



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

SAFETY EVALUATION REPORT
PRAIRIE ISLAND
INDEPENDENT SPENT FUEL STORAGE INSTALLATION
SPECIAL NUCLEAR MATERIAL LICENSE NO. 2506
AMENDMENT NO. 13

1.0 SUMMARY

This safety evaluation report (SER) documents the review and evaluation of a license amendment request (Agencywide Documents Access Management System (ADAMS) Accession No. ML24095A075) to special nuclear material (SNM) License No. 2506 for the Prairie Island (PI) Independent Spent Fuel Storage Installation (ISFSI). By letter dated April 2, 2024, as supplemented June 5, 2024, Northern States Power Company – a Minnesota Corporation doing business as Xcel Energy (NSPM) submitted a license amendment request to the U.S. Nuclear Regulatory Commission (NRC) in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 72.56, to revise the license conditions to describe the inspection intervals similar to the Technical Specifications Surveillance Requirement Frequency (ML15336A109), allowing up to 1.25 times the specified intervals to account for scheduling challenges, including but not limited to inclement weather, security drills, and refueling outages.

2.0 REVIEW CRITERIA

Staff's evaluation of the requested changes is based on ensuring the PI ISFSI continues to meet the applicable requirements of 10 CFR Part 72 for independent storage of spent fuel and of 10 CFR Part 20 for radiation protection. Staff followed the guidelines provided in NUREG-2215 "Standard Review Plan for Spent Fuel Dry Storage Facilities" and NUREG-1927, Revision 1, "Standard Review Plan for Renewal of Specific Licenses and Certificates of Compliance for Dry Storage of Spent Nuclear Fuel" in conducting the evaluation. Staff's evaluation focused only on changes to SNM-2506 requested in the licensee's amendment request and did not reassess previously approved portions of the license, technical specifications (TS), the final safety analysis report (FSAR) or those areas of the FSAR modified by the licensee as allowed by 10 CFR 72.48 which are not associated with this amendment request. The objectives for the following review disciplines are as described below for the requested change.

3.0 MATERIALS EVALUATION

The staff's materials evaluation for the PI ISFSI license amendment application determines whether proposed changes to certain renewed ISFSI license conditions requiring performance of aging management activities are acceptable to ensure that the effects of aging on the material condition of the applicable ISFSI components are adequately managed to meet regulatory requirements in 10 CFR 72.42(a)(2), 72.122(b)(1), and 72.126(a)(6).

Since the amendment application proposes changes to certain renewed ISFSI license

conditions requiring performance of aging management activities, the NRC staff performed its materials evaluation for the application by following the technical guidance in NUREG-2215 and NUREG-1927.

Current Specific License Conditions

The renewed license (Renewed License No. SNM-2506) for the PI ISFSI includes several license conditions requiring performance of aging management activities for the ISFSI. The amendment application proposes to change the required frequency of certain visual inspections and dose rate measurements, as specified in the license conditions for aging management of the in-service dry storage casks at the ISFSI. The applicable conditions that are currently set forth in Renewed License No. SNM-2506 for the PI ISFSI are as follows:

23. With respect to the aging management activities for the dry storage (in-service) casks, as described in the "ISFSI Inspection and Monitoring Program" in Appendix A, Rev. 2, in the Supplement to the License Renewal Application [ADAMS Accession Number ML15285A007], the following activities shall apply to dry storage (in-service) casks as of the date of the issuance of the renewed license (ML15336A291), December 9, 2015.
 - (a) The licensee shall perform visual inspections of accessible exterior surfaces of the dry storage (in-service) casks at intervals not to exceed every quarter.
 - (b) The licensee shall perform visual inspections of the cask bottom and areas underneath the weather protective cover at intervals not to exceed 20 years, for a minimum of one (1) cask.
 - (c) The licensee shall inspect, at a minimum, for signs of corrosion, damage, and debris accumulation on the cask exterior surfaces during all visual inspections identified in License Condition 23.
 - (d) The licensee shall initiate a corrective action if any observable indication of corrosion is identified during any of the visual inspections in License Condition 23.

