UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
245 PEACHTREE CENTER AVENUE NE, SUITE 1200
ATLANTA, GEORGIA 30303-1257

December 4, 2017

Ernest J. Kapopoulos, Jr.
Site Vice President
H.B. Robinson Steam Electric Plant
Duke Energy
3581 West Entrance Road, RNPA01
Hartsville, SC 29550

SUBJECT: H.B. ROBINSON STEAM ELECTRIC PLANT - NRC DESIGN BASES ASSURANCE INSPECTION (PROGRAMS) REPORT NUMBER 05000261/2017007

Dear Mr. Kapopoulos:

On October 20, 2017, the U.S. Nuclear Regulatory Commission (NRC) completed onsite inspection activities at your H. B. Robinson Steam Electric Plant Unit 2. On October 31, 2017, the NRC inspectors discussed the results of this inspection with you and other members of your staff. Additional inspection results were discussed with you and other members of your staff on November 21, 2017. The results of this inspection are documented in the enclosed report.

NRC inspectors documented three findings of very low safety significance (Green) in this report. These findings involved violations of NRC requirements. The NRC is treating these violations as non-cited violations (NCVs) consistent with Section 2.3.2.a of the Enforcement Policy.

If you contest the violations or significance of these NCVs, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region II; the Director, Office of Enforcement; and the NRC resident inspector at the H. B. Robinson Steam Electric Plant.

If you disagree with a cross-cutting aspect assignment in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region II; and the NRC resident inspector at the H. B. Robinson Steam Electric Plant.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at http://www.nrc.gov/reading-rm/adams.html and at the NRC Public Document Room in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

Shakur A. Walker, Chief
Engineering Branch 1
Division of Reactor Safety

Docket No.: 50-261
License No.: DPR-23

Enclosure:
Inspection Report 05000261/2017007
w/Attachment: Supplemental Information

cc: Distribution via ListServ

SUBJECT: H.B. ROBINSON STEAM ELECTRIC PLANT - NRC DESIGN BASES ASSURANCE INSPECTION (PROGRAMS) REPORT NUMBER 05000261/2017007 DATED DECEMBER 4, 2017

Distribution:
G. Ottenberg, RII
T. Fanelli, RII
M. Greenleaf, RII
L. Suggs, RII
S. Walker, RII
PUBLIC

☒ PUBLICLY AVAILABLE ☐ NON-PUBLICLY AVAILABLE ☐ SENSITIVE ☒ NON-SENSITIVE

ADAMS: ☒ Yes ACCESSION NUMBER:___MLXXXXXXXXX_____ ☒ SUNSI REVIEW COMPLETE ☒ FORM 665 ATTACHED

OFFICE	RII:DRS	RII:DRS	RII:DRS	RII:DRP	RII:DRS		
SIGNATURE	**VIA EMAIL**	**VIA EMAIL**	**VIA EMAIL**	**VIA EMAIL**	**SAW4**		
NAME	GOTTENBERG	TFANELLI	MGREENLEAF	LSUGGS	SWALKER		
DATE	12/1/2017	12/1/2017	12/1/2017	12/4/2017	12/4/2017		
E-MAIL COPY?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO

OFFICIAL RECORD COPY DOCUMENT NAME: S:\DRS NEW\ENG BRANCH 1\BRANCH INSPECTION FILES\2017-2018-2019 CYCLE INSPECTION FOLDER FOR ALL SITES\ENG PROGRAMS\ROBINSON EQ 2017\REPORT\ROB EQ INSPECTION REPORT 2017007.DOCX

U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket No.: 050000261

License No.: DPR-23

Report No.: 05000261/2017007

Licensee: Duke Energy Progress, LLC.

Facility: H. B. Robinson Steam Electric Plant, Unit 2

Location: 3581 West Entrance Road
Hartsville, SC 29550

Dates: October 2 – October 20, 2017

Inspectors: G. Ottenberg, Senior Reactor Inspector (Lead)
T. Fanelli, Senior Reactor Inspector
M. Greenleaf, Reactor Inspector

Approved by: Shakur A. Walker, Chief
Engineering Branch 1
Division of Reactor Safety

Enclosure

SUMMARY

IR 05000261/2017-007; 10/02/2017 – 10/20/2017; Duke Energy Progress, LLC., H. B. Robinson Steam Electric Plant, Unit 2; Design Bases Assurance Inspection (Programs)

The onsite inspection activities described in this report were performed between October 2 and October 20, 2017, by three Nuclear Regulatory Commission (NRC) inspectors from Region II. The significance of inspection findings are indicated by their color (i.e., greater than Green, or Green, White, Yellow, or Red) and determined using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process," (SDP) dated April 29, 2015. Cross-cutting aspects are determined using IMC 0310, "Aspects Within the Cross-Cutting Areas," dated December 4, 2014. All violations of NRC requirements were dispositioned in accordance with the NRC's Enforcement Policy dated November 1, 2016. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 6.

NRC-Identified and Self-Revealing Findings

Cornerstone: Mitigating Systems

Green. The NRC identified a non-cited violation of Title 10 of the Code of Federal Regulations (10 CFR) Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," for the licensee's failure to establish a qualified life for the motors covered by Environmental Qualification Documentation Package (EQDP)-0803 in accordance with their administrative procedure AD-EG-ALL-1612, "Environmental Qualification (EQ) Program." Specifcally, the licensee did not correctly establish a qualified life for the motors covered by EQDP-0803 due to a calculational error. In response to the issue, Robinson staff placed the issue in their corrective action program as NCRs 2155050 and 2158467, and demonstrated operability by removing conservatisms regarding assumptions for cumulative energized time of the motors. Additionally, the licensee plans to replace the affected motors.

