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February 14, 2020

L-MT-20-004
10 CFR 50.55a

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U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Monticello Nuclear Generating Plant
Docket No. 50-263
Renewed Facility Operating License No. DPR-22

10 CFR 50.55a Request: Request RR-016 Associated with the Fifth Ten-Year Inservice Inspection (ISI) Interval

Reference: 1) Letter from David L. Pelton (NRC) to Karen D. Fili (NSPM), "Monticello Nuclear Generating Plant – Alternative to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, Examination requirements for the Reactor Pressure Shroud Support Plate Welds H8 and H9 for the Fifth 10-Year Inservice Inspection Program Interval (TAC No. MF3551)", dated January 23, 2015 (ADAMS Accession No. ML15013A036)

Pursuant to 10 CFR 50.55a(z)(2), Northern States Power Company, a Minnesota corporation, doing business as Xcel Energy (hereafter "NSPM"), hereby submits for NRC authorization the enclosed 10 CFR 50.55a alternative for the Fifth Ten-Year Inservice Inspection (ISI) Interval for the Monticello Nuclear Generating Plant (MNGP).

NSPM proposes to revise the previously authorized alternative in RR-008 for the H8 and H9 welds (Reference 1) to remove the 2021 refueling outage from the scope of the authorized alternative and to apply a similar alternative to the H10 welds of the core support structure.

NSPM requests authorization of this 10 CFR 50.55a(z)(2) alternative by March 20, 2021, to support the MNGP April 2021 refueling outage.

If there are any questions or if additional information is needed, please contact Mr. Ronald Jacobson at (612) 330-6542 or Ronald.Jacobson@xenuclear.com.

Summary of Commitments

This letter makes no new commitments and no revisions to existing commitments.

Christopher R. Church
Site Vice President, Monticello Nuclear Generating Plant
Northern States Power Company – Minnesota

Enclosure

cc: Administrator, Region III, USNRC
Project Manager, Monticello, USNRC
Resident Inspector, Monticello, USNRC

ENCLOSURE

MONTICELLO NUCLEAR GENERATING PLANT

PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(z)(2)

REQUEST RR-016 ASSOCIATED WITH THE FIFTH TEN-YEAR INSERVICE INSPECTION (ISI) INTERVAL

(19 pages follow)

1. ASME Code Components Affected

Code Class: 1

Component Numbers: H8 Weld: Shroud Support Plate to Shroud Weld
- ISI Component ID's:
  - C-3E (Shroud Shelf 0°-180°)
  - C-3F (Shroud Shelf 180°-360°)

H9 Weld: Shroud Support Plate to Reactor Vessel Weld
- ISI Component ID's:
  - C-3C (Shroud Shelf 0°-180°)
  - C-3D (Shroud Shelf 180°-360°)

H10 Weld: Shroud Support Leg Weld
- ISI Component ID's:
  - C-7E (90°)
  - C-7N (300°)
  - C-7P (330°)
  - C-7Q (350°)

Examination Category: B-N-2, Welded Core Support Structures and Interior Attachments to Reactor Vessels

Item Number(s): B13.30, Interior Attachments beyond Beltline Region
B13.40, Core Support Structure

Description: Alternative to ASME Section XI, IWB-2420, "Successive Inspections", IWB-2420(b) and IWB-2420(c)

2. Applicable ASME Code Edition and Addenda

The Monticello Nuclear Generating Plant (MNGP) began the Fifth Ten-Year Inservice Inspection (ISI) Program Interval on September 1, 2012. The Code of Record for the Fifth ISI Interval is the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components", 2007 Edition with the 2008 Addenda (hereafter ASME Section XI).

3. Applicable Code Requirement

ASME Section XI, IWB-2420(b) and (c)

IWB-2420(b) states:

> If a component is accepted for continued service in accordance with IWB-3132.3 or IWB-3142.4, the areas containing flaws or relevant conditions shall be reexamined during the next three inspection periods listed in the schedule of the Inspection Program of IWB-2400. Alternatively, acoustic emission may be used to monitor growth of existing flaws in accordance with IWA-2234.

IWB-2420(c) states:

> If the reexamination required by IWB-2420(b) reveals that the flaws or relevant conditions remain essentially unchanged for three successive inspection periods, the component examination schedule may revert to the original schedule of successive inspections.

4. Reason for Request

Pursuant to 10 CFR 50.55a(z)(2), compliance with the successive inspection requirements under ASME Section XI, IWB-2420(b) and (c) would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. This request revises the scope of the alternative in RR-008 (Reference 1) by removing the 2021 refueling outage (RFO) examinations based on the location of the welds, additional dose to workers, and potential risk to equipment, which is supported by the results of the examinations conducted in the RFOs in 2015, 2017, and 2019. The H10 shroud support leg welds are being added to the proposed alternative as they have similar location, examination processes, histories, and risks.

Component Description and Configuration

The H8, H9, and H10 welds are located in the reactor pressure vessel (RPV) interior (Attachments A and B) and are part of the core shroud assembly; specifically, the shroud support structure (see Attachments C and D).

H8, H9, and H10 are weld identifiers designated by the Boiling Water Reactor Vessel and Internals Project (BWRVIP) in the BWRVIP-38 report, "BWR Shroud Support Inspection and Flaw Evaluation Guidelines," (Reference 4) and are used for their applicability to the ISI Program components for ASME Code Items B13.30 and B13.40 designated as the shroud shelf and shroud support legs.

The shroud support assembly includes a horizontal ring plate that is welded between the bottom of the core shroud and the upper region of the reactor bottom head, and vertical support legs that are welded between the bottom of the core shroud cylinder and the bottom head. The horizontal ring plate is referred to as the shroud support plate (synonymous with baffle plate or shroud shelf) and is made of Inconel® (ASME SB-168). The H8 weld is the horizontal weld that joins the support plate to the Inconel® core shroud cylinder. The H9 weld is the horizontal weld that joins the support plate to a weld buildup pad on the RPV bottom head. The H8 and H9 weld material is Inconel® 182, and the weld buildup pad on the RPV is Inconel® 82 and 182. The area below the support plate and core shroud is the RPV lower plenum. The H10 weld is the upper weld of the shroud support legs that join the legs to the core shroud cylinder. The H10 weld material is Inconel® 182 and the shroud support leg and core shroud are Inconel® (ASME SB-168).