For each dry storage (in-service) cask added to the PI ISFSI site after the issuance of the renewed license, the aging management activities, described above in 23(a), (b), (c) and (d), shall commence 20 years after the dry storage (in-service) cask was initially placed in operation.

24. (A) With respect to the aging management activities for the polymer-based neutron shields of the dry storage (in-service) casks as described in the "ISFSI Inspection and Monitoring Program" in Appendix A, Rev. 2, in the Supplement to the License Renewal Application [ADAMS Accession Number ML15285A007], the following activities shall apply to associated polymer-based neutron shields as of the date of the issuance of the renewed license (ML15336A291), December 9, 2015.
 - (1) Within 90 days of the issuance of the renewed license, NSPM shall establish baseline values for dose rate trending analyses to be used in detecting any potential loss of intended function of the neutron shield.

- (2) Thereafter, NSPM shall continue to perform dose rate surveys for each loaded cask at an interval not to exceed three months, as is consistent with the aging management program "ISFSI Inspection and Monitoring Program."
 - (3) NSPM shall compare the measured dose rate data with the established baseline values to detect any increase in neutron dose rates. Upon detecting any unexpected upward trend in the measured neutron dose rates, NSPM shall place the non-compliant cask into their corrective actions program to evaluate the cause for loss of intended function and determine whether a similar problem could occur within other casks.
- (B) For each dry storage (in-service) cask added to the PI ISFSI site after the issuance of the renewed license, the following aging management activities for the associated polymer-based neutron shields shall commence 20 years after the individual dry storage cask was initially placed into operation.
- (1) Within 90 days of reaching 20 years of operation for each cask, NSPM shall establish baseline values for dose rate trending analyses to be used in detecting any potential loss of intended function of the neutron shield.
 - (2) Thereafter, NSPM shall continue to perform dose rate surveys for each loaded cask at an interval not to exceed three months, as is consistent with the aging management program "ISFSI Inspection and Monitoring Program."
 - (3) NSPM shall compare the measured dose rate data with the established baseline values to detect any increase in neutron dose rates. Upon detecting any unexpected upward trend in the measured neutron dose rates, NSPM shall place the non-compliant cask into their corrective actions program to evaluate the cause for loss of intended function and determine whether a similar problem could occur within other casks.

The aging management activities specified in Renewed License Conditions 23 and 24 are described in the ISFSI Inspection and Monitoring Program. The ISFSI Inspection and Monitoring Program is an aging management program (AMP) that is implemented to ensure that the effects of aging on the components of the in-service dry storage casks are adequately managed so that the intended functions of the cask components will be maintained, consistent with their design bases, during the period of extended operation. The 10 elements of this AMP are described in the October 12, 2015, supplement (ML15285A007) to the October 20, 2011, PI ISFSI license renewal application (LRA, ML113040123). The October 12, 2015, LRA supplement is directly cited in Renewed License Conditions 23 and 24.

Proposed Changes to the License Conditions

The amendment application proposed the following changes to Renewed License Conditions 23 and 24 for the PI ISFSI:

Paragraph (a) of License Condition 23 (Condition 23(a)) would be revised to state:

The licensee shall perform visual inspections of accessible exterior surfaces of the dry storage (in-service) casks at intervals of 92 days. This inspection interval is met if the inspection is completed within 115 days.

Paragraph (A)(2) of Condition 24 (Condition 24(A)(2)) would be revised to state:

Thereafter, NSPM shall continue to perform dose rate surveys for each loaded cask at an interval of 92 days, as is consistent with the aging management program "ISFSI Inspection and Monitoring Program." This inspection interval is met if the inspection is completed within 115 days.

Paragraph (B)(2) of Condition 24 (Condition 24(B)(2)) would be revised to state:

Thereafter, NSPM shall continue to perform dose rate surveys for each loaded cask at an interval of 92 days, as is consistent with the aging management program "ISFSI Inspection and Monitoring Program." This inspection interval is met if the inspection is completed within 115 days.

