

**NUCLEAR REGULATORY COMMISSION**

**10 CFR Part 72**

**[Docket No. PRM-72-6; NRC-2008-0649]**

**Petition for Rulemaking Submitted by C-10 Research and Education Foundation, Inc.**

**AGENCY:** Nuclear Regulatory Commission.

**ACTION:** Petition for rulemaking; denial.

**SUMMARY:** The U.S. Nuclear Regulatory Commission (NRC) is denying Requests 4 and 9 of a petition for rulemaking (PRM), dated November 24, 2008, filed by Ms. Sandra Gavutis, Executive Director of C-10 Research and Education Foundation, Inc. (the petitioner). The petitioner requested that the NRC amend its regulations concerning dry cask safety, security, transferability, and longevity. The petitioner made 12 specific requests. The NRC previously denied 9 of these requests and accepted 1 request for consideration in the rulemaking process. Two remaining requests were reserved for future rulemaking determinations. The purpose of this *Federal Register* notice is to announce the NRC's final decision to deny these two remaining requests.

**DATES:** The docket for the petition for rulemaking, PRM-72-6, is closed on **[INSERT DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**.

**ADDRESSES:** Please refer to Docket ID NRC-2008-0649 when contacting the NRC about the availability of information for this action. You may obtain publicly-available information related to

this action by any of the following methods:

- **Federal Rulemaking Web site:** Go to <http://www.regulations.gov> and search for Docket ID NRC-2008-0649. Address questions about NRC dockets to Carol Gallagher; telephone: 301-415-3463; e-mail: [Carol.Gallagher@nrc.gov](mailto:Carol.Gallagher@nrc.gov). For technical questions, contact the individuals listed in the FOR FURTHER INFORMATION CONTACT section of this document.

- **NRC's Agencywide Documents Access and Management System (ADAMS):**  
You may obtain publicly-available documents online in the ADAMS Public Documents collection at <http://www.nrc.gov/reading-rm/adams.html>. To begin the search, select "[ADAMS Public Documents](#)" and then select "[Begin Web-based ADAMS Search.](#)" For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to [pdr.resource@nrc.gov](mailto:pdr.resource@nrc.gov). The ADAMS accession number for each document referenced (if it is available in ADAMS) is provided the first time that it is mentioned in the SUPPLEMENTARY INFORMATION section.

- **NRC's PDR:** You may examine and purchase copies of public documents at the NRC's PDR, Room O1-F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852.

**FOR FURTHER INFORMATION CONTACT:** Torre Taylor, telephone: 301-415-7900, e-mail: [Torre.Taylor@nrc.gov](mailto:Torre.Taylor@nrc.gov); or Haile Lindsay, telephone: 301-415-0616, e-mail: [Haile.Lindsay@nrc.gov](mailto:Haile.Lindsay@nrc.gov); both of the Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington DC 20555-0001.

**SUPPLEMENTARY INFORMATION:****I. The Petition**

Section 2.802 of title 10 of the *Code of Federal Regulations* (10 CFR), "Petition for rulemaking," provides an opportunity for any interested person to petition the Commission to issue, amend, or rescind any regulation. The NRC received a PRM, dated November 24, 2008, filed by Ms. Sandra Gavutis, Executive Director of C-10 Research and Education Foundation, Inc. (ADAMS Accession No. ML083470148). The petitioner requested that the NRC amend its regulations concerning dry cask safety, security, transferability, and longevity. The petitioner made 12 specific requests in the petition. The petition was noticed in the *Federal Register* for public comment on March 3, 2009 (74 FR 9178). The NRC received over 9,000 comment letters, including comments from industry, the American Society of Mechanical Engineers (ASME), non-governmental organizations, and members of the public. The overwhelming majority of the comment letters received were identical (form) e-mails. The Nuclear Energy Institute and the Strategic Team and Resource Sharing organization opposed the petition. All form e-mail comments, ASME, and the Berkeley Fellowship of Unitarian Universalists Social Justice Committee supported the petition. The NRC staff discussed its review of the petition and the comments received in SECY-12-0079, "Partial Closure of Petition for Rulemaking (PRM-72-6) C-10 Research and Education Foundation, Inc.," dated June 1, 2012 (ADAMS Package Accession No. ML12068A090).

