certification process. One commenter supported the use of Part 60 criteria.

The Commission has reconsidered the need to reference Part 60 criteria for canistered vitrified HLW in the amended regulation. The Commission agrees that it is best to avoid incorporating into Part 71--which contains standards for the packaging and transportation of radioactive materials--requirements from Part 60 which are intended for the permanent disposal of HLW in a geologic repository. The NRC staff has analyzed the requirements contained in 60.135(b) and (c) and has determined that the assurance of the integrity of the canistered vitrified HLW, that these requirements were intended to achieve, can instead be achieved by relying on new language in the final rule, unchanged language from the proposed rule, and other existing sections of Part 71.

The design criteria in 60.135(b) require that the waste package shall not contain explosive, pyrophoric, or chemically reactive materials or free liquids in amounts that could cause harm; that waste packages shall be designed to maintain waste containment during handling; and that waste packages have unique identification numbers. The design criteria in 60.135(c) require that the waste be in solid form and placed in a sealed container; that any particulate waste forms be consolidated into an encapsulating matrix; and that any combustible radioactive waste be reduced to noncombustible form. As noted, the Commission believed that by referencing these criteria in the proposed rule, it could assure the integrity of the canistered vitrified HLW.

The Commission now believes that the integrity objective can be achieved, in part, by relying on criteria already required by other language in the amended rule. The requirement in the rule that the HLW be vitrified will provide for a solid form and for waste encapsulation. Vitrification of HLW uses molten glass and this high temperature process will reduce any combustible radioactive waste into a noncombustible form. The amended rule language already requires that the vitrified HLW be in a sealed container. Finally, the Part 60 requirement that a unique identification number be attached to the HLW canister is not relevant for transportation.

Further, the Commission believes the integrity objective can be achieved by relying on other requirements in Part 71. Part 71 contains requirements that radioactive material contained in the packages not contain explosive, pyrophoric, or chemically reactive materials or free liquids. Section 71.43(d) requires that:

A package must be made of materials and construction that assure that there will be no significant chemical, galvanic, or other reaction among the packaging components, among package contents, or between the packaging components and the package contents, including possible reaction resulting from inleakage of water, to the maximum credible extent. Account must be taken of the behavior of materials under irradiation.

The existing requirement in 71.63(a) that the plutonium be in a solid form also will assure that the waste will be in solid form and that the waste package will be free of liquids.

Assuring that the package will be designed to maintain waste containment during handling and transportation will be provided by specifying this requirement in the final rule. Additionally, the Commission has included one acceptable method for meeting these design requirements for handling by referencing appropriate American Society of Mechanical Engineers Boiler and Pressure Vessel Code criteria.

#### ENVIRONMENTAL CONSIDERATIONS

The Commission has determined, under the National Environmental Policy Act of 1969, as amended, and the Commission's regulations in Subpart A of 10 CFR Part 51, that this rule is not a major Federal action significantly affecting the quality of the human environment and therefore, an environmental

impact statement (EIS) is not required.

The NRC's generic EIS on transportation, NUREG-0170<sup>(1)</sup>, covers all types of radioactive material and transport by all modes (road, rail, air, and water). The environmental impact of radioactive material shipments (including plutonium) in all modes of transport under the regulations in effect as of June 30, 1975, is summarized by NUREG-0170 as follows:

Transportation accidents involving packages of radioactive material present potential for radiological exposure to transport worker and to members of the general public. The expected values of the annual radiological impact from such potential exposure are very small, estimated to be about one latent cancer fatality and one genetic effect for 200 years of shipping at 1975 rates.

The principal nonradiological impacts were found to be two injuries per year, and less than one accidental death per 4 years.

On the basis of the analysis and evaluation set forth in this statement, the staff concluded that:

Maximum radiation exposure of individuals from normal transportation is generally within recommended limits for members of the general public.

The average radiation dose to the population at risk from normal transportation is a small fraction of the limits recommended for members of the general public from all sources of radiation other than natural and medical sources and is a small fraction of the natural background dose.

The radiological risk from accidents in transportation is small, amounting to about one-half percent of the normal transportation risk on an annual basis.

The addition of vitrified HLW to the forms of plutonium which are exempt from the double-containment requirements of 10 CFR 71.63(b) should not result in any additional shipments of radioactive material. Shipment of vitrified HLW to a repository is a necessary component of the national HLW disposal strategy, is permitted under current regulations (with double containment), and would need to occur regardless of this change to Part 71. In concluding that this rule would not increase the number of shipments, the NRC staff has presumed that, if the requirement for a separate inner containment is retained, the packaging for transport of the vitrified HLW would be changed, or alternatively, the canisters themselves would be evaluated as a separate inner containment; but that the primary factors which would increase the numbers of shipments (e.g., the number of canisters per package or the physical size and weight of each canister) are generally not related to Part 71 considerations.