This performance deficiency was more than minor because it was associated with the Equipment Performance attribute of the Mitigating Systems Cornerstone, and adversely affected the cornerstone objective of ensuring availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, not establishing the correct qualified life for the motors resulted in a reduction in margin that impacted the reliability of the equipment. The team determined the finding to be of very low safety significance (Green) because the finding was a deficiency affecting the design or qualification of a mitigating structure, system, or component (SSC), and the SSC maintained its operability or functionality. The inspectors determined that the finding was indicative of current licensee performance, because the error occurred on June 28, 2017. A cross-cutting aspect of Documentation [H.7] in the Human Performance Area was assigned because the organization did not create and maintain complete, accurate and up to-date documentation. (Section 1R21.b.1)

Green. The NRC identified a non-cited violation of 10 CFR Part 50.49, "Environmental qualification of electric equipment important to safety for nuclear power plants," for the licensee's failure to correctly identify the maintenance required to maintain the core exit thermocouple reference junction box in a qualified state. Specifically, the licensee did not identify that the qualifying entity required that the cover O-ring be replaced on a 5 year frequency in addition to being replaced any time the junction box cover was removed, and due

to this, the O-rings have not been replaced since original installation. In response to the issue, Robinson staff placed the issue in their corrective action program as NCRs 2157897 and 2161580, and demonstrated operability via analysis of the qualification test results.

This performance deficiency was more than minor because it was associated with the Equipment Performance attribute of the Mitigating Systems Cornerstone, and adversely affected the cornerstone objective of ensuring availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, not maintaining the equipment in its qualified configuration affected its reliability. The inspectors determined the finding to be of very low safety significance (Green) because the finding was a deficiency affecting the design or qualification of a mitigating structure, system, or component (SSC), and the SSC maintained its operability or functionality. A cross-cutting aspect was not assigned because the finding was not indicative of current licensee performance. (Section 1R21.b.2)

Green. The NRC identified a non-cited violation of 10 CFR Part 50.49, "Environmental qualification of electric equipment important to safety for nuclear power plants," for the licensee's failure to correctly determine the most severe composition of chemicals for containment spray for the purposes of environmental qualification of equipment in containment. Specifically, the licensee did not identify that the pH of the chemical spray could have been more severe than what was identified in the Environmental Qualification zone maps if the Spray Additive Tank (SAT) had been operated at its limits provided in procedures CP-001 and OST-023. In response to this issue, the licensee placed the issue into their corrective action program as NCR 2162081, demonstrated operability by reviewing current and historical operating conditions of the tank, and implemented administrative controls to prevent exceeding the qualified pH limit.

This performance deficiency was more than minor because if left uncorrected, the performance deficiency had the potential to lead to a more significant safety concern. Specifically, the containment spray pH could have exceeded the pH to which equipment inside containment was qualified, if the SAT had been operated at its procedural limits. The inspectors determined the finding to be of very low safety significance (Green) because the finding was a deficiency affecting the design or qualification of a mitigating structure, system, or component (SSC), and the SSC maintained its operability or functionality. A cross-cutting aspect was not assigned because the finding was not indicative of current licensee performance. (Section 1R21.b.3)

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Mitigating Systems, Barrier Integrity

1R21 Design Bases Assurance Inspection (Programs) (71111.21N)

a. Inspection Scope

The inspectors performed an inspection conducted as outlined in NRC Inspection Procedure (IP) 71111.21N, Attachment 1, "Environmental Qualification (EQ) under 10 CFR 50.49 Programs, Processes, and Procedures." The inspectors assessed H. B. Robinson's implementation of the site EQ program as required by 10 CFR 50.49, "Environmental qualification of electric equipment important to safety for nuclear power plants." The inspectors evaluated whether H. B. Robinson staff properly maintained the EQ of electrical equipment important to safety throughout plant life, established and maintained required EQ documentation records, and implemented an effective corrective action program to identify and correct EQ related deficiencies.

The inspection included review of EQ program procedures, component EQ files, test records, equipment maintenance and operating history, maintenance and operating procedures, vendor documents, design documents, and calculations. The inspectors interviewed program owners, engineers, and warehouse staff. The inspectors performed in-plant walkdowns (where accessible) to verify equipment was installed as described in H. B. Robinson's EQ component documentation files; and that the components were installed in their tested configuration. Additionally, the inspectors performed in-plant walkdowns to determine whether equipment surrounding the EQ component could fail in a manner that could prevent the safety function of the components, and to verify that components located in areas susceptible to a high energy line break were properly evaluated for operation in a harsh environment. The inspectors reviewed and inspected the storage of replacement parts and associated procurement records to verify EQ parts approved for installation in the plant were properly identified and controlled, and that storage and environmental conditions did not adversely affect the components' qualified lives. Documents reviewed are listed in the Attachment.

The inspection procedure requires the inspectors to select six to ten components to assess the adequacy of the EQ program. The inspectors selected six components for this inspection, three of which were located inside containment. Component samples selected for this inspection are listed below:

- FT-425, RCS Loop B Flow Transmitter
- SV-A58C, V12-9 CV Purge Solenoid Valve
- PENETR-C-8, Electrical Penetration C-08
- PCV-1716-LS-C, PCV-1716 Closed Limit Switch
- HVH-6A-MTR, HVH Safety Injection Pump Area Cooling Unit Motor
- BX-150, Core Exit T/C Reference Junction Box

b. Findings

.1 Failure to Correctly Determine Qualified Life

Introduction: The NRC identified a Green, non-cited violation (NCV) of Title 10 Code of Federal Regulations (CFR) Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," for the licensee's failure to establish a qualified life for the motors covered by Environmental Qualification Documentation Package (EQDP)-0803 in accordance with their administrative procedure AD-EG-ALL-1612, "Environmental Qualification (EQ) Program."

Description: During the inspection, the inspectors observed that the licensee used a value of 536 hours as the accelerated thermal aging time in their calculation that determined the qualified life of the Westinghouse motors in EQDP-0803. This EQDP applied to the HVH-06A/B (safety injection/containment spray pump room) and the HVH-8A/B (residual heat removal pit) room cooler fan motors. The actual accelerated thermal aging time that was performed prior to the qualification testing was 336 hours. It appeared this discrepancy was due to an error in translation of the aging time from the test report to the EQDP calculation when revision 4 to the calculation was performed on June 28, 2017. The inspectors further noted that the licensee's administrative procedure AD-EG-ALL-1612, "Environmental Qualification (EQ) Program," revision 1, required in section 5.9.4, "EQDPs and QDPs Template," substep (13) that "The EQDP or QDP shall: Establish a qualified life for each component." Implicit in this requirement was that it was established correctly, without translational errors from the test report.