The comments were summarized in a *Federal Register* notice, dated October 16, 2012 (77 FR 63254). The NRC denied 9 of the petitioner's 12 requests (Requests 1, 2, 3, 5-8, 10, and 12), accepted one request (Request 11) for consideration as part of the ongoing

independent spent fuel storage installation (ISFSI) security rulemaking effort (RIN 3150-A178; Docket ID NRC-2009-0558), and reserved 2 requests for future rulemaking determination (Requests 4 and 9) in that *Federal Register* notice. The two reserved requests, as stated in the petition, are:

(1) Request 4: “To require that dry casks are qualified for transport at the time of onsite storage approval certification. Transport capacity for shipment offsite must be required in the event of a future environmental emergency or for matters of security to an alternative storage location or repository and must be part of the approval criteria. NRC Chapter 1 of the Standard Review Plan (NUREG-1567) should clearly define Part 72.122(i); 72.236(h); and in 72.236(m).”

(2) Request 9: “To require a safe and secure hot cell transfer station coupled with an auxiliary pool to be built as part of an upgraded ISFSI design certification and licensing process. The utility must have dry cask transfer capability for maintenance as well as emergency situations after decommissioning for as long as the spent fuel remains onsite. The NRC has to date not approved a dry cask transfer system.”

## **II. Reasons for Denial**

The NRC is denying the petitioner’s Requests 4 and 9, because the proposed changes to the NRC requirements are unnecessary to ensure safe and secure storage and transportation of spent fuel. The NRC had reserved a decision on these two requests, because the NRC staff was conducting an ongoing analysis of: (1) spent fuel storage and transportation compatibility; (2) regulatory changes that might be necessary to continue safe storage of fuel in casks beyond the initial storage period over multiple renewal periods; (3) the behavior of high burnup fuel during extended storage periods; and (4) regulation of stand-alone ISFSIs. This analysis was

being done as part of the NRC staff's work related to COMSECY-10-0007, "Project Plan for the Regulatory Program Review to Support Extended Storage and Transportation of Spent Nuclear Fuel" (ADAMS Accession No. ML101390413). Part of this analysis also involved evaluating the licensing programs for spent fuel storage for any improvements. As a consequence of this work, as well as considering information and insight from other sources, the NRC can now resolve the outstanding requests from the petitioner.

#### Petitioner Request 4

The NRC is denying Request 4 for the following reasons. In reviewing Request 4, the NRC staff interpreted the petition to request that the NRC require that a transportation package certificate of compliance be approved at the same time as the onsite storage approval certification. The NRC's decision to deny Request 4 is based on this understanding of the request. In addition to the ongoing work related to COMSECY-10-0007 discussed above, the following efforts discussed in the project plan in COMSECY-10-0007 also relate specifically to Request 4:

The staff will evaluate the compatibility of 10 CFR part 71, 'Packaging and Transportation of Radioactive Material,' and 10 CFR part 72, 'Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste,' requirements to identify (1) areas of overlap where the requirements are substantially similar, (2) areas where the performance requirements are significantly different, (3) specific regulations that must be met for transportation for which there is no similar storage regulation, and (4) recommendations for improving the compatibility and efficiency of the 10 CFR parts 71 and 72 review processes. The staff will also evaluate the different types of currently authorized dry cask storage systems to identify any potential unique compatibility issues. This assessment will also consider potential integration of the storage and transportation safety reviews conducted under 10 CFR parts 71 and 72.

As indicated above, there were four areas in which the staff was evaluating the compatibility of the requirements within 10 CFR part 71 and 10 CFR part 72 related to storage

and transportation of spent nuclear fuel. The NRC reserved its decision on Request 4 until the NRC staff had made sufficient progress on the four areas identified above. These efforts have provided the NRC with sufficient information to now make a decision on Request 4.

