NORTHERN STATES POWER COMPANY

DOCKET NO. 72-58

FIRST REQUEST FOR ADDITIONAL INFORMATION

RELATED TO EXEMPTION REQUEST FOR
FIVE NONCONFORMING DRY SHIELDED CANISTERS 11 THROUGH 15

By letter dated October 18, 2017, Northern States Power Company, doing business as Xcel Energy, submitted an application for an exemption request for nonconforming dry shielded canister dye penetrant examinations for five NUHOMS® Dry Shielded Canisters (DSCs) designated DSCs 11-15, pursuant to the requirements of Section 7 of Part 72 of Title 10 of the *Code of Federal Regulations* (10 CFR 72.7).

This first request for additional information (RAI-1) identifies additional information needed by the U.S. Nuclear Regulatory Commission staff in connection with its review of this exemption request. Each individual RAI describes information needed by the staff to complete its review of the application and to determine whether the applicant has demonstrated compliance with the regulatory requirements.

Materials RAIs

RAI M-1: Provide the procedure qualification records for the welding procedure specifications (WPSs) used for the Inner Top Cover Plate (ITCP) and Outer Top Cover Plate (OTCP) welds. In Enclosure 3, these are listed as WPS SS-8-M-TN Revision 10 (machine GTAW) and SS-8-A-TN Revision 8 (manual GTAW).

Enclosure 1 of the exemption request states:

> *Notwithstanding the nonconforming PT examinations, the weld closures of DSCs 11-15 were performed under a 10 CFR 50 Appendix B QA program, such that the canister integrity is otherwise assured. Accordingly, welding materials were procured to quality requirements, welding processes were developed and qualified for the given configuration, and welders were appropriately qualified to the Code requirements.*

The use of a qualified welding procedure is relied on to support the exemption request. However, observations from the review of the weld head videos appear to be inconsistent with expected observations when using a qualified welding procedure.

This information is needed to determine compliance with 10 CFR 72.122(a).

RAI M-2: Provide the certified material test reports (CMTRs) for the weld filler material heats used in the closure lid welding for DSCs 11-15.

These heat numbers are identified as 737880, 736908 and 527221 in Enclosure 3: Structural Integrity Associates, INC. Report 700388.401, Revision 1, Evaluation of the Welds on DSC 11-

15, Page 3-23, Table 3-1, Welder ID numbers and filler metal heat numbers used [4, 5, 6, 7, 8, 9].

The use of a certified welding filler materials is relied on to support the exemption request. The CMTRs for these filler metals were not provided in the exemption request.

This information is needed to determine compliance with 10 CFR 72.122(b).

RAI M-3: Provide the technical basis and evidence, such as measurements, of the actual thicknesses of the weld deposits on DSCs 11-15 to support the use of a weld deposit thickness that is greater than the weld design dimension.

The applicant stated that the inner top cover plate weld size (dimension of the weld throat) for DSC 16 was determined to be between 0.25 to 0.4" which is considerably larger than the minimum design thickness of 3/16 inch (i.e., 0.188"). The applicant stated that the increased ITCP weld size was considered applicable to DSCs 11-15. However, no evidence such as actual measurements of the ITCP welds were provided to support this assertion.

This information is needed to determine compliance with 10 CFR 72.122(b).

RAI M-4: Provide the following:

1. "Assessment of Monticello Spent Fuel Canister Closure Plate Welds based on Welding Video Records", R. Smith and N. Mohr, SI Report 1301415.403.R2, dated May 22, 2014.
2. Letter report from R. Smith (SI) to J. Becka (Xcel) on "Review of TRIVIS INC Welding Procedures used for Field Welds on the Transnuclear NUHOMS 61BTH Type 1 & 2 Transportable Canister for BWR Fuel", SI Report 1301415.402.R0, dated January 30, 2014.
3. The "welding data sheets" referenced in Enclosure 3 (Report 1700388.401.R1) Page 1-1, Section 1.0 INTRODUCTION, 4th paragraph.

References 1 and 2 are cited in multiple instances in Enclosure 3 and are used to support the assessment of potential defects in the DSC 11-15 welds. The summary of the weld head videos provided in Enclosure 3 Appendix C is a summary of the assessment and is also incomplete as there is no specific comments associated with the DSC-16 weld. A more detailed assessment of the welding videos and weld data sheets beyond what is summarized in the exemption request Enclosure 3 is necessary assess the analysis provided for DSCs 11 through 15.

This information is needed to complete the review in accordance with 10 CFR 72.122(b).

RAI M-5: Provide an explanation for why the information summarized from the weld head videos (Enclosure 3 Appendix C) and the shop floor videos (Enclosure 3 Appendix D) appear to be inconsistent and in some cases contradictory. For example:

1. Appendix C Page C-2 and Appendix D Page D-7 Table 5-8: DSC-16:
    a. ITCP and OTCP welding start and stop times are not in agreement.
2. Appendix C Page C-3 and Appendix D Page D-5 Table 5-4: DSC-12:
    a. OTCP welding start and stop times are not in agreement.
    b. Appendix C Page C-3 identifies grinding in layer #2 that is not identified in Table 5-4.