Therefore, license condition requirements to perform the visual inspections of the accessible exterior surfaces of the casks "at intervals not to exceed every quarter" and to perform dose rate surveys for each loaded cask "at an interval not to exceed three months" would be revised to specify an interval of "92 days" for the visual inspections and the dose rate surveys, with the option to extend the visual inspection and/or dose rate survey intervals to no longer than "115 days." Accordingly, the proposed changes would allow the licensee the option for a no greater than 23-day extension to the current 92-day interval for the cask visual inspections and dose rate surveys, as specified in Conditions 23(a), 24(A)(2), and 24(B)(2).

The licensee stated that the current requirements to perform visual inspections at intervals "not to exceed every quarter" for Condition 23(a) and to perform dose rate surveys at intervals "not to exceed three months" for Conditions 24(A)(2) and 24(B)(2) are inconsistent with similar ISFSI technical specifications surveillance requirements, which allow up to 1.25 times the interval specified in the surveillance requirement. The licensee identified that the proposed interval extension period will provide flexibility to schedule the inspections and surveys around typical challenges, such as inclement weather, security drills, and refueling outages. The licensee stated that the aging effects for the monitored parameters progress slowly such that an additional 25 percent (23-day) extension to the 3-month interval will not impact the licensee's ability to address aging degradation before it becomes a problem that affects the casks' safety functions. The licensee also noted that the proposed changes to the inspection intervals in the relevant license conditions would make them more consistent with the surveillance requirements in the ISFSI technical specifications.

Staff Evaluation of Proposed Amendment

The proposed changes to the license conditions would allow the licensee the option for a no greater than 23-day extension to the quarterly/3-month interval for visual inspections of accessible exterior surfaces and dose rate surveys for in-service dry storage casks. The staff's review considered pertinent attributes of the ISFSI Inspection and Monitoring Program and associated aging management review (AMR) results for the casks described in the October 12, 2015, ISFSI LRA supplement. The staff's review of this LRA information addressed whether the license conditions, if amended, would continue to meet the regulatory requirements in 10 CFR 72.42(a)(2), 72.122(b)(1), and 72.126(a)(6). Specifically, that the amended conditions would continue to ensure that the effects of aging on the material condition of the accessible cask exterior surfaces and inaccessible polymer-based neutron shield components are adequately managed, so that the intended functions of these components will be maintained during the

period of extended operation.

With respect to aging management of the in-service dry storage casks, the description of the ISFSI Inspection and Monitoring Program states that the purpose of the program is to ensure that the intended functions of the cask components are not degraded during the period of extended operation at the ISFSI. The program activities that are specified in Renewed License Conditions 23 and 24 are described in further detail in sections A2.1, A2.3, A2.4, A2.5, and A2.6 of the ISFSI Inspection and Monitoring Program, as documented in the October 12, 2015, ISFSI LRA supplement. The staff noted that these sections describe AMP elements that were evaluated as being consistent with the recommendations of the corresponding AMP elements described in NUREG-1927, Revision 1. The staff also noted that NUREG-2214, "Managing Aging Processes in Storage (MAPS) Report," July 2019 (ML19214A111), which provides more detailed recommendations for ISFSI and spent fuel dry storage system AMPs, was not published until July 2019, several years after the NRC review of the PI ISFSI LRA and issuance of the renewed ISFSI license in December 2015 (80 FR 78257). Therefore, the more specific AMP recommendations in NUREG-2214 are not part of the renewed licensing basis for the PI ISFSI, and the staff did not consider them in its review of the proposed amendment.

Changes to License Condition 23

With respect to the aging management activities described in License Condition 23, the ISFSI Inspection and Monitoring Program section A2.3, "Parameters Monitored or Inspected," states that the condition of the exterior of each in-service cask is inspected visually to ensure that the intended functions of the cask exterior are not compromised. Visual inspections will look for signs of damage or deterioration of the cask exterior surfaces and will identify debris accumulating on the cask exterior surfaces; debris accumulation may create the potential for localized corrosion. The aging effect that is monitored by these inspections is loss of material due to corrosion. Section A2.4, "Detection of Aging Effects," of the AMP states that quarterly visual inspections of the physical condition of the exterior surfaces of in-service casks is performed to detect component degradation due to potential loss of material and confirm that the intended functions are not compromised. The visual inspections of the exterior surfaces of the casks are performed with the unaided eye under general lighting conditions; mirrors, flashlights, and magnifiers may be used as visual inspection aids, but they are not required. Section A2.6, "Acceptance Criteria," of the AMP states that the acceptance criteria for all visual inspections of in-service casks is the absence of aging effects applicable to the cask surfaces, specifically observable indications of loss of material due to corrosion. Section A2.1, "Scope of Program," and section A2.5, "Monitoring and Trending," also include similar information regarding the aging management activities described in License Condition 23. Based on a review of these AMP elements, and considering the cask AMR results discussed below, the staff determined that the proposed change to allow up to a 23-day extension to the 3-month visual inspection interval will have no adverse impact on the adequacy of the AMP for timely detection of corrosion-induced material loss, which ensures that the intended functions of the accessible exterior cask components are not degraded during the period of extended operation at the ISFSI.