The NRC staff's consideration of the compatibility of 10 CFR part 71 and 10 CFR part 72, as part of the NRC staff's efforts related to COMSECY-10-0007, has informed recent safety evaluation reviews performed by the NRC staff of storage design certifications, such as new applications and renewals. Since the petition was received in 2008, the NRC staff has completed the review of 12 storage design applications; information on these reviews can be found at <http://www.nrc.gov/waste/spent-fuel-storage/designs.html>. The NRC staff's work on these storage and transportation compatibility considerations may be further documented in future revisions to the Standard Review Plans for Storage—NUREG-1536, Rev. 1, "Standard Review Plan for Dry Cask Storage Systems" (ADAMS Accession No. ML101040620); and NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities" (ADAMS Accession No. ML003686776).

The petitioner noted the potential for an environmental emergency or matter of security that would require transport of the spent fuel from storage to an alternate location as a basis for why transportation certification approval should be required at the time of storage certification. By design, dry storage systems are robust, passive systems and, as discussed above, transport is unlikely to be the best course of action in an emergency. These systems have been evaluated for several design basis events, including malicious acts. As the first step in addressing an environmental emergency or matter of security, the staff would not recommend removal of the spent fuel from storage. The storage requirements in 10 CFR part 72, in combination with the packaging and transportation requirements in 10 CFR part 71, are adequate to ensure safety. In the case of an environmental emergency, the best course of

action would likely be to secure the area, contain the spent fuel, assess the situation, and to keep the spent fuel in storage until a more thorough evaluation of the situation has been completed. There are interim measures that can be taken to contain the spent fuel and to provide safety, such as restricting access to the area, putting up temporary physical barriers, and using temporary shielding. If it is determined that the spent fuel must be moved, the NRC has several regulatory options to ensure the safe transportation of the spent fuel, including issuing license amendments, issuing immediately effective orders, or evaluating requests for exemptions to the spent fuel transportation regulations in 10 CFR part 71. Under 10 CFR 71.12, "Specific exemptions," the Commission may grant an exemption from the transportation requirements if it determines the exemption is authorized by law and will not endanger life or property or the common defense and security. This allows flexibility for the design and construction of transportation packaging if the controls proposed in the shipping procedures are demonstrated to be adequate to provide an equivalent level of safety of the shipment and its content.

Dry storage system designs have become more standardized and many designs use a welded canister to provide one of the confinement barriers of the spent nuclear fuel. Because the welded canister provides confinement of the spent nuclear fuel, as required under 10 CFR 72.122(h), removal of the fuel during storage should be unnecessary so long as the licensee is complying with the regulations to ensure safety measures are met. Additionally, for packaging and transporting welded canisters containing spent fuel, under 10 CFR part 71, most spent fuel cask vendors have compatible transportation packaging designs either approved or under development. For those limited, older systems that may not have been designed with transportation packaging as a consideration, an exemption can be issued in accordance with 10 CFR 71.12 if the Commission determines that doing so will not endanger life or property or

the common defense and security. This allows flexibility for the design and construction of transportation packaging, if the controls proposed in the shipping procedures are demonstrated to be adequate to provide an equivalent level of safety of the shipment and its content.

In association with efforts related to COMSECY-10-0007, the NRC staff conducted a comparison of the requirements for storage systems in 10 CFR part 72 and those for transportation packaging in 10 CFR part 71 to identify any areas of incompatibility. This work began before receipt of the petition. The NRC staff found from this comparison that there are differences between these requirements, such as differences in thermal design criteria, confinement/containment design criteria, criticality design criteria and specific accident conditions design criteria. However, these differences do not preclude the safe packaging and transportation of spent fuel in casks designed for storage. As an example, there is a difference between the temperature criteria for transportation accident conditions and those for storage accident conditions. If it became necessary to remove the spent fuel casks from storage and transport them, in most cases the temperature criteria differences would not preclude the safe transport. Alternatively, an exemption could be issued in accordance with 10 CFR 71.12 if the transportation criteria were not met but the Commission determined that the transportation would not endanger life or property or the common defense and security.