The purpose of the shroud support plate in connection with the other reactor internals is to maintain an adequate distribution of coolant flow during normal operations, seismic disturbances, and design basis accidents. The shroud support plate specifically is part of the core coolant envelope needed to maintain two thirds core height in the event of a recirculation line break loss of coolant accident (LOCA). In connection with the shroud support legs, the shroud support plate also provides lateral support for the core shroud during normal and accident conditions.

History of H8 and H9 Indications and RR-008

In 2011 (the last outage in the Fourth Ten-Year ISI Interval), indications were discovered during a visual inspection on the underside of the H8 and H9 welds while inspecting the adjacent core shroud support legs. The indications on the H8 and H9 welds were identified in a layer of surface deposits on the welds. Due to the inability to perform meaningful cleaning on the welds at that time, the indications were considered relevant indications and accepted by analytical evaluation under ASME Section XI IWB-3142.4, and the requirements of IWB-2420(b) were applied.

A representative sample of the indications on the underside of both the H8 and H9 welds were reexamined to confirm their relevance in 2013 during the first (of two) RFOs in Period 1 of the Fifth Ten-Year ISI Interval. These examinations were not intended to fulfill the requirements of IWB-2420(b). They were performed to verify that the indications observed in 2011 were in fact relevant indications by utilizing a newly fabricated cleaning tool to remove surface deposits. Therefore, the first successive inspection applicable to IWB-2420(b) was performed in the subsequent 2015 RFO, the second outage in Period 1.

During the 2013 RFO, the indications were initially inspected in the as-found condition, being easily visible on a layer of surface deposits on the welds. Following a specialized cleaning process, the same locations were reexamined. The appearance of the underlying indications was unchanged when compared to the indications seen prior to cleaning. Although the cleaning provided validation that the indications were relevant and were located in the weld metal, examination with the surface deposit in place was equally effective for identifying the flaws and the extent to which the weld was affected.

The indications were found on all of the inspected, accessible underside regions on the H8 and H9 welds using access provided through the jet pump inlet and openings into the lower plenum of the vessel. During the inspection in 2011, it was noted that the indications appeared to continue beyond the regions accessible for inspection on the underside of the welds. Therefore, for evaluation purposes, it has been assumed that there are similar indications in all the uninspected regions of both the H8 and H9 welds.

In the 2013 RFO, topside examinations of the H8 and H9 welds were also performed, and no indications were identified. Analytical evaluations performed following this inspection confirmed acceptance of the components for continued service.

Due to accessibility constraints without performing extensive reactor internals disassembly, NSPM could not meet the requirements of IWB-2420(b) for H8 and H9 at the MNGP. Therefore, in 2014, NSPM submitted "10 CFR 50.55a Request RR-008 Associated with the Fifth Ten-Year Inservice Inspection (ISI) Interval" (Reference 2), which proposed to visually inspect all accessible areas of the topside and underside of the H8 and H9 welds during each of the remaining refueling outages of the Fifth Ten-Year ISI Interval: 2015 (Period 1), 2017 and 2019 (both Period 2), and 2021 (Period 3). In addition to inspecting all accessible areas of the H8 and H9 welds for changes in the general condition of the welds, RR-008 (Reference 2) proposed that four specific areas with known, distinct indications on the underside of the shroud support plate in the H8 and H9 welds would be monitored for any visual changes in the indications. RR-008 was authorized by the NRC in January 2015 (Reference 1). Subsequently, the inspection strategy for the H8 and H9 welds outlined in the relief request has been performed in 2015, 2017, and 2019. In the aggregate, there have been no apparent changes to the indications for the H8 and H9 welds since their initial identification in 2011 and subsequent examinations in 2013, 2015, 2017 and 2019.

History of Indications on Core Shroud Support Legs at H10 Welds

H10 welds have been examined repeatedly since initial indication identifications in 2000. The indications have been accepted by analytical evaluation under IWB-3142.4 and the requirements of IWB-2420(b) applied.

In the 2000 RFO, during Period 3 of the Third Interval, one indication was identified on the H10 weld on the 210° leg. This indication was examined again during the subsequent RFO in the same period of the Third Interval (the 2001 RFO) with no observed changes. In accordance with IWB-2420(b), the indication was reexamined in 2003 during the Fourth Interval, Period 1, and again had no observed change.

In the 2009 RFO (Fourth Interval, Period 2), during the second successive examination for IWB-2420(b), a new indication was reported at a separate location on the 210° leg H10 weld in addition to the previously reported indication, which had no apparent changes. This new indication led to a scope expansion, with 13 of 14 core shroud support legs being examined on the accessible sides (the 350° leg was deemed inaccessible). Including the indication on the 210° leg, new indications were reported on 11 legs, which resulted in 11 of the 14 legs having indications (no indications were observed on the 90° and 330° legs).

The next re-examination was performed in the 2011 RFO (Fourth Interval, Period 3). The vendor used an improved camera that provided higher resolution and focusing capabilities, as well as improved camera- and light-handling techniques. With these improvements, six additional indications were reported, one each on the 30°, 90°, 330°, and 350° legs, and two on the 120° leg. There were no apparent changes to all other previously identified indications. As a result, following the 2011 outage, all 14 shroud support leg H10 welds had documented indications.

During reexaminations in the 2013 RFO (Fifth Ten-Year ISI Interval, Period 1), using the same improved camera and equipment handling techniques as the 2011 outage examinations, the last new indication was reported on the 300° support leg H10 weld, at a separate location from the previous reported weld indication, which had no apparent changes. This location was not accessed in the 2011 outage; therefore, 2013 was its first examination with the improved equipment and techniques. The video from the previous 2009 examination was reviewed to determine if the indication had been present, but with the lesser resolution of the camera and lighting equipment, it could not be definitively determined.