3. Appendix C Pages C-4 and C-5 and Appendix D Page D-5 Table 5-5: DSC-13:
    a. ITCP and OTCP welding start and stop times are not in agreement.
    b. Table 5-5 indicated no grinding of the OTCP weld but Appendix C Page C-5 indicated that the weld in pass 4 appeared to have been ground.
4. Appendix C Page C-6 and Appendix D Page D-6 Table 5-6: DSC-14:
    a. OTCP welding start and stop times are not in agreement.
    b. Table 5-6 indicated no grinding of the OTCP weld but Appendix C Page C-6 indicated that the weld in pass 5a appeared to have been ground.
5. Appendix C Pages C-7 and C-8 and Appendix D Page D-6 Table 5-7: DSC-15:
    a. OTCP welding start and stop times (and dates) are not in agreement.

This information is needed to complete the review in accordance with 10 CFR 72.122(b).

RAI M-6: Provide additional information to support the assumed flaw size and location of the potential lack of fusion flaws in the ITCP welds for the "Reasonable Assurance of Weld Integrity" and the "Additional Stress Margins in Welds" analyses.

For the "Reasonable Assurance of Weld Integrity" analysis Enclosure 1, Page 30 of 75 states the following:

> *LOF [lack of fusion] defects of similar sizes and locations seen in DSC 16 are reasonable assumptions for the other ITCP closure welds. The assumptions made for the ITCP closure weld bounding analysis in DSC 16 are considered reasonable for all ITCP canister closure welds, the conditions of the ITCP welds are judged as similar for all canisters*.

Additional statements in this paragraph indicate lack of fusion defects that might form would likely be located on the vertical sidewall because of the weld groove geometry and because there is limited room to tilt the tungsten electrode towards the side wall. The lack of fusion defects in the sidewall of the ITCP weld on DSC 16 were modeled as a defect in the root pass or layer 1 of 2. It is unclear why weld layer 2 would not also contain lack of fusion defects. Weld head video is limited to DSCs 13 and 16, and additional review of the welding process to qualitatively assess the potential for lack of fusion defects for the remaining DSC ITCP welds is not possible. In addition, the initial DSCs would have little to no benefit from any "learning curve" for the ITCP welds.

In the "Additional Stress Margins in Welds" analysis, the assumed flaw size of 0.14" is used for ITCP weld flaw-2 in Enclosure 6, "NUHOMS® 61BTH Type 1 DSC ITCP and OTCP Maximum Weld Flaw Evaluation," AREVA Calculation 11042-0207, Revision 0.

However, Enclosure 3 Section 3.1.4.1 (page 3-9 or 142/461 of ML17296A205) states:

> *The video welding records (VIDs) reviewed for this weld did not show evidence of electrode tilt (working angle) towards the vertical sidewall to facilitate optimum tie-in to the vertical wall of the weld joint […]. Regardless, the VIDs suggested a nearly vertical tungsten orientation that required the molten weld metal to flow to the side wall with sufficient heat to fuse the bottom of the machined groove to the shell sidewall. The sluggish nature of weld metal flow (lava flow) and the issues encountered with maintaining the proper wire entry location due to the filler wire cast created variability in fusion conditions on the sidewall.*

The ITCP weld is 2 passes with a design thickness of 3/16" (0.188"). The maximum flaw size observed at the ITCP weld/DSC shell interface in DSC 16 was 0.09" according to the Phased Array Ultrasonic Testing (PAUT) results. Because ITCP weld video is limited to DSCs 13 and 16, additional review of the welding process to assess the welding practices and qualitatively assess the potential for lack of fusion defects for the remaining DSC ITCP welds is not possible.

Based on the review of welding video records in Enclosure 3, it appears that the ITCP weld joint would be susceptible to lack of fusion flaws at the ITCP weld to shell interface. Given the limited information provided on the ITCP welds and the combination of the weld joint geometry, unfavorable electrode position and the sluggish nature of the weld metal observed during the welding of DSCs 11-16, it is unclear if the modeled lack of fusion defects in the ITCP weld would be representative of the possibility that lack of fusion defects located at weld to DSC shell interfaces could be present in both of the ITCP weld passes. Because it is not possible to assess through weld head videos whether DSCs 11, 12, 14, and 15 may have lack of fusion defects in both weld passes that comprise the ITCP weld, it is unclear whether the modeled flaw size of 0.14 inches would account for the potential for the ITCP welds to have aligned lack of fusion defects (i.e., lack of fusion defects in each of the two weld passes) located at the DSC shell to ITCP weld interface.

This information is needed to complete the review in accordance with 10 CFR 72.122(b).

RAI M-7: Clarify the size of the ITCP weld analyzed in the Enclosure 6, "NUHOMS® 61BTH Type 1 DSC ITCP and OTCP Maximum Weld Flaw Evaluation," AREVA Calculation 11042-0207, Revision 0.