As required by 10 CFR part 72, cask storage systems must be designed to provide for safe and secure storage taking into consideration natural and human-induced events. For a specific license, the design basis events that must be evaluated are provided in: (1) 10 CFR 72.92, "Design basis external natural events," and (2) 10 CFR 72.94, "Design basis external man-induced events." Nuclear power reactor licensees are authorized to store spent fuel under the general license in 10 CFR 72.210, "General license issued." A general licensee must choose a storage cask that has an NRC-issued certificate of compliance. The list of approved



storage casks is provided in 10 CFR 72.214, "List of approved spent fuel storage casks." For these storage casks, the vendor has already evaluated the cask design against normal, off-normal, and accident conditions as required by 10 CFR 72.236, "Specific requirements for spent fuel storage cask approval and fabrication." The general licensees must meet the specific requirements found in 10 CFR 72.212, "Conditions of general license issued under 10 CFR 72.210." The regulations in 10 CFR 72.212(b)(6) require the general licensee to review the safety analysis report referenced in the certificate or amended certificate and the related NRC safety evaluation report prior to use of the general license. The licensee must determine whether the reactor site parameters, including analyses of earthquake intensity and tornado missiles, are included within the cask design bases. In addition, the licensee must establish that the stored spent fuel will meet the design requirements for natural and human-induced events: (1) 10 CFR 72.212(b)(5)(ii) for static and dynamic loads and (2) 10 CFR 72.212(b)(9) which requires the general licensee to protect the spent fuel against the design basis threat of radiological sabotage in accordance with the requirements set forth in the licensee's physical security plan under 10 CFR 73.55, "Requirements for physical protection of licensed activities in nuclear power reactors against radiological sabotage." These requirements provide assurance that spent fuel storage casks are sufficiently robust to withstand environmental and security events included within the design bases.

The safety of spent fuel storage has been demonstrated by operating experience. Subsequent to the NRC's earlier review of this petition, an earthquake occurred in the vicinity of the North Anna Nuclear Power Plant in Virginia. This earthquake was beyond the design basis event for which the spent fuel storage designs were evaluated. After the earthquake, North Anna Nuclear Power Plant personnel and representatives from the spent fuel storage system manufacturer conducted detailed inspections and monitoring. The NRC staff also conducted

several inspections through an Augmented Inspection Team (ADAMS Accession No. ML113040031) at North Anna Nuclear Power Plant to evaluate and assess the plant conditions as well as the integrity and safety of onsite spent fuel storage systems. These inspections confirmed that there was no damage that had any impact on safety-related features. Some casks experienced minor shifting on the pad that did not impact safety. The spent fuel continued to be surrounded by several tons of steel and concrete and the storage system seals were intact. Radiation surveys indicated no changes to cask surface dose rates, and there were no releases due to the shifting of the systems. As part of the outcome of the NRC's inspections, the licensee sought, and the NRC approved, an amendment to allow the casks that had shifted to remain in place rather than moving them back to the original location. Documentation related to these inspections is publicly available in ADAMS and includes (1) information submitted as part of the amendment request submitted by the licensee (ADAMS Accession No. ML14160A707), (2) the Final Environmental Assessment (ADAMS Accession No. ML15022A575), and (3) the documentation related to Amendment 4 (ADAMS Package Accession No. ML15050A395) of the ISFSI license. The NRC's assessment of the earthquake at the North Anna Power Plant confirmed that the spent fuel storage casks could safely remain in place.

The petitioner also stated that transport capacity for shipment offsite must be required for matters of security. As stated earlier in this document, moving the spent fuel offsite after an environmental emergency or security incident would likely not be the best course of action. Moving the spent fuel from storage onto a public highway or rail system represents a higher risk than protecting the spent fuel storage casks in place, because it increases the potential for unnecessary dose to workers or the public. Storage licensees must have security provisions in place that include physical barriers; surveillance; intrusion detection and response; and, if

needed, assistance from local law enforcement, in accordance with 10 CFR part 73, "Physical Protection of Plants and Materials." These measures provide an adequate level of safety and security.

Finally, the petitioner also stated that "NRC Chapter 1 of the Standard Review Plan (NUREG-1567) should clearly define Part 72.122(i); 72.236(h); and in 72.236(m)." The petitioner did not provide any additional information regarding this statement. The NUREG-1567 provides guidance to the NRC staff for reviewing applications for specific license approval for commercial ISFSIs. Granting the petitioner's request would not result in a rulemaking. The NRC staff will consider making the clarification when it works on the next revision of NUREG-1567.

