



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

September 11, 2014

Ms. Karen D. Fili  
Site Vice-President  
Monticello Nuclear Generating Plant  
2807 W. County Rd 75  
Monticello, MN 55362

SUBJECT: EXEMPTION REQUEST FOR DRY SHIELDED CANISTERS 11-16 DUE TO  
NONCONFORMING DYE PENETRANT EXAMINATIONS, DOCKET NO. 72-58 –  
SUPPLEMENTAL INFORMATION NEEDED

Dear Ms. Fili:

By letter dated July 16, 2014, you submitted a request for exemption from various requirements of Part 72 to Title 10 of the *Code of Federal Regulations* (CFR). The exemption request is for six NUHOMS® 61BTH dry shielded canisters (DSCs) loaded under Certificate of Compliance (CoC) No. 72-1004, Amendment No. 10, that had nonconforming dye penetrant (PT) examinations performed during the loading campaign that started in September 2013. NRC staff performed an acceptance review of the requested exemption to determine if the request contained sufficient technical information in scope and depth to allow the staff to complete the detailed technical review.

This letter is to advise you that based on our acceptance review, the request does not contain sufficient technical information. The information needed to continue our review is described in the enclosure to this letter as requests for supplemental information (RSIs). In order to schedule our technical review, the RSI responses should be provided in two weeks from the date of this letter. If the RSI responses are not received by this date, the review of this application may be delayed. The enclosure also includes some observations. The observations may be addressed with your RSI responses to aid in our review, or we will include them or similar questions in a request for additional information (RAI) at a later date as our review progresses.

This letter confirms our phone call on September 9, 2014, with respect to the supplemental information needed. If you have any questions regarding this matter, please contact me at (301) 287- 9173.

Sincerely,

**/RA/ M. Sampson for**

B. Jennifer Davis, Sr. Project Manager  
Licensing Branch  
Division of Spent Fuel Storage and Transportation  
Office of Nuclear Material Safety  
and Safeguards

Docket No.: 72-58

TAC No.: L24939

cc: John Fields

Enclosure: Request for Supplemental Information

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Enclosure: Request for Supplemental Information

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**ADAMS Accession No.: ADAMS: ML14255A20**

<b>DIVISION</b>	SFST	SFST	SFST	SFST	SFST	SFST
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MONTICELLO NUCLEAR GENERATING PLANT

DOCKET NO. 72-58

REQUEST FOR SUPPLEMENTAL INFORMATION (RSI)

RELATED TO THE REQUESTED EXEMPTION

**RSI-1:** Provide an appropriate technical basis for the modification of the stress reduction factor. Provide supporting calculations using an appropriate modification of the stress reduction factor. Also provide supporting calculations for the inner top cover plate weld.

The exemption request applies to dry shielded canisters (DSCs) 11-16. These DSCs had non-conforming penetrant testing (PT) during canister closure welding operations. The welds with non-conforming PT included:

- Inner top cover plate (ITCP) weld (root and cover PT)
- Siphon port cover plate (SPCP) weld (root and cover PT)
- Vent port cover plate (VPCP) weld (root and cover PT)
- Test port plug (TPP) weld (root and cover PT)
- Outer top cover plate (OTCP) weld (root, intermediate, and cover PT)

The exemption request concludes, based on a preponderance of the evidence, that there is a reasonable assurance of safety for the 20-year service lifetime of DSCs 11 - 16 based on the following:

1. Integrity of the fuel creates a fission product barrier.
2. The quality of the welding process employed provides indication of development of high quality welds.
3. The advantages of the multi-layer weld technique which includes the low probability for flaw propagation, the subsequent covering of weld layer surface flaws and the indication of development of high quality welds.
4. Visual inspections performed on the welds met quality requirements.
5. The helium leak and DSC backfill testing results verify confinement barrier integrity.
6. The lack of a failure mechanism that adversely affects confinement barrier integrity.
7. Stress margins are available in the welds when assuming conservatively large flaws.

Section 3.2.5.1 - Inner and Outer Top Cover Plate Weld Justification, includes a justification for a modified stress reduction factor for the ITCP and the OTCP welds. It is noted that Interim Staff Guidance (ISG)-15<sup>1</sup> requires a stress reduction factor of 0.8 applied to closure welds that are examined by progressive PT rather than volumetric examination. It is also noted in the exemption request that the original 61BTH DSC evaluations used a stress reduction factor of 0.7 for conservatism with respect to the ISG-15 requirement. A modified stress reduction factor

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<sup>1</sup> Spent Fuel Project Office Interim Staff Guidance – 15, “Materials Evaluation,” <http://www.nrc.gov/reading-rm/doc-collections/isg/isg-15.pdf>

of 0.7 is calculated for DSCs 11-16 based on the information provided in the ASME Boiler and Pressure Vessel Code.<sup>2</sup> Specifically, the exemption request states:

The permissible weld reduction factors (ASME Boiler and Pressure Vessel Code, Division 1, Subsection NG, 1998 edition through 2000 Addenda, Table 3352-1) for surface PT and surface visual examination are 0.4 and 0.35, respectively. A modified stress reduction factor of 0.70 ( $0.80 \times 0.35/0.40$ ) is calculated for the non-compliant weld, due to the multiple visual inspections.