The AMR results documented in the ISFSI LRA identify the ISFSI Inspection and Monitoring Program as the aging management program that is credited for managing the effects of aging on the material condition of the cask components. The AMR tables indicate that the exterior components of the casks that are exposed to the outdoor atmosphere and weather are fabricated from carbon steel, stainless steel, and aluminum alloy. The aging effect and associated aging mechanisms for these materials exposed to outdoor atmosphere and weather

are loss of material due to general corrosion, galvanic corrosion, pitting, and crevice corrosion. The staff noted that the loss of material due to these corrosion reactions on carbon steel, stainless steel, and aluminum alloy surfaces exposed to outdoor atmosphere and weather generally occurs very gradually over a period of many years. The staff determined that, for the visual inspections of accessible exterior surfaces of all in-service casks, the proposed change to allow up to a 23-day extension to the 3-month inspection interval will have no significant impact on the extent of potential material loss from cask surfaces due to corrosion. Further, the staff determined that any additional amount of material loss that may result from postponing inspections for 23 days beyond the 3-month interval will not significantly degrade the intended functions of the casks, particularly since a corrective action must be initiated if any observable indication of corrosion is identified during any of the previous visual inspections of the casks. Therefore, the proposed change to allow up to a 23-day extension to the 3-month interval for visual inspections of accessible exterior surfaces of all in-service casks will continue to ensure that corrosion-induced loss of material is detected, evaluated, and corrected, as needed, prior to a significant deterioration in the intended functions of accessible exterior cask components exposed to outdoor atmosphere and weather. Accordingly, the staff finds that the proposed change to allow up to a 23-day extension to the 3-month interval for visual inspections of accessible exterior surfaces of in-service casks meets the requirements of 10 CFR 72.122(b)(1) and therefore is acceptable.

Changes to License Condition 24

With respect to the aging management activities described in License Condition 24, the ISFSI Inspection and Monitoring Program section A2.1, "Scope of Program," states that, for the polymer-based neutron shield materials, the aging effect managed by the AMP is cracking due to material property changes from radiation exposure. Section A2.3, "Parameters Monitored or Inspected," of the AMP states that radiation surveys are used to verify that the radiation levels remain within the specified limits and that the shielding materials in the in-service casks are intact and are effectively performing their intended function. This element states that degradation in the effectiveness of the shielding material would be detected by a corresponding increase in radiation levels. Section A2.4, "Detection of Aging Effects," of the AMP states that quarterly radiation surveys of the casks provide a means to detect shielding material degradation of the in-service casks and confirm that the intended function is not compromised. Section A2.6, "Acceptance Criteria," of the AMP states that the acceptance criterion for radiation dose monitoring of the in-service casks is the absence of an increasing trend in measured radiation dose rate. The AMR results identify that the neutron shield components are fabricated from polymer based materials and are exposed to an internal air or gas environment. The polymer-based neutron shield materials are encased in metallic shells to protect them from the outdoor air and weather environment. Considering the service environment and design characteristics, the staff verified that a decrease in polymer neutron shield performance due to cracking caused by radiation induced changes in the material properties is the only aging effect requiring management for these components.