#### Petitioner Request 9

The NRC is denying Request 9 for the following reasons. After further evaluation of Request 9, and considering the information resulting from the NRC staff's work on COMSECY-10-0007, the NRC staff concludes that a hot cell transfer station coupled with an auxiliary pool is not needed because the requirements currently in place in 10 CFR part 72 are adequate to ensure safety. In the *Federal Register* notice published in October 2012 that addressed the other requests in the petition, the NRC indicated that the need for a hot cell transfer station coupled with an auxiliary pool was still being evaluated as part of the NRC staff's review of the regulatory changes that might be necessary to safely store fuel for multiple renewal periods. The NRC staff stated that, "as discussed in Section 3.1 of Enclosure 1 of COMSECY-10-0007, research is needed to develop the safety basis for the behavior of high burnup fuel during extended storage periods. Whether the fuel retains sufficient structural

integrity for extended storage and eventual transportation may affect whether the NRC would require dry transfer capability at decommissioned reactors storing high burnup fuel.”

The NRC periodically conducts research activities related to the storage of spent nuclear fuel to confirm the safety of operations and enhance the regulatory framework to address any changes in technology, science, and policies. The NRC conducts analyses of beyond design basis conditions to confirm that regulatory requirements continue to provide reasonable assurance for safe storage and transportation of spent nuclear fuel. Additionally, the NRC evaluates the performance of spent nuclear fuel under normal and accident conditions. Recent analyses included evaluation of the effects of high burnup fuel. Two recent studies related to these research activities were completed and published in 2015: (1) NUREG/CR-7198, “Mechanical Fatigue Testing of High-Burnup Fuel for Transportation Applications,” published in May 2015 (ADAMS Accession No. ML15139A389), and (2) NUREG/CR-7203, “A Quantitative Impact Assessment of Hypothetical Spent Fuel Reconfiguration in Spent Fuel Storage Casks and Transportation Packages,” published in September 2015 (ADAMS Accession No. ML15266A413).

The NUREG/CR-7198 documents an evaluation of the ability for high burnup fuel containing mostly circumferential hydrides to maintain its integrity under normal conditions of transport. Using an innovative testing system that imposes pure bending loads on the spent fuel rod, high burnup spent fuel rods underwent bending tests to simulate conditions relevant to both storage and transportation. The test results demonstrated that despite complexities and non-uniformities in the fuel cladding system, the high burnup fuel behaved in a manner that would be expected of more uniform materials.

The NUREG/CR-7203 documents a quantitative assessment of the impact on the safety of spent nuclear fuel storage casks and transportation packages of bounding and very unlikely

beyond design basis hypothetical changes of fuel geometry. The study examined the potential changes to criticality, shielding, confinement/containment, and thermal characteristics of the systems due to changes in fuel geometry. The purpose of this study was to determine whether high burnup fuel is safe for storage and transport under normal, off-normal, and hypothetical accident conditions. The detailed conclusions from this study are quite lengthy; however, in summary, the study concluded that:

Overall, the safety impacts of fuel reconfiguration are system design, content type, and loading dependent. The areas and magnitude of the impact vary from cask/package design to cask/package design. It should also be noted that some of the scenarios are extreme and physically unlikely to occur; they represent bounding values. The spent fuel storage systems and transportation packages approved by the NRC to date provide reasonable assurance that they are safe under normal, off-normal, and hypothetical accident conditions as prescribed in 10 CFR Part 71 and 72 regulations.

The NRC staff recognized at the time of the initial review of the petition that ongoing research into the material properties of high burnup fuel could potentially result in a determination that high burnup fuel would require repackaging after a certain storage period. Therefore, this issue warranted further evaluation to determine if a regulatory requirement for dry transfer capability was needed before a final decision could be made on the petitioner's request. The NRC staff also recognized a potential issue with respect to degradation from aging of high burnup fuel that could cause damage to spent fuel cladding in storage. Based on evaluations of these potential issues in NUREG/CR-7198 and NUREG/CR-7203 the NRC has further evidence of reasonable assurance of adequate safety related to the mechanical behavior and potential degradation of high burnup fuel during extended storage and transportation for the systems approved to date.