In the 2017 RFO (Fifth Interval, Period 2), visual examinations were performed to verify previous indications on H10 welds. These examinations revealed there was a uniform reduction of the contrast presented by the previously reported indications. The indication patterns could still be discerned but were faint when compared to the images in 2013 RFO and appeared to be fading. The indication notification form stated, "The appearance of all the indications on the H10 welds has changed, probably due to the changes in the oxide layer caused by the application of the online noble metal injection."

Based on the results of these 2017 examinations:

- 8 of the 14 shroud support leg H10 welds met the requirements of IWB-2420(b) and (c) by having three successive examinations with no apparent changes to their previously reported indications (10°, 60°, 150°, 170°, 190°, 210°, 240°, and 270°).
- 5 of the 14 shroud support leg H10 welds received the second successive examination with no apparent changes to their previously reported indications (30°, 90°, 120°, 330°, and 350°).
- 1 of 14 shroud support leg H10 welds (300°) received its first successive examination for the indication identified in 2013. A different weld indication, on this leg, that had been initially reported in 2009 and reexamined in 2011, 2013, and 2017, had no apparent changes from its initial identification in 2009, therefore, having no apparent changes for three successive examinations.

Access Considerations and Inspection Technique

In the qualitative analysis, as stated in RR-008 enclosure 2 (Reference 3), the entire underside of both the H8 and H9 welds is assumed to be flawed for evaluation purposes. For the H10 weld evaluation, all legs are assumed to be cracked to a depth of 31.2% of the weld length and no structural credit was taken for the H8 and H9 welds. Any activities to improve visual inspection coverage on the underside of the welds would have no effect on the assumptions or conclusion in the analysis.

Due to inherent design configuration of the reactor vessel internals with a welded core shroud and support assembly, fuel core and core support components, core instrumentation, sparger piping in the upper vessel regions, and jet pump assemblies in the annulus region (see Attachment A), gaining access to the lower plenum is unusually difficult. To gain further access would require extensive disassembly of the fuel cells or jet pumps, which, as described below, would create a hardship without a compensating increase in the level of safety or quality.

Disassembly of any reactor internals includes increased risk of generating foreign material into the core or lower plenum, issues with reassembly that may have an unforeseen effect on future operation, and potential need for replacement/repair options for infrequently disassembled parts.

The access hole covers are welded to the shroud support plate and function to perform a leak-tight barrier between the annulus and lower plenum. These are not intended to be disassembled.

<u>Access through the jet pumps</u>

NSPM has successfully inspected MNGP shroud support components in the region below the shroud support plate, on a limited basis, by inserting camera heads and auxiliary lighting into the jet pump inlets, and down through the jet pump to the vessel lower plenum. With this method, which does not require disassembly of jet pump or fuel cell assemblies, the indications on the underside of the H8 and H9 welds were coincidentally discovered during the MNGP 2011 refueling outage while inspecting the H10 weld of the shroud support legs.

When the inspections were performed on the underside of H8 and H9 welds in the lower plenum, the common areas within a jet pump pair were accessible for inspection. Those areas on either side of the access hole covers and the areas between the jet pump pairs could not be inspected due to the rigidity of the equipment and the limited maneuverability as it passes through the jet pump and the opening in the shroud support plate (see Attachments D and E).

Visual inspections of these welds are performed manually and conducted from the refueling bridge. During the time the bridge is used for in-vessel visual inspections, the bridge is not available for other refueling work. Any manual visual examinations require coordination with refueling activities and impact outage critical path time. Dose rates on the refueling bridge during the 2019 refueling outage were between 1-5 millirem per hour (mrem/hr). Examination of the H8, H9, and remaining H10 welds are estimated to require 48 hours. Applying the 1-5 mrem/hr dose rate to the two people required to perform the exam over the 48 hour time estimate, the estimated dose would be 96 to 480 mrem.

The visual inspection technique deployed through the jet pump inlets for the underside of the H8, H9, and H10 welds has been the best available technique for inspection of the area. However, as described, it provides limited access and examination coverage, and has significant risk due to the potential to introduce foreign material into the lower plenum and jet pump assemblies. This could result in the need for jet pump disassembly and increased risk of degradation or damage. Additionally, camera handling and video quality are affected by flow and require coordination of examinations with shutdown cooling, because shutdown cooling affects the availability of locations to perform examinations, which can lead to increased time and dose to complete the required examinations.

Access through disassembly of jet pumps

As noted in BWRVIP-41, "BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines," (Reference 5) flow induced vibration (FIV) caused by leakage between the slip joint of the mixer and diffuser can cause damage to jet pumps. The FIV caused by slip joint leakage does not occur as long as the jet pumps are properly assembled, as designed and originally installed. Disassembly and reassembly for the inspection may alter the alignment and affect the stability of the jet pumps and increase the risk for damage with limited improvement in inspection coverage.

Disassembly and reassembly of the jet pumps would also have RFO impacts resulting in additional outage time, costs, and dose. Estimates indicate that disassembly and reassembly of a jet pump pair would take approximately 20 to 24 hours. Applying the estimated time for 10 jet pump pairs results in approximately 200 to 240 additional hours (approximately 8-10 days) beyond the required inspection time.

Typically, general area dose rates are approximately 1 to 5 mrem/hr on the refuel floor near the refuel cavity. In 2019, general area dose rates were 1-15 mrem/hr due to crud burst(s) and other plant work being performed, etc. Applying the 1 to 5 mrem/hr dose rate to the lower time estimate of 200 hours for disassembly and reassembly of all 10 pairs, 3 workers per shift, 2 shifts per day, the estimated dose would be 600 to 3000 mrem.

Access through fuel cell disassembly

Vacating a fuel cell for access to the lower plenum to perform inspections would have significant time and dose impacts to an RFO, similar to jet pump disassembly. Estimates indicate that the disassembly and reassembly steps for each cell, including fuel moves, would take approximately 16 hours. Any resulting replacement of components would result in additional time and dose. Additionally, if there is fuel in the vessel during these activities, higher risk conditions exist for water inventory control activities while performing the related under-vessel work as described below, thereby requiring additional steps and extending the time to complete the examinations.