Upon notification of discovery of this error, the licensee recalculated the qualified life for each of the HVH-6A/B and the HVH-8A/B motors. The recalculation for the HVH-6A/B motors resulted in a decrease in calculated qualified life from ~209 years to 131 years. The recalculation for the HVH-8A/B motors resulted in a decrease in calculated qualified life from ~54.9 years to 32.8 years. Because this reduction in the calculated qualified life resulted in the installed equipment (HVH-8A/B motors) being beyond their calculated qualified life, Robinson staff removed some conservatisms in the calculation regarding the assumptions for how long the motors have been energized during their installed lifetimes. Motor energization time affects the aging characteristics of the motors. Following the recalculation that removed the conservatism, the licensee determined that the calculated qualified life of the HVH-8A/B motors had been reduced to 54.5 years. The change in the assumed motor energization times reduced the margin (~40% based on the assumed run time) that had previously been present in the qualification of motors due to the conservative assumptions; however, the calculation change demonstrated operability of the equipment. Additionally, the licensee plans to replace the affected motors.

Analysis: The inspectors determined that the licensee's failure to establish a qualified life in accordance with their administrative procedure AD-EG-ALL-1612, "Environmental Qualification (EQ) Program," was a performance deficiency and a failure to meet 10 CFR 50, Appendix B, Criterion V. Specifically, the licensee did not correctly establish a qualified life for the motors covered by EQDP-0803. This performance deficiency was more than minor because it was associated with the Equipment Performance attribute of the Mitigating Systems Cornerstone, and adversely affected the cornerstone objective of ensuring availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, not establishing the correct qualified

life for the motors resulted in a reduction in margin that impacted the reliability of the equipment.

The inspectors used Inspection Manual Chapter (IMC) 0609, Att. 4, "Initial Characterization of Findings," issued October 7, 2016, for the Mitigating Systems cornerstone, and IMC 0609, App. A, "The Significance Determination Process (SDP) for Findings At-Power," issued June 19, 2012, and determined the finding was of very low safety significance (Green) because the finding was a design or qualification deficiency of a mitigating SSC, and the SSC maintained its operability.

The inspectors determined that the finding was indicative of current licensee performance, because the error occurred on June 28, 2017. A cross-cutting aspect of Documentation [H.7.] in the Human Performance Area was assigned because the organization did not create and maintain complete, accurate and up to-date documentation. Specifically, the licensee did not create and maintain accurate documentation of the calculated qualified life of the motors in EQDP-0803.

Enforcement: Title 10 CFR 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," requires, in part, that, "Activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings." Contrary to the above, since June 28, 2017, the licensee did not accomplish an activity affecting quality in accordance with documented instructions, procedures, or drawings. Specifically, the licensee did not establish an appropriate qualified life for each component in accordance with administrative procedure AD-EG-ALL-1612. In response to this issue, the licensee recalculated the qualified life of the motors using the correct accelerated thermal aging time, and plans to replace the affected motors. This violation is being treated as an NCV consistent with section 2.3.2.a. of the Enforcement Policy. The violation was entered into the licensee's corrective action program as NCRs 2155050 and 2158467. (NCV 05000261/2017007-01, "Failure to Correctly Determine Qualified Life")

.2 Failure to Perform Required O-ring Replacement to Maintain Qualification

Introduction: The NRC identified a Green NCV of 10 CFR 50.49, "Environmental qualification of electric equipment important to safety for nuclear power plants," for the licensee's failure to correctly identify the maintenance required to maintain the core exit thermocouple reference junction box in a qualified state.

Description: During the inspection, the inspectors observed that the licensee incorrectly identified the required maintenance for the cover O-ring associated with Junction Box BX-150, Core Exit Thermocouple junction box. Specifically, the activities the licensee believed to be required to maintain environmental qualification were identified in TMM-036, "Environmentally Qualified (EQ) Electrical Equipment Required Maintenance," revision 44. This document discussed the EQ required maintenance for the junction box in section 10.9 and only identified "Anytime the enclosure door is opened, the O-ring must be replaced." However, the qualifying entity, Westinghouse, identified in WCAP-8687, Supplement 2, section 5.1.1 Thermal Aging (Phase II) that "Since the actual test time was 26 hours, the qualified life in the generic program will be limited to 5 years." Additionally, section 6.4, Irradiation (Phase II) stated, "As specified in reference 4, section 1.4, the cover O-ring should be replaced every 5 years or each time the T/C RJB

is opened." The inspectors noted reference 4 was "Equipment Qualification. Data Package: Incore Thermocouple Reference Junction Box, WCAP-8587 Supplement 1, EQDP-ESE-44A (Non-Proprietary)." In EQDP-ESE-44A, section 1.4, the replacement schedule for the O-rings to maintain qualification of the junction box was specified as the following: "The enclosure O-ring is to be replaced every 5 years or each time the cover is opened." While 26 hours of accelerated aging would have correlated to over 70 years of service, the limitation to 5 years as described in EQDP-ESE-44A accounts for the uncertainties associated with such a short duration, high temperature, accelerated aging test.

Robinson did not correctly identify that the O-rings required replacement on a 5 year frequency, and due to this, the O-rings have not been replaced since original installation. This error required operability to be reviewed and in response to this issue, the licensee determined that since the O-ring survived aging, irradiation, accident, and post-accident conditions, the O-ring qualification testing demonstrated operability.

Analysis: The inspectors determined that the licensee's failure to correctly identify the maintenance required to maintain the core exit thermocouple reference junction box in a qualified state was a performance deficiency and a failure to meet 10 CFR 50.49. Specifically, the licensee did not identify that the qualifying entity required that the cover O-ring be replaced on a 5 year frequency in addition to being replaced any time the junction box cover was removed, and due to this, the O-rings have not been replaced since original installation. This performance deficiency was more than minor because it was associated with the Equipment Performance attribute of the Mitigating Systems Cornerstone, and adversely affected the cornerstone objective of ensuring availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, not replacing the O-ring in accordance with the qualification test report did not maintain the reliability of the O-ring to perform its sealing function when called upon during a design basis accident; as the uncertainties associated with a short duration, high temperature aging regime, was no longer being accounted for as required by the test report.