The NRC continuously monitors safety and security issues related to the storage of spent nuclear fuel, including results from safety inspections and additional studies, when applicable. If the NRC became aware of any safety or security issues that could impact public

health and safety, or security, the NRC would take action. This could include issuing Orders, rulemaking, or revising guidance to clarify requirements.

Additionally, when an ISFSI license is being evaluated for renewal, the licensee must establish an Aging Management Program (AMP) that manages aging effects. The intent of the AMP is to detect, monitor, and mitigate aging effects that could impact the safe storage of spent fuel. The AMP is required under the provisions of Section 72.42, "Duration of license; renewal," paragraph (a)(2) and Section 72.240, "Conditions for spent fuel storage cask renewal," paragraph (c)(3), for storage cask renewals. An AMP includes subcomponents such as: (1) dry shielded canister external surfaces, (2) concrete cask, (3) transfer cask, (4) transfer cask lifting yoke, (5) cask support platform, and (6) high burnup fuel. Since high burnup fuel is included as an AMP for license renewal, this provides defense-in-depth in ensuring the integrity of the fuel cladding during periods of extended operation.

The NRC staff uses the guidance in NUREG-1927, "Standard Review Plan for Renewal of Spent Fuel Dry Cask Storage System Licenses and Certificates of Compliance," published in March 2011 (ADAMS Accession No. ML111020115) in reviewing renewal applications for spent fuel dry cask storage systems and certificates of compliance.

The NUREG-1927 is currently being revised to update guidance and to include information gained from the work previously discussed in this document. The revision to NUREG-1927 was noticed for public comment in the *Federal Register* on July 7, 2015 (80 FR 38780). The AMPs are consistent with 10 program elements that are described in NUREG-1927, including items such as the scope; preventive actions; parameters monitored or inspected; and detection of aging effects before there is a loss of any structure and component function, etc. The AMPs will help ensure timely detection, mitigation, and monitoring of any degradation mechanisms.

An example of NRC staff's review of license renewal applications that include an AMP for high burnup fuel is the recently completed review of the license renewal application for the Calvert Cliffs ISFSI in October 2014 (ADAMS Package Accession No. ML14274A022). From this review, the NRC staff determined that the Calvert Cliffs ISFSI had met the requirements of 10 CFR 72.42(a), which addresses the duration of a license and renewal of such license. As previously discussed in this document, 10 CFR 72.42(a)(2) has a specific requirement for an AMP. The NRC staff concluded in the safety evaluation for this renewal (ADAMS Accession No. ML14274A038) that the dry cask storage systems are still robust and could be renewed.

Additionally, the NRC has a defense-in-depth approach to safety that includes (1) requirements to design and operate spent fuel storage systems that minimize the possibility of degradation; (2) requirements to establish competent organizations staffed with experienced, trained, and qualified personnel; and (3) NRC inspections to confirm safety and compliance with requirements. Based on the NRC's current requirements, licensee maintenance and review programs, and NRC inspections, the NRC staff is confident that issues will be identified early to allow corrective actions to be taken in a timely fashion.

In summary, the NRC has made significant progress on relevant regulatory efforts and evaluations discussed earlier in this document and information gained from that work contributed to current revisions of regulatory guidance, standard review plans, and the NRC staff's reviews of renewal applications. Based on the work performed to date, the results do not indicate a need to revise the regulations. Based on the NRC's review of the petition, the specific changes requested by the petitioner are not necessary to ensure safety and security. The storage and transportation regulations are robust, adequate, and sufficiently compatible to ensure safe and secure storage and transportation of spent nuclear fuel. The NRC staff continues to review and evaluate the storage of spent nuclear fuel and the safety of storage

casks and ISFSIs. If a potential health, safety, or security issue is identified, the NRC will take action to address the concern.

### **III. Conclusion**

For the reasons cited in this document, the NRC is denying the petitioner's two requests from PRM-72-6 that were deferred pending additional research and evaluation on the storage of spent fuel storage. After completing its research, the NRC has concluded that the current regulatory requirements are adequate to protect public health and safety.

Dated at Rockville, Maryland, this 20th day of June, 2016.

For the Nuclear Regulatory Commission.

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Annette L. Vietti-Cook,  
Secretary of the Commission.