Vacating fuel cells for performing inspections on the H8, H9, and H10 welds under the shroud support plate, although slightly less risky than jet pump disassembly, would still likely result in limited accessibility. Of the three welds, the H9 weld is located where the shroud plate joins the reactor vessel bottom head and would be the most difficult to access for inspection. As shown on Attachments A, B, and E, remote tooling for inspection from a disassembled fuel cell would need to travel from the nearest fuel cell across the width of the annulus to reach the H9 weld. The opening in core support plate for each fuel cell is only 10.875" in diameter. Inspection equipment would have to be maneuvered through the narrow opening and have enough flexibility to maneuver across the shroud support plate from the underside to inspect the H9 weld. Considering the unusually difficult measures to perform an inspection in this manner and with the likely result of not being able to examine all areas of each weld to satisfy the requirements of IWB-2420(b), there is not a compensating increase in the level of quality or safety.

Considering that there are 24 peripheral fuel cells to be vacated, the estimated time to complete the work is 384 hours (16 days). Although a portion of that work and related dose may be performed coincidental with some normal refueling activities, there would still be a substantial impact to refueling outage duration, vendor costs, worker dose, and replacement part cost.

Using typical dose levels on the refuel floor, at 1 to 5 mrem/hr, 3 workers for 384 hours, the estimated dose for the refuel floor workers would be approximately 1150 to 5760 mrem. To vacate a fuel cell, a crew of workers is also required under the vessel to perform removal and reinstallation of the Control Rod Drives (CRDs). Using 2019 dose levels for conducted CRD changeouts, the changeout crew received roughly 140 mrem combined dose per drive changeout. Therefore, for changeout of 24 drives necessary to disassemble and reassemble the fuel cells, the combined dose would be approximately 3360 mrem. When added to the refuel floor dose, total dose would be approximately 4510 to 9120 mrem.

Access conclusions

As stated in RR-008 (Reference 2), NSPM could not meet the requirements of IWB-2420(b), i.e., inspection of all areas containing flaws or relevant conditions due to access limitations that preclude the ability to inspect all of the H8 and H9 welds. Therefore, in order to satisfy IWB-2420(b), all the additional work, time, dose, and replacement part costs required to disassemble and reassemble reactor vessel internal components for inspection, as well as the risk of potential damage and future degradation of jet pump assemblies would result in a hardship or unusual difficulty without a compensating increase in the level of quality or safety.

Access for supplemental NDE

The insulation package design on the exterior surface of the reactor vessel limits access to perform a volumetric inspection of the H9 weld from the RPV outside surface. There is no annulus or gap between the insulation and the RPV outside diameter (OD) surface based on NSPM's experience from previous work activities on the vessel OD, as well as past discussions with the outage insulation vendor. In addition, except for the removable insulation panels around the vessel nozzles, the insulation package is interlocked with adjoining insulation sections and is held in place with metal banding. At the location where the H9 weld attaches to the RPV, access from the outside of the RPV is limited to small areas made available by removing the insulation panels at the N1A and N1B recirculation suction nozzles.

Ultrasonic examination (UT) of the RPV base material adjacent to the H9 weld, in limited areas available at the N1A and N1B nozzle locations, was performed in 2011 and 2013. In 2011, a single-sided UT was performed from the OD of the reactor vessel in the N1B recirculation suction nozzle window using a procedure qualified according to the Performance Demonstration Initiative (PDI) for reactor vessel welds. Due to the interference of the permanent insulation, NSPM could only perform axial scans which would identify any potential circumferential indications in the low alloy steel of the reactor vessel at the H9 weld. No indications were identified. In 2013, a similar single-sided UT inspection was performed in the N1A nozzle window, and again no indications were identified. A combined total of approximately 129.5 inches of the reactor vessel was scanned in 2011 and 2013.

5. Proposed Alternative and Basis for Use

NSPM proposes to modify the previously authorized alternative in RR-008 for the H8 and H9 welds (Reference 1). The new proposed alternative requests to apply the examinations and monitoring conducted in the 2013, 2015, 2017, and 2019 refueling outages, as an acceptable alternative to IWB-2420(b) and IWB-2420(c). No examinations or monitoring of H8 and H9 welds will be performed in the 2021 refueling outage.

For the H10 support leg welds, due to the extensive examination history with no apparent changes to any reported indications, the risks associated with examinations through the jet pump assemblies, and existing evaluations for the H10 welds, NSPM proposes to perform no further examinations on the H10 welds at the 30°, 90°, 120°, 300°, 330°, and 350° locations as an acceptable alternative to IWB-2420(b) and (c).

Basis for Use:

As part of the review of the indications, comparisons are made to the images from the previous outages' examinations. Indication Notification Forms (INFs) are prepared and reviewed by the inspection vendor and NSPM personnel. Final reviews are performed by multiple Non-Destructive Examination (NDE) Level III reviewers, both from the inspection vendor and by NSPM personnel. Concurrence on the examination results is needed prior to signature on the INFs included in the Outage Summary Report.

Since the discovery of indications on the H8 and H9 welds in 2011, inspections have been performed on them in every subsequent refueling outage (2013, 2015, 2017, and 2019) with no apparent changes identified.

For the H8 and H9 welds, the alternative specified in RR-008 would result in four examinations, which is one examination more than when performed in accordance with IWB-2142(b) and (c). Although the examinations would not be performed over a span of three successive periods as required by the code, the four examinations performed over the span of eight years from initial identification, with no apparent changes to the relevant indications, meet the intent of the Code and provide reasonable assurance that the structural integrity will be maintained.

For the indications on the H10 support leg welds, there have been no apparent changes observed going back to the initial identification in 2000. Since use of higher resolution cameras and improved equipment handling techniques began in 2011, there have been no apparent changes to identified indications. The last indication was identified in 2013 (300° leg), and showed no apparent changes in its subsequent examination in 2017. The other indication on that same leg has shown no apparent changes during its three successive examinations since initial identification in 2009. 8 of 14 support legs have met the requirements of IWB-2420(b) and (c), and no longer require successive examinations. Of the remaining six legs, five have been reexamined twice with no apparent changes (30°, 90°, 120°, 330°, and 350°) since initial identification in 2011. The remaining indication on the sixth leg (300° leg), as mentioned above, had no apparent change during its 2017 examination.