Section 3.2.5.1 also includes a summary of the calculations using the modified stress reduction factors for normal and accident conditions:

When the modified stress reduction factor and other conservatisms are included as described above are applied for normal conditions, the stress ratio of calculated stress to allowable stress is 0.52 and 0.79 for the ITCP and OTCP welds, respectively. For accident conditions, the stress ratio is 0.84 and 0.71 for the ITCP and OTCP welds, respectively. Therefore, adequate design margins exist for the ITCP and OTCP welds when evaluated against conservative stress allowable values.

Two key points in the analysis provided in the exemption request include point #4, the use of visual inspections that met quality standards, and point #7, the stress margins in the welds assuming conservatively large flaws.

The modified stress reduction factor calculated in Section 3.2.5.1 indicates that stress reduction factors from ASME Boiler and Pressure Vessel Code, Division 1, Subsection NG, 1998 Edition through 2000 Addenda Table NG-3352-1 were used. There are several issues with the proposed approach in the exemption request.

1. Table NG-3352-1 does not include a weld type and category that is representative of the ITCP and OTCP welds used in the 61BTH canister.
2. Table NG-3352-1 does not contain stress reduction factors for multiple visual examinations.
3. Table NG-3352-1 and subsection NG-3350 do not identify permissible combinations of stress reduction factors based on combinations of conforming (or non-conforming) examinations.

Although not specifically identified, it appears that the exemption request is based on the Type VI Category D or Category E welds which are not pressure boundary welds. Table NG-3352-1 indicates that the stress reduction factor for a Type VI Category D or Category E weld is 0.35. Stress reduction factors based on multiple visual examinations are not identified for any of the types and categories of welds included in Table NG-3352-1. In the exemption request, the calculated stress reduction factor for multiple visual inspections for the ITCP and OTCP is 0.7. By this calculation, the exemption request uses allowable stresses for welds with multiple visual examinations that are a factor of 2x ( $0.7/0.35$ ) greater than the same welds with a single surface visual examination. The technical basis for this modified stress reduction factor is not provided.

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<sup>2</sup> ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection NG, 1998 edition through 2000 Addenda

The 2x increase in allowable stress with the modified stress reduction factor in the exemption request is also inconsistent with the stress reduction factors for multiple versus single examination methods that are included in Table NG-3352-1. For example, the stress reduction factors for surface PT, root and final PT, and progressive PT for a Type VI Category D or Category E welds are 0.4, 0.45, and 0.55 respectively. In other words, based on the stress reduction factors in Table NG-3352-1, the allowable stresses in Type VI Category D or Category E welds with progressive PT are a factor of 1.375x (0.55/0.4) greater compared to allowable stresses in welds where only a surface PT was performed. For welds with a root and final PT, the allowable stresses are a factor of 1.125x greater (0.45/0.4) compared to the allowable stresses in weld where only a surface PT was performed.

It is noted that the final PT reexamination of the OTCP weld on DSC #16 identified an indication that was not identified in the visual examination. This observation calls into question the technical basis of relying on the visual examination to determine the integrity of the OTCP and ITCP welds.

Finally, Section 3.2.5.1 of the exemption request refers to calculations conducted for both the ITCP and OTCP welds. Controlling load combinations stress results are provided in Enclosure 2, Tables 1 and 2 for the OTCP closure weld. No controlling load combination stress results were provided for the ITCP closure weld.

In summary, the exemption request contains calculations using modified stress reduction factors that are not supported by the referenced table NG-3352-1 of the ASME Boiler and pressure vessel code. No technical basis is provided to support the modification of the stress reduction factor used in the supporting calculations. Supporting calculations for the inner top cover plate weld were not provided.

This information is required by the staff to determine compliance with 10 CFR 72.236 (c-f, j, l).

**RSI-2:** Submit Reference 5.2, TN Calculation NUH61BTH-0200, Rev. 0, "NUHOMS-61BTH Type 1 Dry Shielded Canister Shell Assembly Structural Analysis," and, for Load Cases TR-9, -10, and -11, provide schematics and summary descriptions of the finite element analysis (FEA) models with proper notations to depict model attributes, including geometry, element types, loading, and boundary conditions to facilitate staff review. Also, include the input and output files for the FEA, per ISG – 21<sup>3</sup>, in the submittal.

This information is required by the staff to determine compliance with 10 CFR 72.236.

