PrairieIslandISFSINPEm Resource

From: Longmire, Pamela
Sent: Monday, May 19, 2014 1:16 PM
To: Adams, Glenn D.
Subject: DRAFT 2nd RAI
Attachments: 2nd RAI_PINGP_ISFSI.pdf

Glenn –

Please find attached the draft of the 2nd request for additional information (RAI). I will reach out to you today to discuss when the responses are due to the NRC. That date will be documented in the RAI transmittal letter. Additionally, we will confirm the date in the first week in June for the public meeting where the NRC will provide any clarification about the questions in the RAI.

Pamela

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SECOND REQUEST FOR ADDITIONAL INFORMATION ON THE LICENSE RENEWAL APPLICATION FOR THE PRAIRIE ISLAND NUCLEAR GENERATING PLANT INDEPENDENT SPENT FUEL STORAGE INSTALLATION

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

DOCKET NO. 72-10
TAC NO. L24592

ACRONYMS	
AMA	Aging Management Activities
AMP	Aging Management Program
AMR	Aging Management Review
CAP	Corrective Action Program
DOE	U.S. Department of Energy
ISFSI	Independent Spent Fuel Storage Installation
ITS	Important to safety
LRA	license renewal application
NRC	U.S. Nuclear Regulatory Commission
NSPM	Northern States Power Company, a Minnesota corporation, d/b/a Xcel Energy
RAI	Request for Additional Information
SAR	Safety Analysis Report

INTRODUCTION

By letter dated October 20, 2011, as supplemented on February 29, 2012, April 26, 2012, and July 26, 2013, Northern States Power Company, a Minnesota corporation, d/b/a Xcel Energy (hereafter "NSPM") submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the Prairie Island Nuclear Generating Plant independent spent fuel storage installation (ISFSI) license, Special Nuclear Material License No. SNM-2506.

In the application, NSPM requested to extend the license for an additional 40 years. The NRC staff performed an acceptance review of the application to determine if the application contained sufficient technical information in scope and depth to allow the staff to complete the detailed technical review. On March 30, 2012, NRC notified NSPM that the application contained sufficient information needed for the NRC staff to conduct a detailed technical review. The NRC staff completed its initial review of the application and determined that additional information was required to assess compliance with 10 CFR Part 72. Contained herein is the NRC's second request for additional information.

A request for additional information (RAI) identifies additional information the NRC staff needs in connection with its review of this application. The RAI describes information the staff needs to complete its review of the application and to determine whether the applicant has demonstrated compliance with the regulatory requirements. The staff followed the guidance provided in NUREG–1927, "Standard Review Plan for Renewal of Spent Fuel Dry Cask Storage System Licenses and Certificates of Compliance" – Final Report, in its review of the application.

RAI-1:

Provide a table, or other format, that identifies each instance in the safety analysis report (SAR) that refers to a limited storage system period. A justification of their categorization should be provided.

The RAI GI-1 response (ML13210A272) stated that areas of the SAR which refer to a limited storage system period (i.e., 25 years, 20 years, storage period, service life, etc.) are grouped into three categories. Only one example was provided in each category. A complete listing and description of all the instances and a justification of their categorization should be provided in order to confirm that the adequacy of the design over the renewal life span has been correctly addressed.

This information is required to evaluate compliance with 10 CFR 72.42(b).

RAI-2:

Provide a revised Aging Management Program (AMP) addressing the following aging effects/mechanisms of the concrete pad, for both above-grade (accessible and inaccessible) and below-grade (underground inaccessible areas), as applicable. Otherwise, provide detailed justifications for why these aging effects/mechanisms do not require an AMP:

- Cracking or loss of material (spalling, scaling) due to chemical attack (above-grade, below-grade);
- Cracking and loss of strength due to cement aggregate reactions (above-grade inaccessible, below-grade);
- Cracking, loss of material, and loss of bond due to corrosion of embedded steel (above grade, below-grade);
- Increase in porosity/permeability and loss of strength due to leaching of $Ca(OH)_2$ (above-grade inaccessible); and
- Cracking due to settlement (above-grade, below-grade).