As discussed in RR-008 (Reference 2), the MNGP shroud support assembly is a flaw-tolerant design (based on flaw tolerance estimates provided in BWRVIP-38 (Reference 4)). Additionally, NSPM implemented hydrogen water chemistry (HWC) at MNGP in 1989 and Online Noble Metal Chemistry (OLNC) in 2013. There have been seven applications of OLNC since 2013, the most recent application having been in October 2019. The environment of the lower plenum is well mitigated against flaw growth and initiation based on the water chemistry controls implemented in accordance with BWRVIP-190, "BWR Water Chemistry Guidelines" (Reference 6) and BWRVIP 2019-025, "2019 BWR Water Chemistry Guidelines Interim Guidance" (Reference 7), via the MNGP Strategic Chemistry Plan.

Since 2000, when the relevant indications were initially identified on the H10 welds, and 2011, when the indications in the H8 and H9 welds were initially discovered, extensive analysis was performed (Reference 3) regarding the relevant indications and how they may affect the structural integrity of the shroud support assembly. These analyses demonstrated that the relevant indications in the H8 and H9 welds, as well as the H10 welds, have a negligible effect on the ability of the shroud support assembly to perform its design and safety functions during normal and accident conditions.

One of the evaluations performed for the H8 and H9 welds included the potential for the relevant indications in the H9 weld to grow into the low alloy steel of the reactor vessel. The probability of flaw growth into the low alloy steel of the reactor vessel is low based on the water chemistry environment in the lower plenum in the MNGP reactor vessel and the low residual stresses in the reactor vessel. None of the observed relevant indications in the visual inspections were found to extend beyond the boundary of the H8 and H9 weld metal.

There is very limited OD access to the reactor vessel for UT due to the design of the RPV insulation package. There are small areas of access near the recirculation suction nozzles (N1A and N1B) where the insulation is designed to be removable, and UT can be performed. As described earlier, NSPM performed UT of the location where the H9 weld adjoins the RPV with no indications reported. The UT results support the conclusion that the probability of flaw growth into the low alloy RPV material is low.

The primary consideration with the H8 and H9 welds is the uplift of the shroud support plate in the event of a design basis loss-of-coolant accident. The uplift of the shroud support plate would be driven by the vertical seismic loads and reactor internal pressure differences across the plate (Reference 3). The evaluations done in 2011 and 2013 assume very conservative flaw profiles including complete circumferential cracking of both the H8 and H9 relevant indications with cracking in the depth direction of approximately 75% through the weld thickness (through-wall). In the 2013 evaluation, using conservative flaw profiles, and consideration of the loading acting upon the shroud support plate in the reactor vessel, only 18% of the total weld surface is required to be free of through-wall indications to overcome the uplift loads acting on the shroud support plate. Considering such extensive flaw profiles, the evaluations demonstrate that the structural integrity of the shroud support plate and its ability to resist uplift remain intact for at least 12 years and maintain the core coolant envelope.

The evaluations performed for the H10 welds are very conservative (Reference 3). For the H10 weld evaluations, no structural credit is taken for the H8 and H9 welds. If structural support from welds H8 and H9 is considered, it is expected that significantly larger margins would be obtained. The shroud support plate welds are structurally redundant to the shroud support legs, and acceptable margin is achieved assuming that the H8 and H9 welds are completely failed. For the H10 weld evaluation, all legs are conservatively assumed to be cracked to a depth of 31.2% of the H10 weld length. The observed relevant indications are small relative to this assumption. See Reference 3 for additional details of evaluations that were performed.

All of the evaluations done to demonstrate the structural integrity of the shroud support assembly, including the shroud support plate H8 and H9 welds and the shroud support leg H10 welds, were summarized and further described in Reference 3, "Monticello Shroud Support Structure Flaw Evaluation Review and Support Plate Weld Inspection Recommendations." The document evaluated whether reduced inspection coverage was technically justifiable in lieu of the requirement to inspect all flawed areas of the H8 and H9 welds as described in IWB-2420(b). The document recommended minimum inspection requirements based on the conservatisms built into the evaluations performed to that time, the MNGP water chemistry in the lower plenum of the reactor vessel, and crack growth potential of the relevant indications. The minimum inspection recommendations provided in Reference 3 were as follows:

1. At least 15% coverage of the top side of welds H8 and H9 with the objective of identifying at least 13% of the top side weld length to be unflawed.

    a. The extent of top side coverage should be increased until at least 13% of the weld length for both H8 and H9 are shown to be unflawed.

2. 5% coverage of the bottom side of welds H8 and H9 in areas with known flaws with the objective of monitoring for unexpected change of flaw appearance.

In 2019, NSPM was able to inspect 37% of the topside of the H8 weld and 38% of the topside of the H9 weld with no relevant indications. Based on a review of previously inspected regions on the underside of the H8 and H9 welds, the areas accessed through the jet pump inlets were used to meet the 5% coverage recommendation.

The proposed alternative to the requirements of IWB-2420(b) and (c) demonstrates, with reasonable assurance, that the structural integrity of the shroud support plate and support leg welds, will be maintained.

Summary:

NSPM proposes the alternative for the H8, H9, and H10 welds based on:

- The evaluation provided in Reference 3 provides a technical basis to perform fewer examinations of flawed areas than required by IWB-2420(b) and (c).
- No apparent changes in the indications on the H8 and H9 welds in four subsequent outages following initial identification.
- No apparent changes in the indications on the H10 welds following initial identification.
    - Completion of successive examinations meeting the requirements of IWB-2420(b) and (c) on 8 of 14 supporting leg H10 welds with no apparent changes in the identified indications.

    - Completion of two successive examinations on 5 of 14 H10 welds with no change in the identified indications.
    - Completion of one successive examination on 1 of 14 H10 welds with no change in the identified indications.
- Continued implementation of OLNC.
- The hardship of examination via the jet pumps, or by disassembly of jet pumps or fuel assemblies and other internal components.