**RSI-3:** Provide a technical basis for the "line welds," pin-connection, assumption for the ½" partial penetration lid-to-shell weld for the OTCP, given that, in previous FEAs for the canister shell assemblies, including those listed in Tables K.3.7-13 and T.3.7-16 of the NUHOMS<sup>®</sup> Updated Final Safety Analysis Report (UFSAR)<sup>4</sup>, the subject weld was not explicitly called out for stress margin evaluations. Specifically, using load combination TR-10 as an example, justify that the calculated primary stress of 11.4 ksi for the weld in Table 1 of the calculation in the

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<sup>3</sup> Spent Fuel Project Office Interim Staff Guidance – 21, "Use of Computational Modeling Software," <http://pbadupws.nrc.gov/docs/ML0610/ML061080669.pdf>

<sup>4</sup> Transnuclear, Inc., "Updated Final Safety Analysis Report (UFSAR) for the Standardized NUHOMS<sup>®</sup> Horizontal Modular System for Irradiated Nuclear Fuel," NUH-003, Revision 12, February 1, 2012, ML12037A013

exemption request, is a conservative representation of the primary membrane and the primary membrane-plus-bending stress intensities of 32.34 ksi and 55.21 ksi, respectively.

It is unclear how the lid-to-shell weld FEA discretization and the section cut for post-processing of nodal values to obtain the membrane and membrane-plus-bending stress intensities as reported in Table K.3.7-13 referenced above, are simulated with line weld stresses involving both shear and normal components. Similarly, it is unclear how the stress acceptance criteria are applied conservatively for the line welds as modeled. The basis and justification are needed for staff to perform its safety review.

This information is required by the staff to determine compliance with 10 CFR 72.236.

**RSI-4:** For the structural integrity evaluation of the line welds, identify ASME Code, Section III, Subsection NB, requirement exceptions with justifications and compensatory measures, including the NB-3210 provisions of the design by analysis evaluation methods and stress acceptance criteria for the subject partial penetration lid-to-shell weld.

The calculation No. 11042-0204 introduces a design by analysis weld evaluation analysis/evaluation method, which appears to be substantively different from those in Subsection NB. As such, similar to those in Table 4.9-1 of the NUHOMS® UFSAR, a code exceptions summary is needed for the staff to consider the exceptions in performing safety review of the exemption request.

This information is required by the staff to determine compliance with 10 CFR 72.236.

### **Observations**

**OBS-1:** Provide the measured heat loads at time of fuel loading for DSCs 11-16.

Provide a table showing the measured decay heat values at time of fuel loading for DSCs 11-16. This is to provide information regarding how much the actual heat loading is below the design heat limit for each DSC. The information will help assure that fuel cladding and cask component temperatures remain below the limits for each DSC (DSCs 11-16).

This information is required by the staff to determine compliance with 10 CFR 72.236(f).

**OBS-2:** Provide the maximum DSC surface temperatures measured at the closure welds at the time of PT examination (DSCs 11-16).

Provide a table listing the maximum DSC surface temperatures measured at the inner top cover plate weld, the siphon port cover plate weld, and the vent port cover plate weld, at the time of PT examination for all DSCs 11-16.

The information will provide a basis to assure that the satisfactory PT exams have been completed on the closure welds of each DSC (DSCs 11-16).

This information is required by the staff to determine compliance with 10 CFR 72.236(f).

**OBS-3:** Clarify the intent of, or modify, as appropriate, the statement in Section 2.0, Conservatism/Assumptions on page 4 of the exemption request, “[h]owever, conservatively the secondary stresses are scaled, increased, for the reduction in the OTCP weld size.”

The “line welds” assumption for the lid-to-shell configuration results in weld reactions in shear and tensile force components, which are necessitated for force equilibrium for the inner and outer top cover plates resisting the canister internal pressure and canister drop inertia forces. As such, stresses associated with the line welds ought to be categorized as primary for invoking appropriate stress acceptance criteria.

This information is required by the staff to determine compliance with 10 CFR 72.236.

**OBS-4:** Clarify the intent of, or modify, as appropriate, the statement in Section 7.1 on page 7, OTCP weld for reduced Weld Size Evaluation, “[t]he three components of the secondary stress are membrane (Pm), bending (Pb) and thermal stress (Q).”

Only thermal stress can be considered secondary. See technical basis comment in the previous observation (OBS-3).

This information is required by the staff to determine compliance with 10 CFR 72.236.

**OBS-5:** For Table 1 explain the basis for determining the Service Level D, allowable stresses of 32.4 ksi, 29.4 ksi, and 31.1 ksi for load cases TR-9, TR-10, and TR-11, respectively.

Identical at-temperature stress allowables should be used for the same weld analyzed.

This information is required by the staff to determine compliance with 10 CFR 72.236.