Section A2.6 (NSPM, 2011), "Acceptance Criteria," states that the acceptance criteria for all visual inspections of the concrete pads will be consistent with, or more restrictive than, those contained in ACI 349.3R, "Evaluation of Existing Nuclear Safety-Related Concrete Structures." ACI 349.3R details degradation mechanisms applicable to the reinforced concrete pad, which were excluded from AMP results in NSPM (2011). A complete AMP should address these aging mechanisms, or a detailed justification is required for their exclusion. The justification should provide a site-specific technical basis (e.g., engineering analysis, operational experience data), which demonstrates that these aging mechanisms will not adversely affect the ability of the pad to perform its intended important-to-safety (ITS) function during the period of extended operation. If the applicant intends on relying on the degradation of accessible areas as a precursor for degradation in inaccessible areas (both above and below grade), the justification should demonstrate that such an approach will be sufficient to prevent a loss of ITS function. Note that per ACI 349.3R, testing activities may be used to quantify the environment to which the below-grade or inaccessible structure is exposed. These tests could include a program for analysis of soils and groundwater chemistry, as well as an evaluation of their propensity to cause concrete degradation or steel reinforcement corrosion. Similar guidance and acceptance

criteria are given in ASME Code Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components."

This information is needed to determine compliance with 10 CFR 72.42(a)(2), 122(b)(1) and 72.122(f).

RAI-3:

Specify which materials properties are covered by the aging effect "Change in Materials Properties" when referring to the aging mechanism "Leaching of $Ca(OH)_2$" in the concrete pad. Provide technical justification detailing how the proposed Aging Management Activity (i.e., visual examination) will be able to properly identify any 'changes in materials properties' adversely affecting the ability of the pad to perform its intended ITS function during the license period of extended operation.

Table 3.4.1 (NSPM, 2011), "AMR Results for Concrete Pads," identifies leaching of $Ca(OH)_2$ as an aging mechanism of the concrete pad. The corresponding aging effect is named "Change of Materials Properties," yet NSPM (2011) does not provide details on what specific materials properties are to be measured or evaluated. These properties need to be properly defined in the license renewal application and the proposed AMP must include sufficient detail to ensure its adequacy and applicability. An applicable AMP should use a method/technique that ensures detection of the aging effect before there is a loss of the intended safety function. Additionally, the AMP must provide valid acceptance criteria. As an example, if the monitored "change in materials properties" is a reduction in modulus of elasticity, the applicant should provide a valid justification for the adequacy of the proposed method/technique (visual, volumetric, etc.) to characterize such material property, as well as valid acceptance criteria or reference to an applicable consensus standard (e.g., ACI, ASME, ASCE code). Note that ACI 349.3R provides acceptance criteria based solely on visual inspections for specific materials properties and not all materials properties.

This information is needed to determine compliance with 10 CFR 72.42(a)(2), 122(b)(1) and 72.122(f).

RAI-4:

Revise the license renewal application (LRA) to include a water chemistry program as part of the AMP for the concrete pad. The program should provide results representative of water in the near proximity to the pad. Otherwise, provide an engineering justification for why it is not required for the management of the following aging mechanisms/effects:

- Cracking or loss of material (spalling, scaling) due to chemical attack; and
- Cracking, loss of material, and loss of bond due to corrosion of embedded steel.

The scope of the ISFSI Inspection and Monitoring Activities Program (Section A.2.1, NSPM, 2011) does not include a water chemistry program. However, response to RAI A-3 (NSPM, 2013) states that NSPM periodically samples water from on-site wells and the Mississippi River for chloride, sulfate, and pH. The applicant used results from samples taken in October 2012 and June 2013 to justify not needing to manage below-grade aging effects due to chemical attack and corrosion of embedded steel. However, periodic evaluation of the water quality in near proximity to the pad is required to ensure that an aggressive soil/ground water environment will not be present throughout the 40 years of extended operation. As stated in ACI 349.3R,

chemical attack may occur from exposure to aggressive groundwater, acidic rain/condensation, seawater/salt-spray, exposure to any acids, caustics or other aggressive chemicals (including pesticides for weed and rodent control). The water chemistry program should include sufficient detail about the 10 program elements of an adequate AMP, as detailed in NUREG-1927, "Standard Review Plan for Renewal of Spent Fuel Dry Cask Storage System Licenses and Certificates of Compliance."