Pursuant to 10 CFR 50.55a(z)(2), NSPM requests authorization of the proposed alternative to ASME Section XI, IWB-2420(b) and (c). Complying with IWB-2420(b) and (c) at MNGP for relevant indications or relevant conditions on the underside of the H8 and H9, and also on H10 welds of the welded core support structure would result in hardship or unusual difficulty for NSPM without a compensating increase in the level of quality and safety.

6. Duration of Proposed Alternative

The proposed alternative will be applied for the remainder of the Fifth Ten-Year ISI Interval of the MNGP ASME Section XI Inservice Inspection Program that is expected to end on May 31, 2022.

7. Precedents

NSPM 10 CFR 50.55a request RR-008 (Reference 1).

8. References

1. Letter from David L. Pelton (NRC) to Karen D. Fili (NSPM), "Monticello Nuclear Generating Plant - Alternative to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, Examination requirements for the Reactor Pressure Shroud Support Plate Welds H8 and H9 for the Fifth 10-Year Inservice Inspection Program Interval (TAC No. MF3551)", dated January 23, 2015 (ADAMS Accession No. ML15013A036)

2. Letter from NSPM to the NRC, "10 CFR 50.55a Request RR-008 Associated with the Fifth Ten-Year Inservice Inspection (ISI) Interval", dated February 28, 2014 (ADAMS Accession No. ML14064A185)

3. Structural Integrity Associates, Inc., Evaluation File No. 1301525.301, Monticello Shroud Support Structure Flaw Evaluation review and Support Plate Weld Inspection Recommendations", dated February 25, 2014 (ADAMS Accession No. ML14064A186)

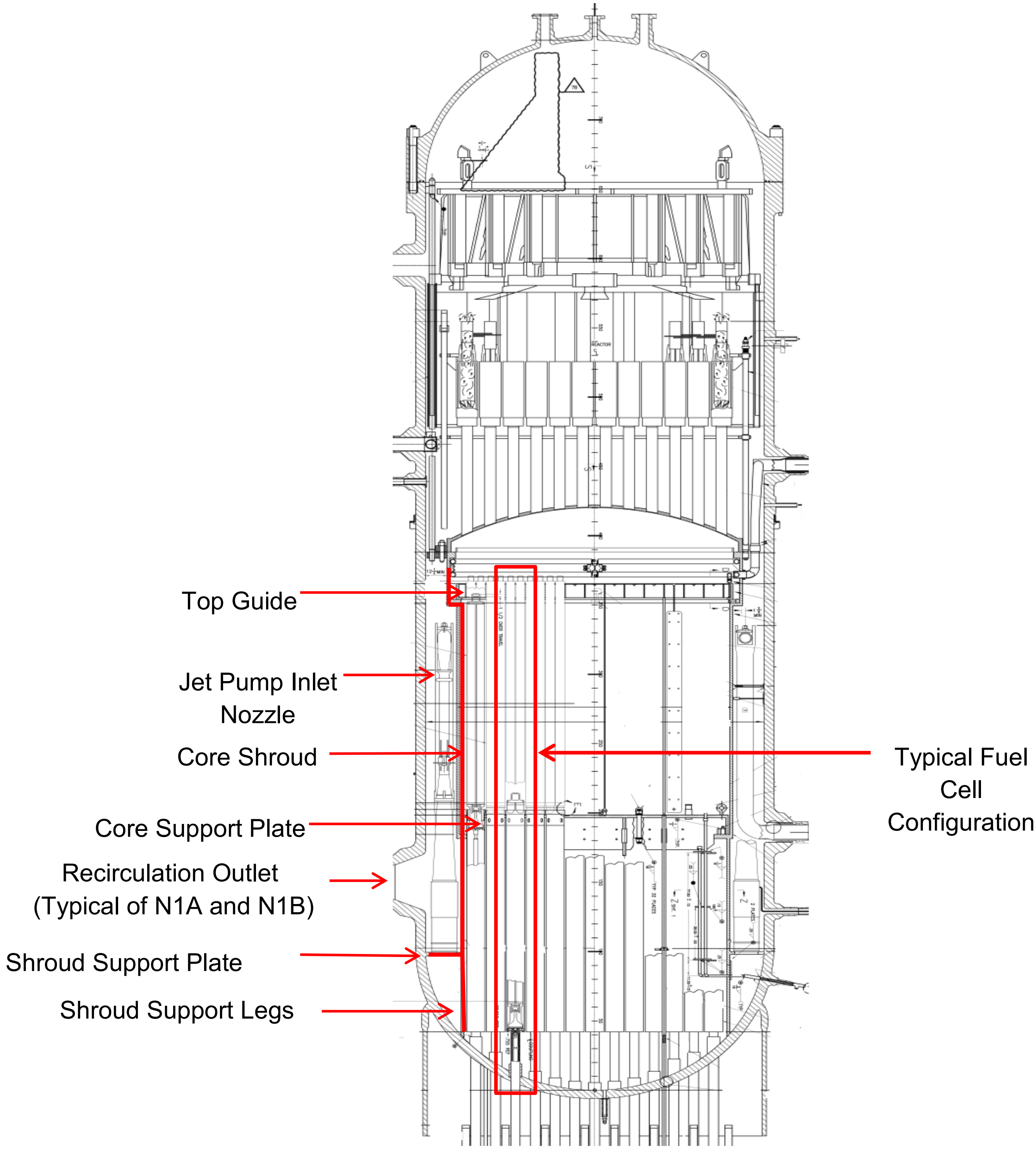
4. Boiling Water Reactor Vessel and Internals Project, "BWR Shroud Support Inspection and Flaw Evaluation Guidelines", (BWRVIP-38), Revision 0, September 1997

5. Boiling Water Reactor Vessel and Internals Project, "BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines", (BWRVIP-41), Revision 4A, December 2018

