RAS M-171

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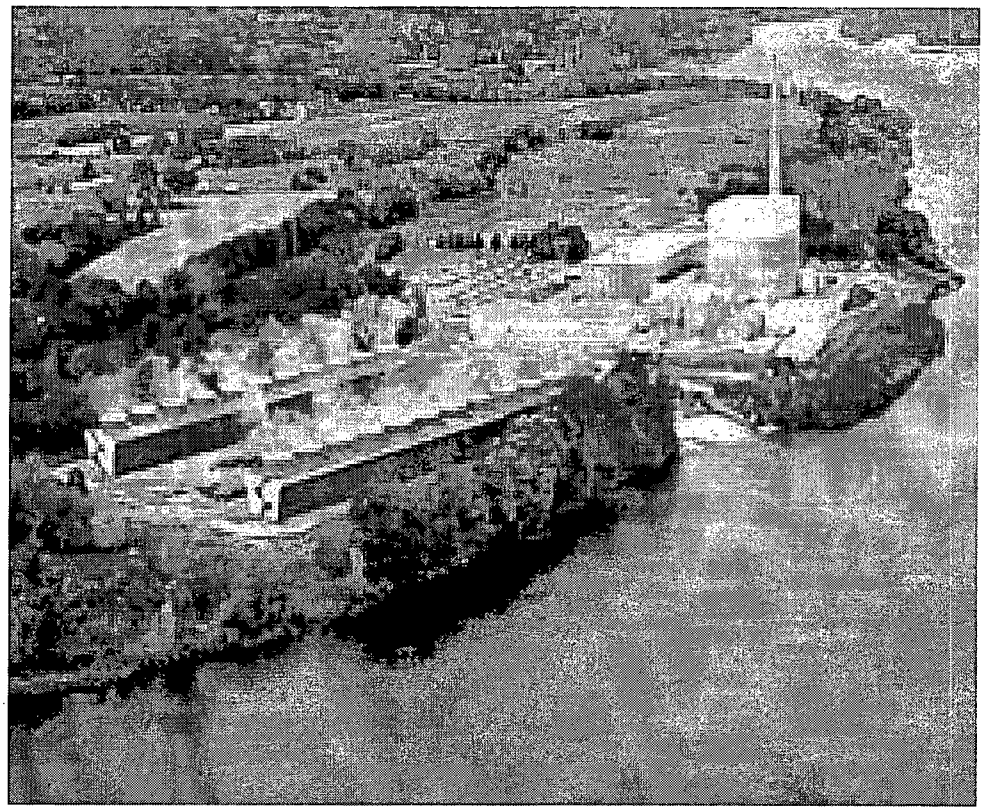
LICENSE RENEWAL APPLICATION



VERMONT YANKEE
NUCLEAR POWER STATION

Template Secy-027

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B.1.4 BWR PENETRATIONS

Program Description

The BWR Penetrations Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M8, BWR Penetrations.

The program includes (a) inspection and flaw evaluation in conformance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) documents BWRVIP-27 and BWRVIP-49 and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure the long-term integrity of vessel penetrations and nozzles.

NUREG-1801 Consistency

The BWR Penetrations Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M8, BWR Penetrations, with exceptions.

Exceptions to NUREG-1801

The BWR Penetrations Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M8, BWR Penetrations, with the following exceptions.

Attributes Affected	Exceptions
3. Parameters Monitored/Inspected 4. Detection of Aging Effects	Table IWB-2500-1 from the 1998 edition with 2000 addenda of ASME Section XI is used to specify SLC nozzle inspections, while NUREG-1801 specifies the 2001 edition with 2002 and 2003 addenda.[1]
4. Detection of Aging Effects	VYNPS examines ½ inch of the volume next to the widest part of the N10 nozzle to vessel weld, rather than half of the vessel wall thickness.[2]

Exception Notes

1. Since ASME Section XI through the 2003 Addenda has been accept by reference in 10CFR50.55a paragraph (b) (2) without modification or limitation on use of Table IWB-2500-1 from the 1998 edition with 2000 addenda for BWR components, use of this version is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.