This information is needed to determine compliance with 10 CFR 72.42(a)(2), 122(b)(1), (e) and (f).

RAI-5:

Revise inspection frequencies to intervals consistent with ACI 349.3R or provide detailed justifications for any deviations from this criterion. For below-grade areas (underground), justify the use of opportunistic inspections for assessing the condition of the concrete and embedded steel, instead of periodic examination of excavated areas subject to the severest condition.

Section A2.6 (NSPM, 2011), "Acceptance Criteria," states that the acceptance criteria for all visual inspections of the concrete pad will be consistent with, or more restrictive than, those contained in ACI 349.3R. ACI 349.3R states that all safety-related structures should be visually inspected at intervals not to exceed 10 years. Specifically, Table 6.1 in ACI 349.3R, "Frequency of Inspection," states that above-grade (directly and indirectly exposed to a natural environment) and below-grade (underground) structures are to be inspected every five and 10 years, respectively. However, Section A2.4 in NSPM (2011), "Detection of Aging Effects", states that the concrete surface underneath the cask will be inspected every 20 years, and below-grade structures will be inspected only when excavated, exposed or modified.

This information is required to determine compliance with 10 CFR 72.42.; and 72.122(f)and (i); 72.128(a).

RAI-6:

Regarding the NSPM Corrective Action Program (CAP) and the concrete pad:

- Clarify the criteria applied to determine which inspection results will require either:
  1. an Action Request;
  2. a modification to the existing AMP; and/or
  3. an official notification to the NRC.
- Provide details on how the CAP will capture and evaluate operating experience (OE) from other ISFSIs using similar dry cask storage systems where the concrete pad is important to safety. Clarify the CAP criteria applied to determine which external OE will trigger any of the action items listed above.
- Provide details on how the CAP will ensure proper monitoring and trending once an aging effect has been identified but not corrected following an earlier inspection.

Section A2.6 (NSPM, 2011), "Acceptance Criteria," states that the acceptance criteria for all visual inspections of the concrete pad will be consistent with, or more restrictive than, those contained in ACI 349.3R. ACI 349.3R provides three-tier acceptance criteria: (1) acceptance without further evaluation, (2) acceptance after review, and (3) acceptance requiring further evaluation. The staff needs clarification on the CAP criteria used to determine which results under a Tier 2 or Tier 3 acceptance will require either (1) an Action Request, (2) a modification to the existing AMP (e.g., inspection frequency), and/or (3) an official notification to the NRC.

The applicant should clarify any differences in the CAP criteria based on OE obtained at other ISFSIs using similar TN cask systems where the concrete pad is important to safety. The staff also needs details on how the NSPM CAP will update baseline data for the concrete pad based on results from previous inspections, to ensure proper monitoring and trending once an aging effect has been identified.

This information is required to determine compliance with 10 CFR 72.42(a), and 72.172.

RAI-7:

Include the following information in the AMP for the berm:

- A definition of "absence of aging effects" as it is used as a criteria for satisfactory berm performance as outline in ML12065A073.
- The technical basis for the berm inspection frequency criteria as outline in the same response. Provide basis on how operating experience (LRA Section A2.4.2, last sentence page A-6) supports the 5 year inspection frequency.
- Identify in the LRA, Table A2.1-1: (i) earthen berm material properties that will change due to desiccation and (ii) visible signs of the effects of the earthen berm material properties change that could be detected by visual inspection.

Table A2.1-1 indicates that the aging due to a number of degradation mechanisms causes a change in unnamed materials properties. Changes in the materials properties of the component may affect its ability to perform its safety function. In order for a visual examination to determine if a change in properties has occurred, this change must be manifest in a visual affect. Clarification of these broad statements is needed in order to determine what materials properties changes affect the visual appearance of the component and whether visual examination is adequate to determine the changes in these properties.

This information is needed to meet the requirement of 10 CFR 72.42(a)(2).