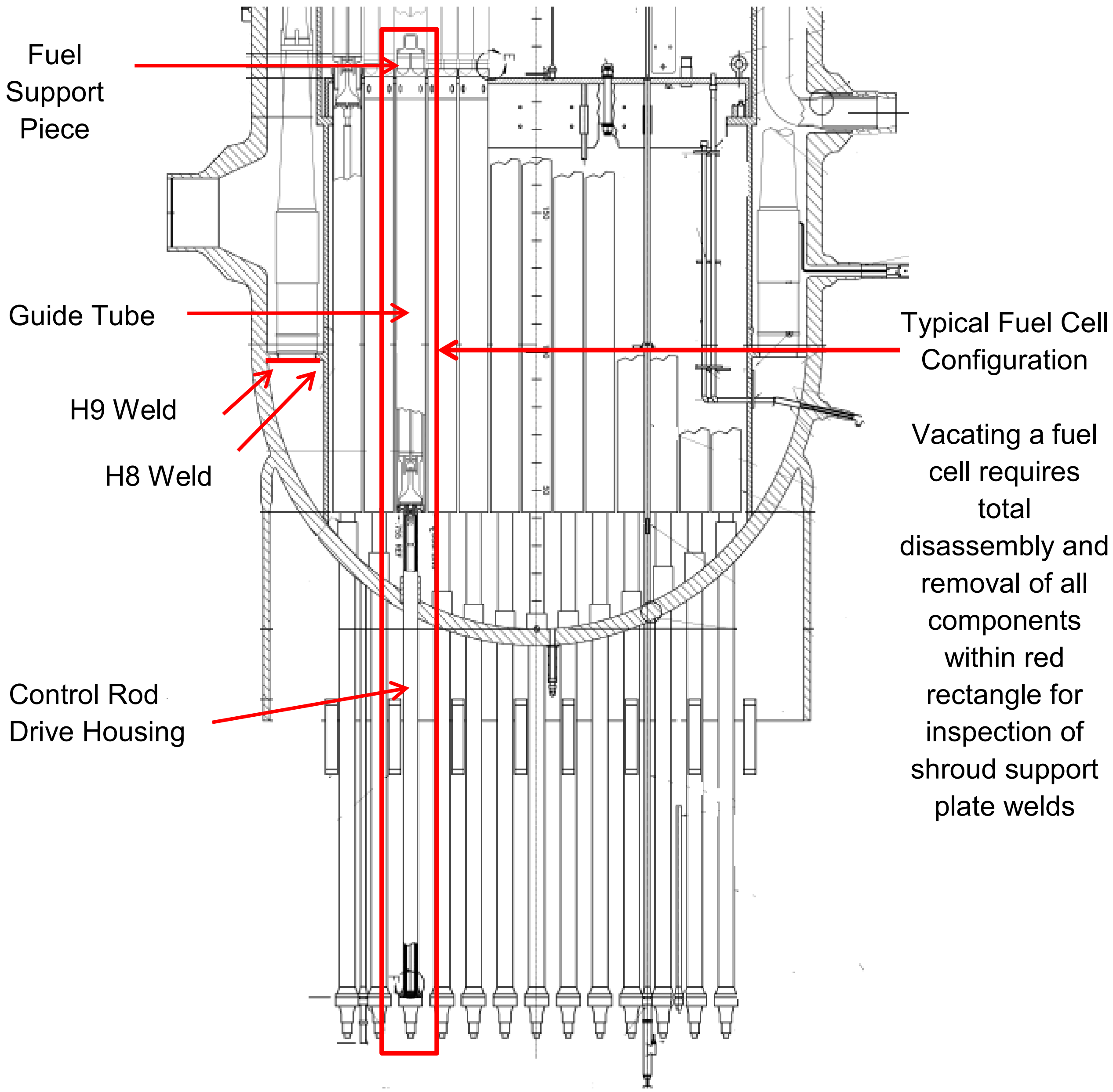
6. Boiling Water Reactor Vessel and Internals Project, "BWR Water Chemistry Guidelines - 2014 revision", (BWRVIP-190)

7. BWRVIP 2019-025, “2019 BWR Water Chemistry Guidelines Interim Guidance”

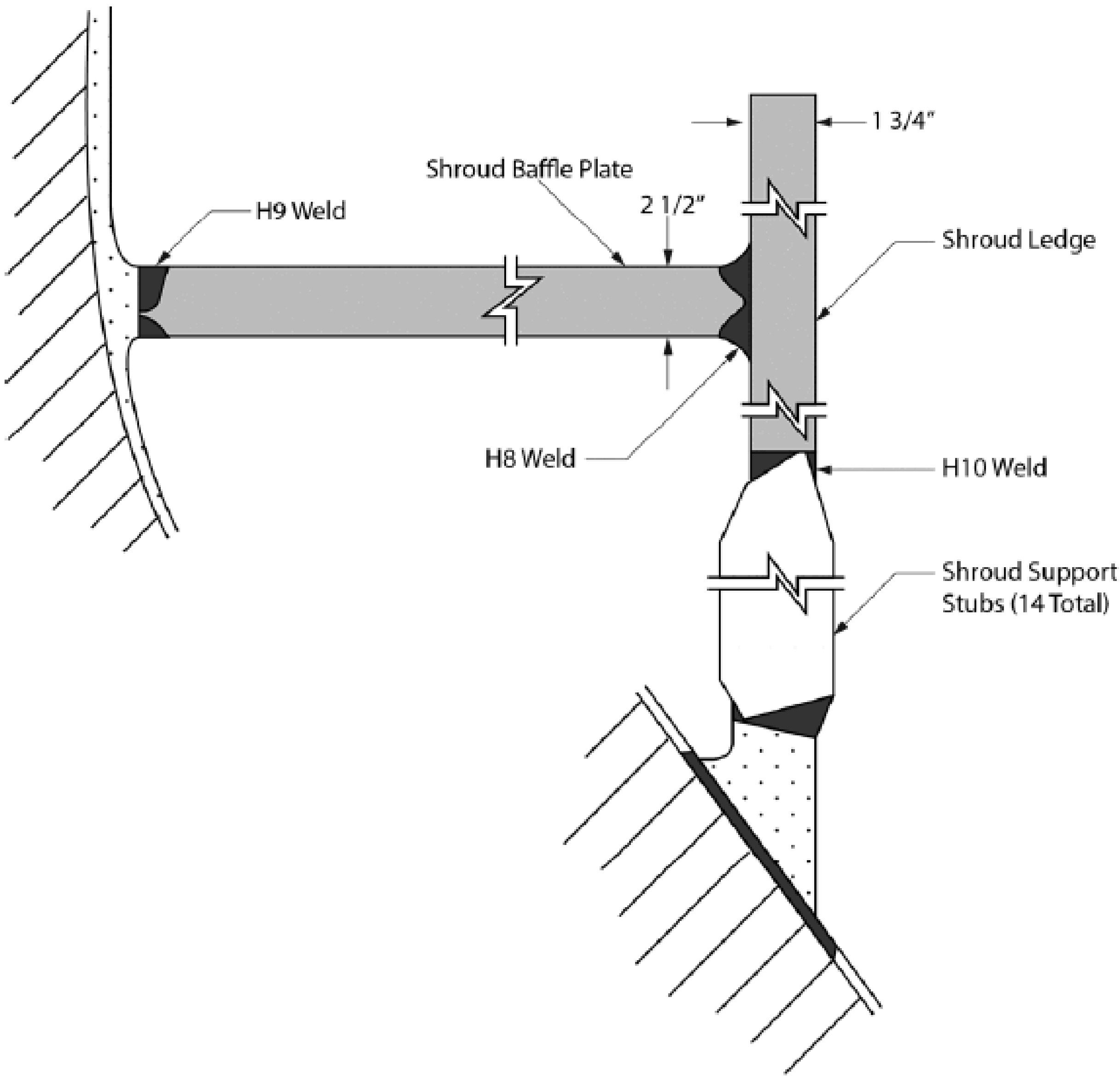
Attachment A – Reactor Vessel and Internals Overview