2. Extending the examination volume into the base metal as required by ASME Section XI, 1998 Edition, 2000 Addenda, Figure IWB-2500-7(b) prolongs the examination time significantly and results in no net increase in safety. The extra volume is base metal region which is not prone to in-service cracking and has been extensively examined before the vessel was put into service and during the first, second and third interval examinations.

Enhancements

None

Operating Experience

Enhanced leakage inspection (with insulation removed) of the SLC nozzle in October, 2002 resulted in no recordable indications. Absence of recordable indications on the SLC nozzle provides evidence that the program is effective for managing cracking of the SLC nozzle.

Liquid penetrant examination of instrument penetration nozzles in May, 2001 resulted in no recordable indications. Absence of recordable indications on the instrument nozzles provides evidence that the program is effective for managing cracking of the instrument penetration nozzles.

As a participant in the BWRVIP, VYNPS is committed to incorporate lessons learned from operating experience of the entire BWR fleet, not just that of VYNPS. BWRVIP inspection criteria and industry OE are evaluated to determine whether the existing program should be modified.

Conclusion

The BWR Penetrations Program has been effective at managing aging effects. The BWR Penetrations Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.5 BWR STRESS CORROSION CRACKING

Program Description

The BWR Stress Corrosion Cracking Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M7, BWR Stress Corrosion Cracking.

The program includes (a) preventive measures to mitigate intergranular stress corrosion cracking (IGSCC), and (b) inspection and flaw evaluation to monitor IGSCC and its effects on reactor coolant pressure boundary components made of stainless steel, CASS, or nickel alloy.

NUREG-1801 Consistency

The BWR Stress Corrosion Cracking Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M7, BWR Stress Corrosion Cracking, with an exception.

Exceptions to NUREG-1801

The BWR Stress Corrosion Cracking Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M7, BWR Stress Corrosion Cracking, with the following exception.

Attributes Affected	Exception
6. Acceptance Criteria	The 1998 edition with 2000 addenda of ASME Section XI, Subsection IWB-3600 is used for flaw evaluation, while NUREG-1801 specifies the 1986 edition of ASME Section XI, Subsection IWB-3600 for flaw evaluation.[1]

Exception Note

1. Since ASME Section XI through the 2003 Addenda has been accept by NRC in 10CFR50.55a paragraph (b) (2) without modification or limitation on use of subsection IWB-3600 from the 1998 edition with 2000 addenda, use of this version for flaw evaluation is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.

Enhancements

None

Operating Experience

Liquid penetrant and ultrasonic examinations of GL 88-01 nozzle safe end welds in May, 2001 and October, 2002 resulted in no recordable indications. Absence of recordable indications on the nozzle safe end welds provides evidence that the program is effective for managing cracking of austenitic stainless steel piping and components. .

Preventative measures for mitigation of cracking, including replacement and modification of austenitic piping and components have been approved by NRC as part of an effective stress corrosion cracking mitigation strategy.

QA assessment in 2001 revealed no issues or findings that could impact effectiveness of the program.

Conclusion

The BWR Stress Corrosion Cracking Program has been effective at managing aging effects. The BWR Stress Corrosion Cracking Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.6 BWR VESSEL ID ATTACHMENT WELDS

Program Description

The BWR Vessel ID Attachment Welds Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M4, BWR Vessel ID Attachment Welds.

The program includes (a) inspection and flaw evaluation in accordance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) BWRVIP-48 and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 (EPRI Report 1008192) to ensure the long-term integrity and safe operation of reactor vessel inside diameter (ID) attachment welds and support pads.

NUREG-1801 Consistency

The BWR Vessel ID Attachment Welds Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M4, BWR Vessel ID Attachment Welds, with an exception.