The inspectors used IMC 0609, Att. 4, "Initial Characterization of Findings," issued October 7, 2016, for the Mitigating Systems cornerstone, and IMC 0609, App. A, "The Significance Determination Process (SDP) for Findings At-Power," issued June 19, 2012, and determined the finding was of very low safety significance (Green) because the finding was a design or qualification deficiency of a mitigating SSC, and the SSC maintained its operability. Specifically, the failure to replace the O-ring every 5 years as required was a qualification deficiency, and the licensee's evaluation demonstrated its operability. The inspectors determined the finding was not indicative of current licensee performance, and did not assign a cross-cutting aspect.

Enforcement: Title 10 CFR 50.49 requires, in part, that, "The electric equipment qualification program must include and be based on the following: (5) Aging…The equipment must be replaced or refurbished at the end of this designated life unless ongoing qualification demonstrates that the item has additional life." Contrary to the above, since the requirement for the 5 year replacement requirement was introduced, the licensee did not replace or refurbish the O-rings, as required, at the end of their designated life, and did not perform ongoing qualification that demonstrated the item had additional life. In response to this issue, the licensee reviewed the test documentation and determined that since the O-ring survived aging, irradiation, accident, and post-

accident conditions, the O-ring qualification testing demonstrated operability. This violation is being treated as an NCV consistent with section 2.3.2.a. of the Enforcement Policy. The violation was entered into the licensee's corrective action program as NCRs 2157897, and 2161580. (NCV 05000261/2017007-02, "Failure to Perform Required O-ring Replacement to Maintain Qualification")

.3 Failure to Determine Most Severe Containment Spray pH

Introduction: The NRC identified a Green NCV of 10 CFR 50.49, "Environmental qualification of electric equipment important to safety for nuclear power plants," for the licensee's failure to correctly determine the most severe composition of chemicals for containment spray for the purposes of environmental qualification of equipment in containment.

Description: During the inspection, the inspectors requested information regarding the maximum pH expected for design basis accidents. The licensee provided calculation RNP-M/MECH-1792 which utilized design basis inputs (technical specifications limits and administrative limits) to determine the highest possible pH that could be allowed by procedure and specification. The calculation concluded that the containment spray pH could be as high as 12.8 during recirculation mode of operation. The inspectors noted that the max pH described in the EQ zone maps, indicated on drawing series HBR2-11260, was 10.5 for equipment inside containment based on the station's administrative limits for the Spray Additive Tank (SAT) level and sodium hydroxide (NaOH) concentration. The inspectors also observed that the Technical Specification Bases for the Spray Additive System, and the Updated Final Safety Analysis Report (UFSAR) section 3.1.5.1, "Chemical Environment," indicated that containment spray pH could range from 8.5- 11 during the recirculation mode of operation, and further identified that equipment inside containment was qualified to less than this value (10.5 based on the EQ zone maps). During follow-up to this concern, the licensee determined that the administrative limits in procedures CP-001, "Chemistry Monitoring Program" and OST-023, "Monthly Surveillances," could have allowed the containment spray pH to exceed the 10.5 stated in the EQ zone maps if the SAT were to be placed in operation at the high limits for tank level and NaOH concentration. During the inspection, the licensee confirmed that the SAT was currently, and has historically been, below the NaOH concentration that would keep the containment spray solution pH below 10.5. Upon discovery, the licensee implemented administrative controls to prevent exceeding the qualified pH limit.

Analysis: The inspectors determined that the licensee's failure to correctly determine the most severe composition of chemicals for containment spray for the purposes of EQ of equipment inside containment was a performance deficiency and a failure to meet 10 CFR 50.49. Specifically, the licensee did not identify that the pH of the chemical spray could have been more severe than what was identified in the EQ Zone Maps if the SAT had been operated at its limits provided in procedures CP-001 and OST-023. This performance deficiency was more than minor because if left uncorrected, the performance deficiency had the potential to lead to a more significant safety concern. Specifically, the containment spray pH could have exceeded the pH to which equipment inside containment was qualified, if the SAT had been operated at its procedural limits.

The inspectors used IMC 0609, Att. 4, “Initial Characterization of Findings,” issued October 7, 2016, for the Mitigating Systems cornerstone, and IMC 0609, App. A, “The Significance Determination Process (SDP) for Findings At-Power,” issued June 19, 2012, and determined the finding was of very low safety significance (Green) because the finding was a design or qualification deficiency of a mitigating SSC, and the SSC maintained its operability. Specifically, the failure to correctly determine the most severe composition of chemicals for containment spray was a qualification deficiency, and the licensee demonstrated its operability by reviewing current and historical operating conditions of the tank. The inspectors determined the finding was not indicative of current licensee performance, and did not assign a cross-cutting aspect.

Enforcement: Title 10 CFR 50.49(e)(3), “Chemical effects” required, in part, that “The composition of chemicals used must be at least as severe as that resulting from the most limiting mode of plant operation (e.g., containment spray, emergency core cooling, or recirculation from containment sump).” Contrary to the above, since at least the issuance of calculation RNP-M/MECH-1792 (Nov 20, 2006), the licensee did not use a concentration of chemicals at least as severe as that resulting from the most limiting mode of plant operation to qualify the equipment inside containment. Specifically, the equipment was not qualified to the most severe pH that could exist if the SAT level and NaOH concentration were as high as station procedures allowed. In response to this issue, the licensee demonstrated the equipment operability by reviewing current and historical operating conditions of the tank and implemented administrative controls to prevent exceeding the qualified pH limit. This violation is being treated as an NCV consistent with section 2.3.2.a. of the Enforcement Policy. The violation was entered into the licensee’s corrective action program as NCR 2162081. (NCV 05000261/2017007-03, “Failure to Determine Most Severe Containment Spray pH”)

.4 (Opened) Unresolved Item, Crouse-Hinds Qualification and Life Extension

Introduction: The inspectors identified an unresolved item (URI) involving three separate concerns that could affect the qualification of Robinson’s Crouse-Hinds (C-H) electrical penetration assemblies (EPAs). First, the inspectors were concerned that a similarity analysis, which fulfilled the requirements of Commission memorandum and Order CLI 80-21, “In the matter of Petition for Emergency and Remedial Action,” and 10 CFR 50.49, “Environmental Qualification for Electric Equipment Important to Safety for Nuclear Power Plants,” may not have been completed. Second, the inspectors were concerned that Robinson may not have demonstrated that the penetration’s electrical performance specifications were met using appropriate IEEE standards, as stated in the UFSAR. Third, the inspectors were concerned that the licensee may not have used appropriate methods when extending the qualified life of the C-H EPAs.