The staff previously determined that, for polymer-based neutron shield materials, the quarterly monitoring of neutron dose rates provides an effective means for ensuring that these shielding materials do not undergo unacceptable cracking due to radiation-induced changes in the properties of the polymer. In this case, unacceptable cracking of the polymer would be detected by a significant increasing trend in the measured neutron dose rates since the formation and growth of cracks in the polymer due to radiation-induced changes would, over time, result in a detectable increase in neutron radiation streaming through cracks in the polymer. The staff noted that such an increase in measured neutron dose rates caused by the formation and

growth of cracks in the polymer would occur very gradually since the progression of radiation-induced changes in the microstructure and properties of polymer-based neutron shield materials that lead to formation and growth of cracks is known to occur over many years of service. Any change in the polymer neutron shield material properties that may result from postponing dose rate surveys for 23 days beyond the 3-month interval will have a negligible impact on the extent of crack formation and crack growth in the polymer; thus, any increase in neutron radiation streaming through the polymer due to the 23-day extension would be insignificant. Therefore, the staff determined that the proposed change to allow up to a 23-day extension to the 3-month interval for the dose rate surveys will have no significant impact on the capability of the AMP to detect adverse trends in measured neutron dose rates. Accordingly, the staff finds that the proposed change to allow up to a 23-day extension to the 3-month interval for performing dose rate surveys meets the requirements of 10 CFR Sections 72.122(b)(1) and 72.126(a)(6) and is acceptable.

3.1 EVALUATION FINDINGS

- The staff finds that the proposed changes to Conditions 23(a), 24(A)(2), and 24(B)(2) in Renewed License No. SNM-2506 for the PI ISFSI will continue to ensure that the effects of aging on the material condition of the accessible cask exterior surfaces and inaccessible polymer-based neutron shield components are adequately managed so that the intended functions of these components will be maintained during the period of extended operation. Therefore, the staff finds that the amendment application to change Conditions 23(a), 24(A)(2), and 24(B)(2) in Renewed License No. SNM-2506 for the PI ISFSI meets the regulatory requirements in 10 CFR 72.42(a)(2), 72.122(b)(1), and 72.126(a)(6).

4.0 SHIELDING EVALUATION

The objective of this review is to evaluate NSPM's request to amend SNM License No. SNM-2506, specifically License Conditions 23(a), 24(A)(2), and 24(B)(2) to ensure the proposed radiation protection features meet the NRC design criteria for direct radiation and effluent controls and occupational radiation doses will not exceed the limits specified in the NRC's radiation protection standards.

4.1 RADIATION PROTECTION DESIGN FEATURES

The proposed change to the license conditions, as described above in section 3, were reviewed by the NRC staff to ensure that they will not adversely impact the ability of the storage casks to safely store irradiated fuel while in use at the PI ISFSI.

The technical and safety aspects of these changes to the AMP were evaluated by the NRC staff as documented in section 3 of this SER, and staff concluded that the changes were acceptable. Specifically, the staff concluded the dose rate surveying and trending, along with other plant radiation protection programs, will continue to ensure compliance with 10 CFR 72.126(a)(6) because these radiation protection systems continue to provide adequate shielding protection for all areas and operations where onsite personnel may be exposed to radiation or airborne radioactive materials. Further, structures, systems, and components for which operation, maintenance, and required inspections may involve occupational exposure will be designed, fabricated, located, shielded, controlled, and tested to control external and internal radiation exposures to personnel.

4.2 EVALUATION FINDINGS

- The NRC staff finds that the conditions for use remain in compliance with 10 CFR 72.126(a)(6), and that the applicable design and acceptance criteria have been satisfied. The revised license conditions provide reasonable assurance that the PI ISFSI will continue to allow safe storage of spent fuel.

5.0 OPERATION PROCEDURES AND SYSTEMS EVALUATION

5.1 ACCEPTANCE CRITERIA AND MAINTENANCE PROGRAM EVALUATION

The objective of this review is to ensure that NSPM's ISFSI FSAR and TS include the appropriate acceptance criteria/tests and maintenance programs for the system. A clear, specific listing of these commitments will help avoid ambiguities concerning design, fabrication, and operational testing requirements when the NRC staff conducts subsequent inspections. The acceptance criteria/tests demonstrate that the cask has been fabricated in accordance with the design criteria and that the initial operation of the cask complies with regulatory requirements. For this amendment, NSPM proposed no changes that are relevant to acceptance testing.