Exceptions to NUREG-1801

The BWR Vessel ID Attachment Welds Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M4, BWR Vessel ID Attachment Welds, with the following exception.

Attributes Affected	Exception
3. Parameters Monitored/Inspected	Table IWB-2500-1 from the 1998 edition with 2000 addenda of ASME Section XI is used, while NUREG-1801 specifies the 2001 edition with 2002 and 2003 addenda.[1] (Note 1)

Exception Note

1. Since ASME Section XI through the 2003 Addenda has been accept by reference in 10CFR50.55a paragraph (b) (2) without modification or limitation on use of Table IWB-2500-1 from the 1998 edition with 2000 addenda for BWR components, use of this version is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.

Enhancements

None

Operating Experience

Visual inspections of vessel ID attachment welds in October, 2002 resulted in no recordable indications. Absence of recordable indications on vessel attachment welds provides evidence that the program is effective for managing cracking of vessel attachment welds.

NRC inspections in 2002 and 2004 and a self-assessment in 2002 revealed no issues or findings that could impact effectiveness of the program.

Conclusion

The BWR Vessel ID Attachment Welds Program has been effective at managing aging effects. The BWR Vessel ID Attachment Welds Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.7 BWR VESSEL INTERNALS

Program Description

The BWR Vessel Internals Program at VYNPS is comparable to the program described in NUREG-1801, Section XI. M9, BWR Vessel Internals.

The program includes (a) inspection, flaw evaluation, and repair in conformance with the applicable, staff-approved, industry BWR Vessel and Internals Project (BWRVIP) documents, and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure the long-term integrity of vessel internal components.

NUREG-1801 Consistency

The BWR Vessel Internals Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M9, BWR Vessel Internals with exceptions and an enhancement.

Exceptions to NUREG-1801

The BWR Vessel Internals Program at VYNPS is consistent with the program described in NUREG-1801, Section XI.M9, BWR Vessel Internals with the following exceptions.

Attributes Affected	Exceptions
1. Scope of Program 4. Detection of Aging Effects	**Core Shroud** For shroud horizontal welds H1, H2 and H3, VYNPS inspects 18 inches in length in each of the four quadrants from the outside diameter using EVT-1 methods. If cracks are found in a quadrant, the length is expanded in that quadrant to detect 18 inches of unflawed weld. Thus, VYNPS does not meet the BWRVIP-76 requirement to inspect both the outside and inside diameter of the welds and does not meet the requirement to inspect 100% of the length of the welds.[1]

1. Scope of Program 4. Detection of Aging Effects	**Core Plate** VYNPS performs VT-3 inspection of 50% (15) of the top of the core plate rim hold-down bolts every other refueling outage. If access to the lower plenum becomes available, VYNPS plans to perform a VT-3 inspection of accessible rim hold-down bolt bottom locking engagement and accessible aligner pin assemblies. Thus, VYNPS does not meet the BWRVIP-25 requirement to perform enhanced VT-1 from below the core plate of 50% of the hold-down bolts.[2]
1. Scope of Program 4. Detection of Aging Effects	**Core Spray** VYNPS defers inspection of the three inaccessible welds inside each of the two core spray nozzles, and the P9 welds inside the core spray shroud collars, until a delivery system for ultrasonic testing of the hidden welds is developed. Thus, VYNPS does not meet the BWRVIP-18 requirement to perform an ultrasonic inspection of a full target weld set every other refueling outage.[3]
1. Scope of Program 4. Detection of Aging Effects	**Jet Pump Assembly** VYNPS uses EVT-1 inspection of six jet pump welds with UT indications. Thus, VYNPS does not meet guidance implied in BWRVIP-41 that when flaws are identified, subsequent examinations should use the same technique that originally found the flaw.[4] VYNPS defers inspection of jet pump inaccessible welds, until a delivery system for ultrasonic testing of the hidden welds is developed. Thus, VYNPS does not meet the BWRVIP-41 requirement to perform a modified VT-1 of 100% of these welds over two 6-year inspection cycles and 25% per inspection cycle thereafter.[3]