Description:

(1) In Robinson’s initial Bulletin 79-01 response dated June 1980, to justify the qualification of the C-H EPAs by similarity, Robinson submitted a Westinghouse (WEC) qualification report AB-11/12/73, “Qualification Tests for a Modular Penetration 5” dia. (Prototype B1),” obtained from Brunswick nuclear station; a record of a phone conversation between Robinson and WEC, CPL-77-550, dated 11/29/1977; and a WEC design specification for the C-H EPAs, CPL-R2-E3, dated 6/26/1968. In the technical evaluation report (TER) dated July 8, 1982, that accompanied the NRC staff safety evaluation report (SER) dated January 5, 1983,

regarding the Robinson EQ Program, the C-H EPAs qualification was identified as Category IV "Documentation Not Available." In the 1982 TER and NRC SER, these specific submitted documents were listed as reviewed and, the qualification of the C-H EPAs remained Category IV. In a licensee letter, dated March 2, 1984, the licensee documented a meeting with the NRC staff discussing Robinson's proposed methods of resolution for each of the EQ deficiencies identified. Robinson appeared to commit to documenting a similarity analysis between their C-H manufactured EPAs and other similar EPAs found acceptable by the NRC staff. In the 1985 final NRC SER, the staff found Robinson's proposed method of resolution specified in the March 2, 1984 letter, acceptable. However, the 1984 submittal summarized a January 18, 1984 meeting with NRC where it was stated the NRC would not perform any additional equipment review and it was left up to the utility to state the adequacy of the documentation.

During the inspection, Robinson provided the documents originally submitted (AB-11/12/73, CPL-77-550, and CPL-R2-E3) to the inspectors to justify qualification by similarity. The inspectors had concerns with these documents justifying similarity between the WEC and C-H EPAs.

a) In a review of AB-11/12/73 and comparing it to what was known about the C-H EPAs, the inspectors identified that the materials used in the WEC EPAs were not identical or sufficiently similar in material composition or performance specifications. The WEC tested EPAs used silicone rubber O-rings, a proprietary WEC composition "Q" epoxy resin potting material as the internal filler, and had a 5" diameter. The C-H EPAs did not use O-rings, used room temperature vulcanized (RTV) silicone rubber potting material as the internal filler, a thin layer of Sty-Cast epoxy resin to seal the end opening exposed to a DBA, and has an approximately 11" diameter.

b) The inspectors noted the performance requirements demonstrated by the WEC pressure tests did not appear to envelope the required Robinson DBA pressure performance. The WEC maximum pressure only developed 1286.9lbf at 105psig, and the C-H EPA would develop 3955.2lbf at 42 psig. The affects of the more substantial forces on the C-H EPAs was not addressed.

c) In the review of specification, CPL-R2-E3, the inspectors noted that specification CPL-R2-E3 was actually an EBASCO specification rather than a WEC specification as had been stated, and that C-H had taken exception to the specification due to chemical incompatibilities between the RTV potting material and cable insulations specified by EBASCO. Many of the Robinson documents still specify these incompatible cable insulations for use with the C-H EPAs without justification.

d) In the review of CPL-77-550, the inspectors noted that the record of the phone call did not have any suitably specific information that could justify similarity to the C-H in materials, performance specifications, or manufacturing methods.

The inspectors are concerned that Robinson was unable to provide an acceptable similarity analysis to address the deviations between the tested and installed EPAs. The licensee entered this concern into their corrective action program as NCR 2161911, and determined the equipment was operable.

(2) Robinson's UFSAR Section 3.8.1.2 stated, in part, that "electrical penetrations are designed and demonstrated by test to withstand, without loss of leak tightness, the containment post-accident environment and to meet the National Electric Code, IEEE - Proposed Guide for Electrical Penetration Assemblies in Containment Structures for Stationary Nuclear Power Reactors or subsequent issues of this standard, IEEE Electric Penetration Assemblies in Containment Structure for Nuclear Power Generating Stations" [IEEE 317]. In accordance with the IEEE 317 versions reviewed from 1971 to 1976, the performance requirements are to be met by test during all conditions from mild plant conditions (normal) to the most limiting environmental conditions produced during DBAs (accident), and post-accident conditions. When asked to provide the test documentation that met these original requirements, Robinson was not able to provide them. In addition, the inspectors noted that electrical calculation RNP-E-5.30, "Crouse-Hinds Electrical Penetration Ampacity, Short Circuit, and Heat Generation Calculation," revision 6, indicated that the current plant design exceeded the electrical performance specification for some of the C-H EPAs, and thus these EPAs would not meet the UFSAR and IEEE 317 specifications.

The inspectors requested evidence that Robinson met the required verifications testing specified in the UFSAR Section 3.8.1.2, and that those test conditions are bounding of the current electrical plant design described in RNP-E-5.30. The inspectors are concerned that Robinson may not be in conformance with statements in the UFSAR and 10 CFR 50, Appendix B, Criterion III, Design Control, which required, in part, that "the design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program." The licensee entered this issue into their corrective action program as NCRs 2159165 and 2164589.

(3) The inspectors identified two concerns with the way Robinson extended the qualified life of the C-H EPAs. First, Robinson reverse calculated an activation energy which appears to be outside of known acceptable Arrhenius techniques. Second, Robinson derived activation energies from EPAs with materials that were not the same as in the C-H EPAs. The inspectors noted that the Division of Operating Reactors (DOR) guidelines, "Guidelines for Evaluating Qualification of Class 1E Electrical Equipment in Operating Reactors," and NUREG 0588 both accepted Arrhenius techniques as acceptable methods for determining the qualified lives of components, and required that the materials be identical or be justified by analysis.