Adopting this rule could result in reducing the total number of shipments of vitrified HLW. Since a separate inner containment vessel would not be required, the quantity of vitrified HLW per package could, in some instances, be increased. Increasing the quantity per package could result in fewer shipments. Because, as shown by NUREG-0170, the greatest contributor to the overall risk of transportation of radioactive material is related to the normal (non-accident) conditions of transport, this reduction potential in the total number of shipments could offset any minimal additional risk which might be incurred by not requiring double containment of the canistered, vitrified HLW.

As requested in the petition, shipments of vitrified HLW contained in a sealed canister, which contains plutonium, are only expected to be made from three DOE facilities: West Valley, New York; Savannah River Site (SRS), South Carolina; and Hanford, Washington to a federal geologic repository. However, the possibility also exists of intermediate shipments to an interim storage facility. DOE has inventoried the HLW stored within the DOE complex and estimated the total number of vitrified HLW canisters that will be produced and transported to a geologic repository. This inventory<sup>(2)</sup> estimates the total number of HLW canisters at: Hanford - 7,067; SRS - 5,717; and West Valley - 300. This yields approximately 13,000 canisters, to be processed and stored at these sites by 2030. This number of HLW canisters could change if plutonium production were to resume or if weapons' plutonium were to be combined with HLW for disposal purposes. Additionally, approximately 700 HLW canisters from INEEL may also be generated and transported to the geologic repository. These canisters were not considered in the petition because the HLW treatment technology to be used at INEEL had not yet been selected.

DOE estimates that the number of shipments of plutonium-bearing vitrified HLW glass from the DOE complex to the repository would be about 3,500 total, to be spread out over several years. These shipments would not start until a geologic repository or an interim storage facility becomes available. The risk associated with this number of shipments is incidental to, and bounded by, the environmental impacts of all radioactive materials transportation, as described in NUREG-0170.

The only impact of this rule is expected to be that shipments of vitrified HLW will not be required to be made in packages which have a separate inner containment that meet the requirements of Subparts E and F of Part 71. Vitrified HLW is shipped in Type B packages. Every Type B package is required to meet the standards for normal and hypothetical accident conditions set forth in Part 71. The shipping casks for vitrified HLW are anticipated to be similar in design and robustness to shipping casks for irradiated reactor fuel elements. Irradiated reactor fuel elements are exempt from the double-containment requirement of 71.63(b). Also, irradiated reactor fuel elements typically contain a significantly higher concentration of plutonium than the vitrified HLW being proposed by DOE.

In 1987, the NRC performed a modal study (NUREG/CR-4829), which examined the accident risks associated with transport of spent nuclear fuel, by relating the thermal and mechanical forces that the NRC certified packages could withstand to the frequencies of accidents that could result in such forces. The conclusion of this study was that the ability of spent nuclear fuel packages to withstand the hypothetical accident conditions in Part 71, as required during the NRC-certification, bounded the actual accidents which might occur during transport, such that the fraction of accidents resulting in any radiological hazard was less than 0.6 percent, and the annual risks of transporting spent nuclear fuel were estimated at less than one-third the NUREG-0170 estimates for all radioactive materials.

Since: (1) vitrified HLW in a sealed canister is an essentially nonrespirable form of plutonium; (2) this form of plutonium provides a level of protection comparable to reactor fuel elements; (3) the vitrified HLW contained in a sealed canister designed to maintain waste containment during handling activities associated with transport, will be contained within a Type B transportation package; (4) there will be a greater number of shipments of

irradiated reactor fuel elements as compared to vitrified HLW; and (5) the previous findings related to the impacts of radioactive materials shipments in NUREG-0170 and spent fuel shipments in NUREG/CR-4829; the NRC finds that there is no significant effect on the quality of the environment associated with this rulemaking.

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ATTACHMENT 4

The Honorable Dan Schaefer, Chairman  
Subcommittee on Energy and Power  
Committee on Commerce  
United States House of Representatives  
Washington, DC 20515

Dear Mr. Chairman:

The U.S. Nuclear Regulatory Commission has sent to the Office of the *Federal Register*, for publication, the enclosed final rule that amends the Commission's regulation in 10 CFR Part 71. The amendment adds vitrified high-level waste contained in a sealed canister to the forms of plutonium exempt from the double-containment packaging requirements for transportation of plutonium. This amendment is in response to a petition for rulemaking submitted by the U.S. Department of Energy. Double containment provides two independent barriers to assure that respirable plutonium will not be released from a transportation package. NRC agrees with the petitioner that shipments of vitrified high-level waste contained in a sealed canister provides a comparable level of protection and is essentially nonrespirable, and therefore the packaging requirement for double containment is unnecessary. This approach is consistent with that currently used for the shipment of nuclear reactor fuel elements. The rule change will allow an alternative means of transporting this waste with no significant impact on public health and safety. The rule will also make a minor correction to the usage of metric and English units, to be consistent with existing NRC policy on such use.