1. Scope of Program 4. Detection of Aging Effects	**Control Rod Drive Housing** VYNPS performed less than 5% of the CRD guide tube weld exams within the first six-year interval. Thus, VYNPS does not meet the BWRVIP-47 requirement to inspect 5% of the CRD guide tube welds within the first six years.[5]
3. Parameters Monitored/Inspected	Table IWB-2500-1 from the 1998 edition with 2000 addenda of ASME Section XI is used, while NUREG-1801 specifies the 2001 edition with 2002 and 2003 addenda.[6]

Exception Notes

1. The core spray spargers cover H1 and H2, and grating covers the periphery of the top guide. Therefore, access to the shroud inside diameter would be through vacated fuel cells, which would result in the camera being too distant from the inspection surfaces to perform an adequate EVT-1 of H1, H2, or H3. Although no BWRVIP guidance is given for one-sided visual examinations of horizontal welds, they are inspected on a six-year frequency following the BWRVIP guidance for a one-sided EVT-1 of vertical welds. The excellent results obtained in the 1995 ultrasonic examination of welds H1, H2, and H3 (very limited indications) and the 1996 ultrasonic examination of the vertical and ring segment welds (no indications) provide additional assurance that a one sided EVT-1 is acceptable.
2. A baseline VT-3 examination of the tops of all 30 bolted connections was performed in 1996. Follow-up VT-3 examinations of tops of 50% of the bolted connections were performed in 1999, 2000 and 2001. None of the exams found evidence of cracking or bolting disassembly. Since the lower bolted connections are similar to the top, and there are no failed connections in the sample that is inspected, it is unlikely that a significant number of failed connections could exist in the remainder of the population. Therefore, the VYNPS inspection plan is adequate for ensuring the structural integrity of the core plate configuration to resist sliding against shear loads.

3. The three core spray thermal sleeve welds in each of the two core spray nozzles are full penetration butt welds, which decreases the likelihood of cracking. Inspection of similar core spray piping welds, such as junction box-to-pipe and upper elbow welds, showed no indication of cracking. Integrity of the P9 welds must be considered because indications have been recorded during ultrasonic examination of collar-to-shroud welds at VYNPS. The P9 welds are creviced. All other creviced core spray welds at VYNPS – the junction box cover plate welds, P1 welds and downcomer sleeve welds – show no indications of cracking. The hidden jet pump welds are far enough into the nozzle that failure at these welds would not result in the thermal sleeve disengaging from the nozzle before the riser contacted the shroud. If the jet pump thermal sleeve or riser piping severed, it would be detected through jet pump monitoring, which alarms if the riser pipe moves more than 10% while at or above a core flow of 42 Mlb/hr. Therefore, deferral of inspection of the inaccessible welds is justified.

4. For jet pump welds, BWRVIP-41 finds EVT-1 or UT to be acceptable examination techniques. In 1996, VYNPS performed UT examinations and recorded indications in six jet pump welds. All six welds were reinspected by UT after two cycles of operation and there were no new indications or growth of existing indications. Since the reinspection demonstrated that there is no active cracking in these welds, and EVT-1 inspection will reveal cracking prior to encroachment on the weld structural integrity limit, performing subsequent inspections using the EVT-1 technique is acceptable. VYNPS will perform the EVT-1 inspections every two cycles until three successive inspections confirm no new indications or growth of existing indications, at which time VYNPS will revert to the six-year inspection interval specified in BWRVIP-41.