For the first concern, UFSAR Section 3.11.3, "Qualification Tests Results," specified the EQDPs contained the qualification justification analysis for EQ components. The EQDP-0900, for the C-H EPA, credited the WEC EQ report AB-11/12/73 for thermal aging life calculation. The WEC EQ report applied Arrhenius techniques in accordance with IEEE 98-1972, "IEEE Standard for the Preparation of Test Procedures for the Thermal Evaluation of Solid Electrical Insulating Materials," and IEEE 101-1972, "IEEE Guide for the Statistical Analysis of Thermal Life Test Data." The WEC EQ report indicated that they had determined an activation energy and the confidence bounds, but they did not include this information or the data used to derive it. The omitted information would be required to identify the limitations of what WEC had derived for their thermal aging. To derive the pseudo activation energy and extend the life of the C-H EPAs' from 40 to 60 years, Robinson applied

an Arrhenius equation and discounted the limitations involved with using the Arrhenius extrapolation techniques as specified in known quality standards.

For the second concern, the inspectors determined that there were material deviations between the WEC and C-H EPAs that could potentially invalidate the pseudo activation energy Robinson derived. Robinson derived a 1.018eV activation energy, when the silicone RTV known to be used in construction of the C-H EPA had a more limiting activation energy of 0.63eV. The 0.63eV would have significant negative effect on the qualified life of the C-H EPA, invalidating the life extension and current EQ status.

In addition, the inspectors noted that in the Robinson license renewal application and safety evaluation report, NUREG 1785, Section 4.4.1.1, "Summary of Technical Information in the Application," the licensee appeared to commit to using the Arrhenius method, as described in Electric Power Research Institute (EPRI) NP-1558, "A Review of Equipment Aging Theory and Technology." The inspector noted that NP-1558 was not a quality standard as required by general design criteria 1 and 10 CFR 50.54(jj); however, its use would have likewise invalidated the WEC information for the C-H life extension.

The inspectors are concerned that despite the specifications in the IEEE quality standards and the information in EPRI report NP-1558, Robinson extrapolated an invalid qualified life for the EPAs possibly making them unqualified to withstand a DBA. The licensee entered this concern into their corrective action program as NCR 2164567.

This URI is opened to determine if a performance deficiency or a violation exists. To resolve the various aspects of this URI, the inspectors need: (1) Actual material and performance specification similarity analysis or confirmation of licensing basis; (2) The documented verification testing that satisfies statements in UFSAR 3.8.1.2, and confirmation that the electrical performance specifications tested are bounding of the current plant design; and 3) Confirmation that the actual penetration materials needed to be used when extending the qualified life, and what is required for appropriate application of Arrhenius techniques. (URI 05000261/2017007-04, "Crouse-Hinds Qualification and Life Extension")

.5 (Opened) Unresolved Item, Questions Regarding EQDP-0401 Method Used to Determine Activation Energy and Responsibility for Verification

Introduction: The inspectors identified a URI concerning Robinson's requirement to verify the qualification of components (e.g., Rosemount transmitters) required to meet 10 CFR 50.49.

Description: The Rosemount transmitters' EQ described by Robinson EQDP-0401, referenced Wyle test report 45592-3 for qualification, which referenced NUREG 0588 Category 1 requirements. The Wyle report, Table III "Aging Matrix," identified electronic components along with their respective activation energies (eV) and the references that identified the source of this information. The report specified that thin film metal resistors were the most limiting of these components. The reference for the thin film metal resistor activation energy was an IEEE white paper published in 1965, "The Determination and Application of Aging Mechanisms Data in Accelerated Testing of

Selected Semiconductors, Capacitors and Resistors." The validity of Wyle's determination of activation energies was in question because their methods had not been validated, as stated in the IEEE white paper. The inspectors reviewed the other components in Table III of the Wyle report to verify what components were more limiting and determined that the metal film resistors were not the most limiting. The inspectors identified that the activation energy in the Wyle report for transistors was for metal enclosed transistors, 1.02eV, but the transistors used in the transmitter construction were actually plastic enclosed transistors with activation energies ranging from 0.5eV to 0.66eV. The transmitters used some carbon resistors that were more limiting than metal film resistors and were more sensitive to radiation synergisms. Further, the information in the IEEE white paper seemed to indicate a phase change with an associated more limiting activation energy in the range of the normal plant environmental temperatures. The licensee appeared to not have evaluated this phase change and used the less conservative activation energy from the IEEE white paper throughout their extrapolations. Finally, Robinson may not have reviewed the actual activation energy test data, the test plan and acceptance criteria for the activation energy, or information about the test program, or if any equivalent App. B program supported the information's quality.

NUREG 0588 Section 5(2), specified that independent verification of similarity or equivalence must be established, and that it was incumbent on the applicant to have the necessary documentation to justify the adequacy of using data from similar or equivalent equipment. In addition, this Section 5(2) and NUREG 0588, Appendix E, specified, that for electrical equipment that will experience the environmental conditions of design basis accidents for-which it-must function, the licensee must provide: the qualification test plan, test setup, test procedures, acceptance criteria and a summary of test results that demonstrates the adequacy of the qualification program. Additionally, if analysis is used for qualification, justification of all analysis assumptions must be provided. Further, NUREG 0588 Section 4(5) specified that known material phase changes must be addressed; and Section 4(6) specified that the aging acceleration rate used during qualification testing, and the basis upon which the rate was established, should be described and justified. In NUREG 0588 Part II, the comment resolution to Section 4(6), it was specified that the testing of the equipment should be conducted using the most limiting (lowest) activation energy of the components.

Standard IEEE 323-1974 Section 5, "Principles of Qualification," specified, that principles and procedures for demonstrating qualification include assurance that any extrapolation or inference be justified by allowances for known potential failure modes and the mechanism leading to them. Section 5.1, "Type Testing," specified that test alone satisfies qualification only if the equipment to be tested is aged, subjected to all environmental influences, and operated under post-event conditions to provide assurance that all such equipment will be able to perform their intended function for at least the required operating time. The inspectors identified other known failure mechanisms were not considered. For instance, electro-migration of aluminum in diodes, transistors, and Zener diodes present in the electronics has an activation energy between 0.5eV and 0.63eV, which is more limiting than what was used. This failure mechanism was identified in EPRI NP-1558, "A Review of Equipment Aging Theory and Technology," and in many IEEE documents that were known at the time of qualification.

Robinson used what appeared to be an unvalidated activation energy that also appeared to overlook a phase change that occurs within the licensee's service conditions to extend

the qualified life. The activation energy value and the method used to arrive at this value are in question.