RAI-8:

Provide a detailed technical basis for the statement in the AMP that the acceptance criteria for all visual examinations of an in-service cask are the absence of any signs of aging, as indicated in LRA Section Sec A2.6.2 page A-8.

The current acceptance criterion is absence of aging effects as indicated in LRA Section A2.6.2, which is a subjective and vague criterion. The response to RAI A-2 indicates that a calculation was done to show: 1) based on referenced corrosion rates that the maximum expected corrosion of the bottom of the cask should be less than an inch in 100 years. Furthermore, it was calculated that a loss of one inch of the original 7.35 inch bottom plate had no effect on the ability of the cask to perform its safety functions. Hence, a quantitative or actionable operational criterion such as identified in the calculations is required.

This information is needed to meet the requirement of 10 CFR 72.42(a)(2).

RAI-9:

Provide conclusive evidence supporting the statement that there was no "observable corrosion or loss of material" in the Response to RAI A-2, page 14. Clarify the use of the observations

from the lead cask examination in the operational experience section of the AMP to support the conclusion.

- Define the meaning of “measurable loss of material” used in discussing the examination of the lead cask (LRA, page A-12).
- Place labels indicating salient features on all photographs in the Response to RAI Enclosure 2, Attachments 2, 3, 4 (Inspection Results) that support the statement in the observational experience section of the AMP that there was “no measurable loss of material”.
- Provide evidence that there were no pits exceeding the acceptance criterion given in the response to RAI M7 under the cask base areas exhibiting corrosion and corrosion product stains indicated in the AMP section under “lead cask inspection.”

Table A2.1-1 indicates that general and pitting corrosion are aging mechanisms for the carbon steel cask. The photographs in the CAP reports were insufficient to support the conclusion that there was no observable loss of material on the base metal of Cask 01. While some photographs used for support are self-explanatory, many photographs need labels to determine the reason the photograph supports the conclusions reached about the degradation.

This information is needed to meet the requirement of 10 CFR 72.42(a)(2).

RAI-10:

Provide an AMP for monitoring the degradation of the cask neutron shield. Specifically, the AMP should demonstrate its effectiveness with respect to elements (3), (4), (5), (6), (7), and (8) of an AMP as defined in NUREG-1927, Section 3.6.

In RAI A-1 transmitted to the applicant (ML13035A083), the staff requested the applicant to provide an aging management program that is capable of detecting degradation of the cask neutron shield. In its response, the applicant stated that the TLDs at the PINGP ISFSI will provide dose monitoring to assure that the requirements of 10 CFR 72.104, 72.106, and 10 CFR 72.128(a)(2) are met. In addition, the applicant stated that the PINGP ISFSI Inspection and Monitoring Activities Program reviews the 2-meter dose rate measurements and verifies the absence of an increasing trend on any individual cask. The applicant also stated that any age-related degradation of the shielding material occurs slowly and quarterly monitoring of the TLDs provides sufficient time to detect degradation of shielding materials.

The staff reviewed the applicant’s responses to the RAI and determined that the response did not adequately address the concerns for the following reasons:

1. The TLDs may not be able to detect degradation of the neutron shield for individual casks because it is almost impossible to use the TLD measurement data to detect increases in radiation from individual casks.

2. The neutron dose rate measurements at 2-meters from the cask surface presented in the response to the RAI do not seem to be adequate for detecting degradation of the neutron shield as it can be observed that the measurement data provide neither correlation to the decay of the source terms nor any consistency between measurements. Furthermore, it is unclear if these measurements were taken with the same equipment at the same locations and distance away from the casks all the time.

Although neutron dose rate measurements outside the cask may be used as a means to detect neutron shield degradation, the measurements must be carefully designed. First, the detector must be carefully selected and calibrated as the neutrons from the fuel will be moderated into a wide range of energies after going through the neutron shield. When the neutron shield degrades, the neutrons passing through it will shift to higher energies because the neutron shield functions both as a moderator and an absorber. The detector should be able to detect the shift of the neutron energy. Secondly, the locations of the measurements must be carefully selected to ensure the measured data is consistent and not disproportionately influenced by the radiation from other casks and background. Inaccurate data could result if radiation from surrounding casks as well as background is not considered when taking measurements. Thirdly, the measurements should have sufficient resolution to assure that degradation of any part of the neutron shield can be detected. Unless the degradation is uniform, radiation measurements at one location would only tell if degradation occurred at that location. Fourthly, the data should be analyzed to cull the time dependency of the source terms and irregular measurements for trending analysis. Finally, a time-limited aging analysis may be necessary to determine the degradation of the neutron shield due to heat and irradiation in order to detect cracks and/or unexpected degradation of the neutron shield.