The staff finds that the acceptance tests and maintenance program are in compliance with 10 CFR 72.44, "License Conditions," and ensure that the cask fabrication meets the applicable acceptance criteria and design requirements. The evaluation of the maintenance program provides reasonable assurance that the PI ISFSI will enable the safe storage of spent fuel. This finding is based on a review that considered the regulations, appropriate regulatory guides, applicable codes and standards, and accepted practices.

5.2 OPERATING PROCEDURES

The operating procedures review ensures that NSPM presents acceptable operating sequences, guidance, and generic procedures for key operations. The review also ensures that the application incorporates and is compatible with the applicable operating control limits in the technical specifications. For this amendment, NSPM proposed no changes that are relevant to operating procedures.

5.3 QUALITY ASSURANCE EVALUATION

NSPM did not propose any changes that affect the staff's quality assurance evaluation provided in the previous SERs for SNM License No. 2506 for the PI ISFSI. Therefore, the staff determined that a new evaluation was not required. There are no proposed changes to the quality assurance program associated with the current license.

5.4 EVALUATION FINDINGS

- NSPM has met the requirements in 10 CFR 72.44(c). The revised license conditions provide reasonable assurance that the PI ISFSI will continue to operate safely through periodic inspection and monitoring of ISFSI structures and subcomponents classified as important to safety, in accordance with the surveillance requirements specified in the technical specifications.
- NSPM has met the requirements in 10 CFR 72.122(f). The revised license conditions

provide reasonable assurance that the PI ISFSI is designed to permit inspection, maintenance, and testing.

6.0 REQUIREMENTS FOR NOTICING PROPOSED ACTION

In accordance with 10 CFR 72.16(e), a Notice of Proposed Action and a Notice of Opportunity for Hearing was published in the *Federal Register* (FR) on May 28, 2024 (89 FR 46176). No requests for a hearing or leave to intervene were submitted. Accordingly, pursuant to 10 CFR 72.46(d), action can be taken on this license amendment request.

7.0 ENVIRONMENTAL REVIEW

The licensee stated that the amendment request met the categorical exclusion criteria in 10 CFR 51.22(c)(11). Per 10 CFR 51.22(c)(11), a categorical exclusion for an amendment which is administrative, organizational, or procedural in nature - or which results in a change in process operations or equipment - is allowed provided the amendment: (i) would not produce a significant change in either the types or significant increase in the amounts of any effluents that may be released offsite, (ii) would not produce a significant increase in individual or cumulative occupational radiation exposure, (iii) would not have significant construction impact, and (iv) would not produce a significant increase in the potential for or consequences from radiological accidents.

After evaluating the amendment request, staff made the following determinations: (i) the amendment would not produce a significant change in either the types or significant increase in the amounts of any effluents that may be released offsite because the amendment did not alter the confinement boundary components as documented in section 3, (ii) the amendment would not produce a significant increase in individual or cumulative occupational radiation exposure because, as stated in section 3, the likelihood of fuel cladding failure would not be increased by the requested changes, (iii) the amendment would not have significant construction impact because the amendment only provides flexibility to schedule the inspections around typical challenges, including but not limited to inclement weather, security drills, and refueling outages and also makes them more consistent with the PI ISFSI TS, and (iv) the amendment would not produce a significant increase in the potential for or consequences from radiological accidents because the change will not alter confinement boundary components as documented in section 3. Consequently, staff finds the amendment request meets the categorical exclusion criteria in 10 CFR 51.22(c)(11), and the staff will not prepare an environmental assessment or environmental impact statement.

8.0 CONCLUSION

Based on its review of the license amendment request, the staff determined there is reasonable assurance that: (i) the activities authorized by the amended license will be conducted without endangering the health and safety of the public, and (ii) these activities will be conducted in compliance with the applicable regulations. Staff further determined that the issuance of the amendment will not be inimical to the common defense and security. As such, the staff concludes that SNM License No. 2506, as amended, meets the requirements of 10 CFR Part 72. Therefore, the amendment should be approved.

Issued with Materials License No. SNM-2506.

Dated: September 23, 2024