5. To meet the BWRVIP-47 requirement to inspect 5% of the CRD guide tube welds within the first six years, VYNPS would have to inspect five guide tubes. Four CRD guide tube assemblies were inspected during the first six-year period, for a total of 4.5% of the welds. The inspections began in RFO 22 (2001), when four guide tube assemblies were inspected, and were expected to be completed during RFO 23 (2002). Control blade change-out allows access to the interior of the CRD guide tube and, typically, there are between three and ten blade change-outs each outage. However, no control blades were changed during RFO 23. Inspecting one guide tube during RFO 23 to attain the 5% sample level would have required vacating an additional fuel cell (more fuel moves) and an added three hours for disassembly and reassembly (not counting inspection time). This hardship is not justified in terms of safety in order to raise the inspection sample from 4.5% to 5%. The BWRVIP-47 requirement to inspect 10% of the CRD guide tubes over the first twelve years will be met.

6. Since ASME Section XI through the 2003 Addenda has been accept by reference in 10CFR50.55a paragraph (b) (2) without modification or limitation on use of Table IWB-2500-1 from the 1998 edition with 2000 addenda for BWR components, use of this version is appropriate to assure that components crediting this program can perform their intended function consistent with the current licensing basis during the period of extended operation.

Enhancements

The following enhancement will be initiated prior to the period of extended operation.

Attributes Affected	Enhancement
1. Scope of Program	The VYNPS top guide fluence is projected to exceed the threshold for IASCC ($5x10^{20}$ n/cm^2) prior to the period of extended operation. Therefore, ten (10) percent of the top guide locations will be inspected using enhanced visual inspection technique, EVT-1, within the first 12 years of the period of extended operation, with one-half of the inspections (50 percent of locations) to be completed within the first 6 years of the period of extended operation. Locations selected for examination will be areas that have exceeded the neutron fluence threshold.

Operating Experience

Cracking of jet pump riser welding (RS-1) was discovered during 1998 inspections. Subsequent inspection showed no new indications or growth of existing indications. Also, potential core spray piping weld flaws were identified during ultrasonic examination in 2001. Indications were evaluated in accordance with BWRVIP-18 evaluation criteria and found to be acceptable. This OE provides evidence that the program is effective at managing the effects of cracking on the intended function of applicable components.

Visual inspections of reactor vessel internals in 2004 revealed no new age-related indications. Absence of new indications provides evidence that the program is effective at managing the effects of aging on the intended function of applicable components.

NRC inspections, self-assessments, QA audits, and evaluations of industry OE from 1999 through 2004 revealed no issues or findings that could impact effectiveness of the program.

Conclusion

The BWR Vessel Internals Program has been effective at managing aging effects. The BWR Vessel Internals Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.29 THERMAL AGING AND NEUTRON IRRADIATION EMBRITTLEMENT OF CAST AUSTENITIC STAINLESS STEEL (CASS)

Program Description

The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program at VYNPS will be comparable to the program described in NUREG-1801, Section XI.M13, Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS).

The purpose of the Thermal Aging and Neutron Irradiation Embrittlement of CASS Program is to assure that reduction of fracture toughness due to thermal aging and reduction of fracture toughness due to radiation embrittlement will not result in loss of the intended function. This program will evaluate CASS components in the reactor vessel internals and require non-destructive examinations as appropriate.

EPRI, the BWR Owners Group and other industry groups are focused on reactor vessel internals to ensure a better understanding of aging effects. Future Boiling Water Reactor Vessel Internals Project (BWRVIP) reports, EPRI reports, and other industry operating experience will provide additional bases for evaluations and inspections under this program. This program will supplement reactor vessel internals inspections required by the BWR Vessel Internals Program to assure that aging effects do not result in loss of the intended functions of reactor vessel internals during the period of extended operation.

The program will be initiated prior to the period of extended operation.

NUREG-1801 Consistency

The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program will be consistent with the program described in NUREG-1801, Section XI.M13, Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program is a new program for which there is no operating experience.

Conclusion

The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program will use existing techniques with demonstrated capability and a proven industry record to provide reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.