Sincerely,  
Dennis K. Rathbun, Director  
Office of Congressional Affairs

Enclosure: *Federal Register* notice

cc: Representative Ralph Hall

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The Honorable James M. Inhofe, Chairman  
Subcommittee on Clean Air, Wetlands, Private  
Property and Nuclear Safety  
Committee on Environment and Public Works  
United States Senate  
Washington, DC 20510  
Dear Mr. Chairman:

The U.S. Nuclear Regulatory Commission has sent to the Office of the *Federal Register*, for publication, the enclosed final rule that amends the Commission's regulation in 10 CFR Part 71. The amendment adds vitrified high-level waste contained in a sealed canister to the forms of plutonium exempt from the double-containment packaging requirements for transportation of plutonium. This amendment is in response to a petition for rulemaking submitted by the U.S. Department of Energy. Double containment provides two independent barriers to assure that respirable plutonium will not be released from a transportation package. NRC agrees with the petitioner that shipments of vitrified high-level waste contained in a sealed canister provides a comparable level of protection and is essentially nonrespirable, and therefore the packaging requirement for double containment is unnecessary. This approach is consistent with that currently used for the shipment of nuclear reactor fuel elements. The rule change will allow an alternative means of transporting this waste with no significant impact on public health and safety. The rule will also make a minor correction to the usage of metric and English units, to be consistent with existing NRC policy on such use.

Sincerely,  
Dennis K. Rathbun, Director  
Office of Congressional Affairs

Enclosure: *Federal Register* notice

cc: Senator Bob Graham

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Mr. Robert P. Murphy  
General Counsel  
General Accounting Office

Room 7175  
441 G. St., NW,  
Washington, DC 20548  
Dear Mr. Murphy:

Pursuant to Subtitle E of the Small Business Regulatory Enforcement Fairness Act of 1996, 5 U.S.C. 801, the U. S. Nuclear Regulatory Commission is submitting a final amendment to the Commission's rules in 10 CFR Part 71. NRC is amending its regulations to add vitrified high-level waste contained in a sealed canister to the forms of plutonium exempt from the double-containment packaging requirements for transportation of plutonium. This amendment responds to a petition for rulemaking submitted by the U.S. Department of Energy.

We have determined that this rule is not a "major rule," as defined in 5 U.S.C. 804(2). We have confirmed this determination with the Office of Management and Budget.

Enclosed is a copy of the final rule that is being transmitted to the Office of the Federal Register for publication. This final rule will become effective 30 days after it is published in the *Federal Register*.

Sincerely,  
Dennis K. Rathbun, Director  
Office of Congressional Affairs

Enclosure: Final Rule

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The Honorable Al Gore  
President of the United  
States Senate  
Washington, DC 20510  
Dear Mr. President:

Pursuant to Subtitle E of the Small Business Regulatory Enforcement Fairness Act of 1996, 5 U.S.C. 801, the U.S. Nuclear Regulatory Commission is submitting a final amendment to the Commission's rules in 10 CFR Part 71. NRC is amending its regulations to add vitrified high-level waste contained in a sealed canister to the forms of plutonium exempt from the double-containment packaging requirements for transportation of plutonium. This amendment responds to a petition for rulemaking submitted by the U.S. Department of Energy.

We have determined that this rule is not a "major rule," as defined in 5 U.S.C. 804(2). We have confirmed this determination with the Office of Management and Budget.

Enclosed is a copy of the final rule that is being transmitted to the Office of the *Federal Register* for publication. This final rule will become effective 30 days after it is published in the *Federal Register*.

Sincerely,  
Dennis K. Rathbun, Director  
Office of Congressional Affairs

Enclosure: Final Rule

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The Honorable Newt Gingrich  
Speaker of the United States  
House of Representatives  
Washington, DC 20515  
Dear Mr. Speaker:

Pursuant to Subtitle E of the Small Business Regulatory Enforcement Fairness Act of 1996, 5 U.S.C. 801, the U.S. Nuclear Regulatory Commission is submitting a final amendment to the Commission's rules in 10 CFR Part 71. NRC is amending its regulations to add vitrified high-level waste contained in a sealed canister to the forms of plutonium exempt from the double-containment packaging requirements for transportation of plutonium. This amendment responds to a petition for rulemaking submitted by the U.S. Department of Energy.

We have determined that this rule is not a "major rule," as defined in 5 U.S.C. 804(2). We have confirmed this determination with the Office of Management and Budget.

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Sincerely,  
Dennis K. Rathbun, Director  
Office of Congressional Affairs

Enclosure: Final Rule

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1. NUREG-0170, "Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes," December 1977.
2. DOE/RW-0006, Rev. 11, "Integrated Data Base Report - 1994, U.S. Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics," September 1995.