This URI is opened to determine if a performance deficiency or violation exists. To resolve the various aspects of this URI, the inspectors need to: (1) assess the validity of the methods used in the IEEE white paper, which includes addressing the apparent phase change; (2) assess the difference of the more limiting activation energies for the resistors used in the Robinson transmitters compared to the value the licensee is using (including addressing the more limiting activation energies for the other electronics in question); and (3) evaluate the self-heating effects of the junctions in the electronic components and its impact on activation energy. Finally, the inspectors need to assess what responsibilities and to what extent, the licensee has to ensure the activation energies provided by an Appendix B vendor, are accurate and reasonable. The licensee entered this concern into their corrective action program as NCR 2164598. (URI 05000261/2017007-05, "Questions Regarding EQDP-0401 Method Used to Determine Activation Energy and Responsibility for Verification")

.6 (Opened) Unresolved Item, Penetration F01 Submergence

Introduction: The inspectors identified a URI concerning the submergence qualification of Robinson EPA F-01. The qualification may not have qualified the EPA in accordance with NUREG-0588, Category 1 requirements.

Description: In 1988, the licensee determined that penetration F-01 would become submerged and subsequently contracted testing to demonstrate qualification. The inspectors reviewed Wyle qualification test report 41175-1, and EGS qualification test report, EGS-TR-903200-04-R000. These two reports were credited for submergence in EQDP-1700 for the CONAX penetrations. The inspectors were concerned that the CONAX penetration F-01 was not tested in its most limiting configuration.

To place the penetration pigtails in a configuration that could support qualification, the licensee performed a modification, MOD 977, "Repairs to Protect Penetration F-01," to re-terminate the pigtails by adding Raychem heat shrink to provide submergence protection. Modification, MOD 977, specifically figure 1, drawing number C20482, and feedthrough detail drawing number B190670 revision 1, appears to allow 36 conductors to be bundled together in a single pass through. The EGS and Wiley test reports did not test the 36 conductor configuration or demonstrate that the signals passing through these bundles would remain operable for the duration of submergence as required by NUREG-0588, Category 1 requirements. The inspectors were also concerned that while the termination procedures in MOD 977 required a two inch Raychem overlap, it also allowed a one-half inch overlap during Raychem installation . A one-half inch overlap may not ensure submergence qualification in accordance with EGS qualification report EGS-TR-903200-04-R000. In addition, the EGS qualification used an 8.3 pH caustic solution during submergence testing, which is less than what was required for Robinson's harsh environment design basis (10.5 pH).

Title 10 CFR 50.49(d)(3) and (e)(6), RG 1.89 revision 1, C.d.3.a, and NUREG 0588 Section 2.2(5) "Qualification by Test," required that equipment that could be submerged must be qualified by testing in a submerged condition to demonstrate operability for the duration required. The inspectors are concerned that F-01 is not qualified for submergence and the pigtails may not meet the requirements for submergence

qualification. The licensee entered this concern into their corrective action program as NCR 2167136.

This URI is opened to determine if a performance deficiency or violation exists. To resolve this URI, the inspectors need the licensee to address the apparent lack of qualification required by NUREG-0588, Category 1 EQ requirements. (URI 05000261/2017007-06, "Penetration F01 Submergence")

.7 (Opened) Unresolved Item, Justification of Activation Energy of ASCO Solenoid Coil Assemblies

Introduction: The inspectors identified a URI concerning the qualified life of ASCO solenoid operated valves. The qualified life determined by the licensee utilized unvalidated information provided by a third-party, non-Appendix B vendor and discounted other critical materials in their weak-link analysis without providing justification in accordance with Regulatory Guide 1.89, Rev. 1.

Description: In 2006, the Nuclear Utility Group for Environmental Qualification (NUGEQ) provided a letter suggesting methods to extend the qualified lives of the solenoid operated valves. The licensee modified the qualified life of their ASCO valves as described by NUGEQ and failed to validate and justify the information's acceptability for use. Inspectors determined that the use of MW-35 magnet wire's activation energy in place of MW-16 was not appropriate as activation energies are material and failure specific, and are not "transferrable" between different material compositions. Furthermore, the inspectors determined that the licensee (and NUGEQ) failed to adequately justify the discounting of the other materials in the ASCO solenoid coils, which had lower activation energies than the MW-16 magnet wire as reported by ASCO in their qualification test reports.

The failure to justify the discounting of MW-16 magnet wire and other identified limiting component of the ASCO coil assembly was a performance deficiency and a violation of 10 CFR 50.49. Regulatory Guide 1.89, Rev. 1, Regulatory Position 5.c requires, in part, that the basis upon which the rate and activation energy were established should be defined, justified, and documented. Contrary to the above, the licensee failed to justify and document their use of the MW-35 activation energy in place of all other identified limiting activation energies in the ASCO solenoid coil assembly. Additionally, 10 CFR 50.49(e)(5) requires, in part, that equipment be replaced before the expiration of its qualified life unless ongoing testing can demonstrate that the equipment has additional life. Contrary to the above, the licensee failed to demonstrate that the ASCO solendoid coil assemblies have additional life when they failed to justify their departure from ASCO's limiting activation energies.

This URI is being opened to determine if this performance deficiency is more than minor. To resolve this URI, the inspectors need to review the licensee's response to proposed questions regarding the validation and justification of the appropriate activation energy that will be used in determining the qualified life. (URI 05000261/2017007-07, "Justification of Activation Energy of ASCO Solenoid Coil Assemblies")

4. OTHER ACTIVITIES

4OA6 Meetings, Including Exit

On October 31, 2017, the inspectors presented the inspection results to Mr. E. Kapopoulos and other members of the licensee's staff. On November 21, 2017, a re-exit meeting was conducted via teleconference to present the final inspection results to Mr. E. Kapopoulos and other members of the licensee's staff. The inspectors confirmed that proprietary information was controlled to protect from public disclosure.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee personnel:
E. Kapopoulos, Site Vice President- RNP
D. Schroeder, Manager Nuclear Engineering, Plant & Programs Engineering - RNP
K. Ellis, Manager Nuclear Regulatory Affairs, Regulatory Affairs-Nuclear
J. Brady, Nuclear Licensing Consultant, Regulatory Affairs
J. Wild, Sr. Nuclear Engineer, Regulatory Affairs – RNP
C. Abernathy, Principal Nuclear Engineer, Fleet Engineering Programs