The staff believes that due to either inconsistencies in the measurement technique, equipment, locations, variations in background, or a combination of all of these factors, the data (LRA Figure A.2.10 -1.2, and RAI A-1 response) presented is insufficient to detect degradation of the neutron shield. The applicant needs to revise its neutron shield degradation monitoring program and demonstrate that the revised program is sufficient and effective for this purpose.

This information is needed for the staff to meet the requirement of 10 CFR 72.42(a)(2).

RAI-11:

Provide TLAA calculations to support the contention that there will be no buildup of flammable hydrogen based on radiolytic degradation of the polymer neutron shielding material from doses expected over the total storage duration (initial plus renewal). If the analysis indicates a buildup of flammable hydrogen then provide a description and an AMP for the safety relief valve.

The response to RAI A-4 in the 2nd, 3rd and last paragraphs was not sufficient. No calculation of the potential hydrogen buildup in the initial storage period was conducted as part of the initial licensing basis. In addition, the response indicated that the dose was too low, no source of ignition was present, and that the steel enclosures were vented with a relief valve. The larger dose from the longer storage period may generate hydrogen, and as acknowledged in the RAI A-4 response, due to the small volumes involved, a flammable concentration may be reached. The response further states that even if there is a build-up of hydrogen there are vent valves to alleviate the situation. Since hydrogen flammability is a safety concern, the relief valves, which prevent a harmful buildup of hydrogen, becomes important to safety if the TLAA calculation indicates that a flammable buildup of hydrogen is possible.

This information is needed to meet the requirement of 10 CFR 72.42(a)(2), and 10 CFR 72.120(d).

RAI-12:

Provide an AMP for the high burnup fuel behavior addressing the required 10 points indicated in NUREG-1927 and include it in the revised Appendix A of the LRA which will be incorporated by reference in the license.

The AMP should be based on the response to RAI 3-2 (NSPM, 2013). Since the response relies on the DOE Cask Demonstration Project, this AMP should be developed to be consistent with the DOE Cask Demonstration test plan (EPRI, 2014), and ISG-24 (NRC, 2013). The site plans may be cited if appropriate and specific section reference citations are provided.

This information is needed to meet the requirement of 10 CFR 72.42(a)(2).

REFERENCES

1. NSPM. "Prairie Island Independent Spent Fuel Storage Installation Application for Renewed ISFSI Site-Specific License." ML11304A068. Materials License No. SNM–2506, Docket No. 72-10. Welch, Minnesota: Northern States Power Company. October 20, 2011.

2. NSPM. "Responses to Requests for Supplemental Information—Prairie Island Independent Spent Fuel Storage Installation (ISFSI) License Renewal Application (TAC No. L24592)." ML12065A073. Materials License No. SNM–2506, Docket No. 72-10. Welch, Minnesota: Northern States Power Company. February 29, 2012.

3. NSPM. "Supplement to License Renewal Application—Responses to Requests for Additional Information (TAC No. L24592)." ML13210A272. Materials License No. SNM–2506,
Docket No. 72-10. Welch, Minnesota: Northern States Power Company. July 26, 2013.

4. EPRI. "High Burnup Dry Storage Cask Research and Development Project, Final Test Plan." Palo Alto, California: Electric Power Research Institute. February 27, 2014.

5. NRC. "Division of Spent Fuel Storage and Transportation Interim Staff Guidance-24, Rev 0 - Draft: The Use of a Demonstration Program as a Surveillance Tool for Confirmation of Integrity for Continued Storage of High Burnup Fuel Beyond 20 Years." ML13056A516. Washington, DC: U.S. Nuclear Regulatory Commission. July 2013.