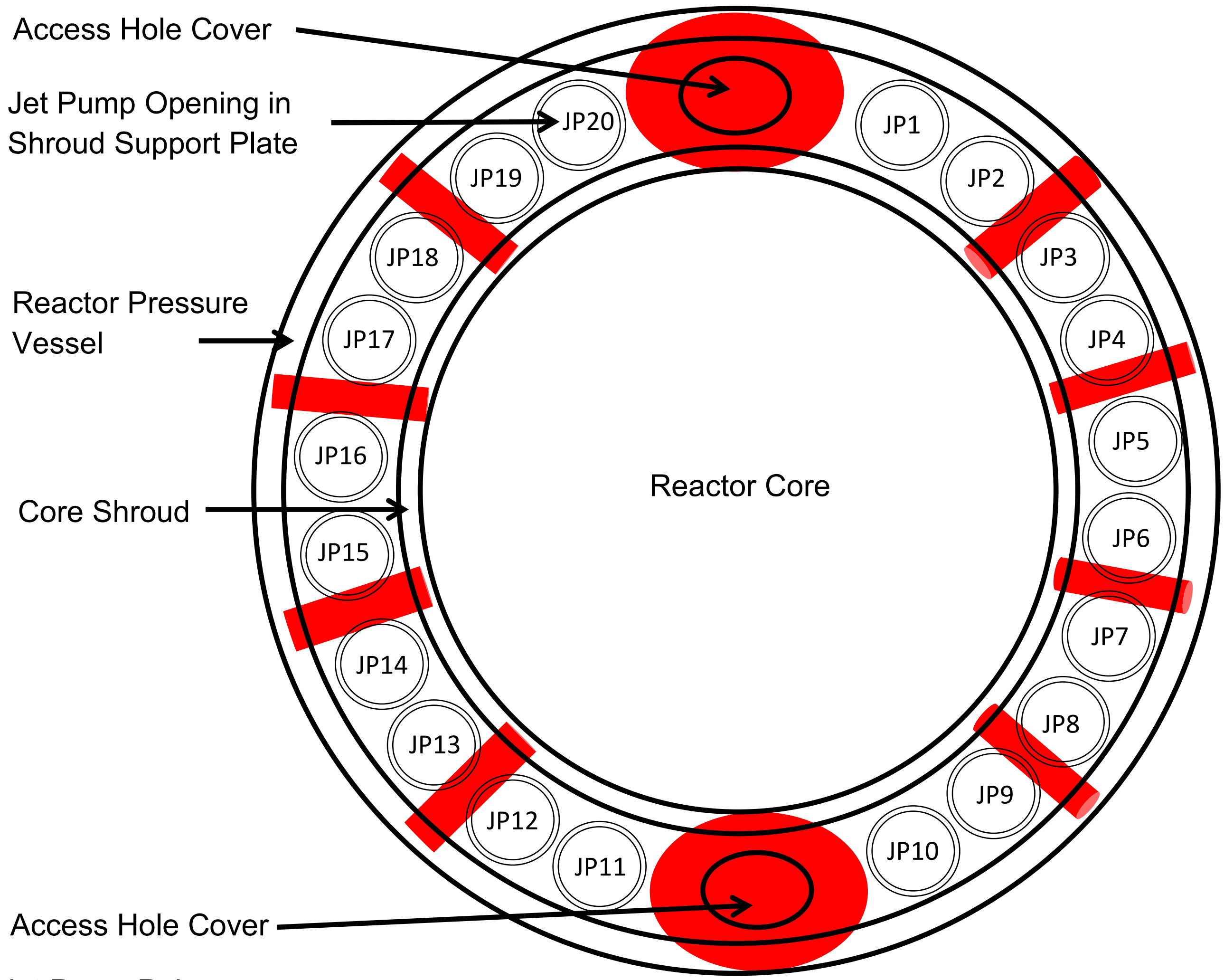
Attachment B – Area Below Top Guide



Attachment C – Monticello Shroud Support Structure Illustration



Attachment D – Monticello Shroud Support Plate Underside Illustration
(Shroud Support Legs Not Illustrated)



<u>Jet Pump Pairs</u>
JP1 / JP2
JP3 / JP4
JP5 / JP6
JP7 / JP8
JP9 / JP10
JP11 / JP12
JP13 / JP14
JP15 / JP16
JP17 / JP18
JP19 / JP20

Areas in red are inaccessible for inspection due to the rigid nature of the inspection equipment and limited maneuverability within the jet pumps.

Attachment E – Tooling Insertion Paths