



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

November 4, 1997

M. Haisfield  
OMB response  
EDO,  
AF 59-2  
PDR

Ms. Norma Gonzales  
Office of Information and Regulatory Affairs  
Office of Management and Budget  
Washington, DC 20503

Dear Ms. Gonzales:

Under the Congressional Review provisions of the Small Business Regulatory Enforcement Fairness Act ("the Act") (5 U.S.C. §§ 801-806), your office determines whether final agency actions are "major rules" for purposes of the Act. Enclosed you will find brief descriptions of final statements that the Nuclear Regulatory Commission may issue in the next 30 to 90 days. These are new actions which have not yet been submitted for your review. We believe that these actions are not "major rules" under the Act.

If you agree with our determinations, please indicate your concurrence on this letter, and fax the letter to me at 301-415-5144. You may also respond by return e-mail to DLM1@nrc.gov.

If you have any questions about these actions, please feel free to call me at 301-415-7162.

Sincerely,

*Michael T. Lee*

David L. Meyer, Chief  
Rules and Directives Branch  
Division of Administrative Services  
Office of Administration

Enclosures:

3150-AF59  
NUREG-1574

11-4-97

*I concur.*

*M. D. Gily*

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AGENCY: Nuclear Regulatory Commission

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

LEVEL OF SIGNIFICANCE: Not a major rule

UPCOMING ACTION: Publication in the Federal Register of the Final Rule

AGENCY ID NUMBER: RIN 3150-AF59

ESTIMATED DATE OF  
ISSUANCE: February 1998

STATUTORY OR  
JUDICIAL DEADLINE: None

DESCRIPTION OF ACTION:

The NRC is amending its regulations to remove canisters containing vitrified high-level waste containing plutonium from the packaging requirement for double containment. This amendment is in response to a petition for rulemaking (PRM-71-11) submitted by the Department of Energy (DOE). On May 8, 1997 (62 FR 25146), the NRC published a proposed rule in the Federal Register which was in response to the DOE petition. This action will finalize the proposed amendments with minor changes and will also make a minor correction to the usage of metric and English units to be consistent with existing NRC policy.

AF 59-2  
PDR

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.

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<sup>1</sup> NUREG-0170, "Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes," December 1977.



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.

Shipments of vitrified HLW contained in a sealed canister, which contains plutonium, are only expected to be made from four DOE facilities: West Valley, New York; Savannah River Site (SRS), South Carolina; Hanford, Washington; and Idaho Falls, Idaho (INEEL) 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. Additionally, approximately 700 HLW canisters from INEEL would also be generated and transported to the geologic repository. This yields approximately 13,800 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.

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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<sup>2</sup> DOE/RW-0006, Rev. 11, "Integrated Data Base Report - 1994, U.S. Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics," September 1995.



AF 59-2  
PDR

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.

February 25, 1998

AF59-2  
POR

MEMORANDUM TO: File

FROM: Philip Brochman, Nuclear Engineer  
Original /s/ by Spent Fuel Project Office  
Office of Nuclear Material Safety  
and Safeguards

SUBJECT: ACRS QUESTIONS ON RULEMAKING TO REVISE 10 CFR PART 71.63

The attached questions were received on February 10, 1998, from a member of the Advisory Committee on Reactor Safety (ACRS), Dr. Dana A. Powers. These questions pertain to a final rule to amend 10 CFR Part 71 to add vitrified high-level waste to the forms of plutonium which are exempt from the double containment requirement of § 71.63(b).

Docket: PRM-71-11

Attachment: As stated

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To: N. Dudley and T. Kress

From: Dana A. Powers

**Subject: ACRS Review of "Requirements for Shipping Packages Used to Transport  
Vitrified High-Level Waste (PRM-71-11)**

Transportation of radioactive waste is not a high priority topic for the ACRS and historically has been found by dispassionate analysis to pose relatively low risk. It is, however, a very visible safety issue for the public and does mandate attention from Congress. I think therefore that we need to be careful about any changes to rules regarding the transport of nuclear waste to assure that they are based on very sound science. I have some technical questions about the proposed final rule, "Requirements for Shipping Packages Used to Transport Vitrified High Level Waste" (PRM-71-11). I think we need to have satisfactory answers to these questions before we conclude that this rule can go forward without ACRS review. My questions are:

° The hazard analysis done on the proposal for not requiring double containment of vitrified waste assumed based on results of tests done at Savannah River that transportation accidents would not yield significant amounts of plutonium contaminated fines. It is, known, however, that the amount of fines produced by glass impacts depends very much on the glass properties. What precautions are to be taken to assure that vitrified waste has properties similar to those of the glasses tested at Savannah River? What precautions are to be taken to assure that loading of the borosilicate glass does not lead to devitrification of this unstable glass with the consequent formation of localized stress risers in the glass? What precautions will be taken to assure that the thermal stresses in the glass at the time of impact are bounded by the thermal stresses in the glass tested at Savannah River?

° To my knowledge, the DOE has not selected a particular geometry and configuration for vitrified waste logs. Configuration twice as large and ten times as large as that now made at Savannah River have been considered at other sites including the DOE sites to be affected by this proposed rule. The decision to use private contractors to fabricate vitrified waste logs could also lead to some substantial variability in the susceptibility of the vitrified waste to fines formation in the event of a transportation accident. Why, then, do we feel the testing done at Savannah River is in any sense bounding?

° Vitrified waste canisters are unavoidably contaminated with plutonium-bearing materials during the fabrication or loading process. Does this contamination disqualify the stainless steel as the first container, much less the only container, in connection with the double containment rule? Was the external contamination of the canisters recognized in the assessment of accident risk?

° Does thermal shock to the vitrified waste in the event of fire during a transportation accident contribute to the formation of respirable fines contaminated with plutonium? What tests have been done on this matter and how do they bound the range of possible accidents?

Attachment

° Did the risk analyses take into account the contributions of americium to the dose from the plutonium waste form? What limits will be placed on the contamination of the waste by radioactive isotopes having more penetrating radiation than plutonium such as the radioactive isotopes of Sr, Cs, and Tc? Will not the contamination by these isotopes affect the risk?

° The environmental analysis asserts the increase in risk caused by transportation of the singly contained vitrified waste is 0.5% of normal transportation risk. Quantitative health objectives for nuclear facilities assert a goal for the NRC regulations of 0.1% of normal accident risks both with respect to prompt fatality and latent fatality. Why is this 5-fold difference in the risk limit tolerable?

° Uncertainty analyses of the quantitative assessments of risk need to be provided.

It may well be that answers to all of these questions are readily available in the supporting documents and can be assembled easily. If not, I think the ACRS should hear about the rule change and that during the hearing answers to the above questions should be provided.

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Subject: ACRS Questions  
Creation Date: 2/10/98 8:06am  
From: Noel Dudley

Created By: TWD1.TWP2:NFD

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From: Noel Dudley  
To: WND1.WNP7.PGB  
Date: 2/10/98 8:06am  
Subject: ACRS Questions

Attached are a set of questions from Dr. Powers related to the justification of the statement that plutonium within vitrified high level waste is essentially nonrespirable. He believes the ACRS should hear a briefing on this issue, unless the answers to his concerns are contained in supporting documentation.

Thanks,  
Noel