Enclosure 6 Section 3 (Design Input/Data) and Section 4 (Methodology) both reference Enclosure 5 ("61BTH ITCP and OTCP Closure Weld Flaw Evaluation" AREVA Document No. 11042-0205 Revision 3). Enclosure 5 Section 3 (Design Input/Data) states the following:

> *The ITCP is 0.75" nominal thickness. Per the Reference 5.5 drawing, it is welded to the DSC shell and vent/siphon block with a 3/16" groove weld. However, the ITCP lid groove (weld prep) is 0.25" minimum, and it was confirmed that the weld is also 0.25."*

Enclosure 1 (Exemption Request for Nonconforming Dry Shielded Canister Dye Penetrant Examinations) page 29 of 75 states:

> *For the ITCP weld […] The analysis calculates the critical flaw size for a weld size of 0.25 inch per the PAUT results for DSC 16 (which indicated a distance between the root and crown at the canister wall from 0.25 to 0.40 inches) in lieu of the design thickness of 3/16 inch. This increased weld size is considered equally applicable to DSCs 11-15 based on the joint configuration and same welding process application.*

Subsequently, Enclosure 1 page 32 of 75 references the analysis in Enclosure 6. However, in the discussion of the results contained in Enclosure 6, page 33 of 75 of Enclosure 1 states:

> *The maximum modeled weld flaws for OTCP to DSC shell weld are 0.43 inch and 0.42 inch in height, which represents about 85% through-wall of the 0.5-inch minimum weld throat. The maximum modeled full-circumferential weld flaws for ITCP to DSC shell weld are 0.16 * cos(45°) = 0.11 inch and 0.14 inch in height, which represents*

respectively 58% and 74% through-wall of the 0.19-inch minimum weld throat as shown in Figure 7 (note that in Figure 7, weld heights are labeled as weld lengths).

These statements appear to be provide contradictory information and it is not clear whether the ITCP weld is modeled as the minimum design thickness or as the minimum measured thickness from the PAUT results for DSC 16.

This information is needed to complete the review in accordance with 10 CFR 72.122(b).

Structural RAIs

RAI ST-1: Provide the following ANSYS files used to analyze DSCs 11-15 in Enclosures 6 and 7, including load cases Internal Pressure 2D-Axisymmetric model and Side Drop 3D-Half-Symmetric model with extensions: .db, .inp, .err, .mntr, .out, .db, and .rst, and revise modeling descriptions presented in Section 4.1 of Enclosure 6 accordingly.

The aforementioned files are needed to verify modeling details which are not being sufficiently captured in a text format (exemption description). Modeling details regarding element type, distribution (mesh), flaw depiction, constitutive material properties, and loading in both 2D and 3D space are most directly presented in the ANSYS files themselves. As an example on the need for clarifying modeling details description, the staff noted that, on page 6 of the enclosure, the applicant states (underscores added):

> *Initial ANSYS finite element iterations were performed by increasing all the four flaws by a very small length resulting in a negligible increase in plastic strain. In the second step very large flaws where considered (leaving only one element of the model connected at each flaw) resulting in excessive strain for the elastic-plastic side drop analysis. Similarly, few more iterations were performed such that the weld flaw reaches close to acceptable strain limit for the elastic-plastic side drop analysis. Only the final flaw configuration is presented in the document*

Specifically, to add clarity to the above modeling description, the applicant needs to consider: (1) If finite element iterations are not ANSYS inherent for a limit load analysis, describe the process of selecting and monitoring the flaw length increment, which resulted in a "negligible increase" in plastic strain, (2) Clarify whether or not the resulting "one element" configurations are related to the limit load plastic hinge formation at the welds with maximized flaws by presenting appropriate finite element meshing annotation, which depicts nodal displacements for all the adjacent elements connected to the element incipient to the plastic hinges formation for the collapse load determination, (3) Revise, as appropriate, the statement, "[f]ew more iterations were performed …for the elastic-plastic side drop analysis," to recognize the "iteration" in context is ANSYS inherent for an elastic-plastic analysis methodology, and (4) Revise, as appropriate, the statement, "[s]uch that the weld flaw reaches close to acceptable strain limit," by recognizing that the elastic-plastic analysis is performed to demonstrate large strain ductility demand to be within the American Society of Mechanical Engineers (ASME) Code strain acceptance limits.

RAI ST-2: Regarding Exemption Request Enclosure 1, revise the description of using stress in lieu of strain margin(s) of safety as a basis for demonstrating structural performance of DSCs 11-15 using the limit load and elastic-plastic analysis methodology. Page 2 of the enclosure noted that reasonable assurance of weld integrity is demonstrated by adequate stress margin in welds to accommodate flaws. The use of the word, “stress,” does not reflect, in context, that only “strain” acceptance criteria in terms of ductility demands were considered in the closure weld evaluation. Similar descriptions in this and other enclosures may also need to be revised, as appropriate.

This information is needed to complete the review in accordance with 10 CFR 72.236(l).