NRC personnel:
J. Rotton, Robinson Senior Resident Inspector
L. Suggs, Chief, Projects Branch 3

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened & Closed

05000261/2017007-01	NCV	Failure to Correctly Determine Qualified Life (Section 1R21.b.1)
05000261/2017007-02	NCV	Failure to Perform Required O-ring Replacement to Maintain Qualification (Section 1R21.b.2)
05000261/2017007-03	NCV	Failure to Determine Most Severe Containment Spray pH (Section 1R21.b.3)

Opened

05000261/2017007-04	URI	Crouse-Hinds Qualification and Life Extension (Section 1R21.b.4)
05000261/2017007-05	URI	Questions Regarding EQDP-0401 Method Used to Determine Activation Energy and Responsibility for Verification (Section 1R21.b.5)
05000261/2017007-06	URI	Penetration F01 Submergence (Section 1R21.b.6)
05000261/2017007-07	URI	Justification of Activation Energy of ASCO Solenoid Coil Assemblies (Section 1R21.b.7)

LIST OF DOCUMENTS REVIEWED

Corrective Action Documents Written as a Result of the Inspection
NCR 02155050, 2017 RNP EQ DBAIP Error in Qualified Life Calculation
NCR 02155219, 2017 RNP EQ DBAI(P): NRC Inspector plant entrance Issue
NCR 02155992, 2017 RNP EQ DBAIP
NCR 02156045, 2017 RNP EQ DBAI Catid 71476949 has no shelf life indication
NCR 02157822, 2017 RNP EQ DBAIP gap with ANSI N45.2.2 record requirement
NCR 02157897, 2017 RNP NRC EQ DBA Inspection -- EQDP-1801 O-Ring
NCR 02158467, 2017 RNP EQ DBAI(P) HVH-8A-MTR and HVH-8B-MTR
NCR 02159165, 2017 RNPEQ DBAI(P): Discrepancy in RNP-E-5.030 and CPL-R2-E3
NCR 02159206, 2017 RNPEQ DBAI(P): RNP-E-5.030 Error
NCR 02159353, 2017 RNP EQ DBAI (P) Overly Conservative Cycling Assumption
NCR 02159568, 2017 RNPEQ DBAI(P): Discrepancy in Drawing HBR2-11260
NCR 02161580, 2017 RNP NRC EQ DBA Inspection -- EQDP-1801 O-Ring Follow-Up
NCR 02161767, 2017 RNP NRC EQ DBA Inspection -- ASCO Ea Value NUGEQ Memo
NCR 02161911, 2017 RNP NRC EQ DBA Inspection - Crouse-Hind EPA Similarity
NCR 02162081, RNP-M/MECH-1792 Calc has high CV Sump/Spray pH vs, EQ maps
NCR 02162934, 2017 RNP NRC EQ DBA Inspection -- ASCO NUGEQ Memo Validation
NCR 02164567, 2017 RNP EQ DBAI - Crouse Hinds EPA qualification methods
NCR 02164589, 2017 RNP EQ DBAI Wording unclear in UFSAR 3.8.1.2
NCR 02164598, 2017 RNP NRC EQ DBAI - URI on Rosemount 1154 Activation Eng
NCR 02167136, 2017 RNP NRC EQ DBAI – CONAX F-01 Penetration

Procedures
AD-EG-ALL-1612, Environmental Qualification (EQ) Program, Rev. 1
AD-RP-ALL-5003, Receipt of Radioactive Material, Rev. 0
SCDP-402, Material Management (Storage, Issue And Maintenance), Revs. 7 and 8
SCDP-402, Material Management (Storage, Issue, and Maintenance), Rev. 8

Drawings
5739—0188, Course-Hinds Penetration Typical, Rev. 3
B-190628 SH 551, Control Wiring Diagram, Rev. 8
CH-6, H.B. Robinson- Unit 2, Reactor Auxiliary Bldg, Chemical and Volume Control, Sht. 1, Rev. 1
CH-6, H.B. Robinson- Unit 2, Reactor Auxiliary Bldg, Chemical and Volume Control, Sht. 2, Rev. 1
G-190311, HVAC – Control Diagrams – Sheet 2, Rev. 23
HBR2-11260 SH00001, ZONE MAP FOR ENVIRONMENTAL PARAMETERS REACTOR AUX. BLDG. EL. 226`-0" (N), Rev. 10
HBR2-11260 SH00002, ZONE MAP FOR ENVIRONMENTAL PARAMETERS REACTOR AUX. BLDG. EL. 226`-0" (S), Rev. 8
HBR2-11260 SH00003, ZONE MAP FOR ENVIRONMENTAL PARAMETERS REACTOR AUX. BLDG. EL. 246`-0" (S), Rev. 1
HBR2-11260 SH00004, ZONE MAP FOR ENVIRONMENTAL PARAMETERS REACTOR AUX BLDG. EL. 242`-6" AND 246`-0", Rev. 3
HBR2-11260 SH00005, ZONE MAP FOR ENVIRONMENTAL PARAMETERS REACTOR AUX BLDG. EL. 242`-6" AND 246`-0", Rev. 3
HBR2-11260, Zone Map for Environmental Parameters, Reactor Aux Bldg. El. 226’-0” (N), Sht. 1, Rev. 10

HBR2-11260, Zone Map for Environmental Parameters, Reactor Aux Bldg. El. 226'-0" (S), Sht. 2, Rev. 8
HBR2-11260, Zone Map for Environmental Parameters, Reactor Aux Bldg. El. 246'-0", Sht. 3, Rev. 1
HBR2-11260, Zone Map for Environmental Parameters, Reactor Aux Bldg. El. 242'-6" and 246'-0", Sht. 4, Rev. 3
HBR2-11260, Zone Map for Environmental Parameters, Reactor Building El. 228.00' (N), Sht. 5, Rev. 6
HBR2-11260, Zone Map for Environmental Parameters, Reactor Building El. 276.00' (N), Sht. 7, Rev. 6
HBR2-11260, Zone Map for Environmental Parameters, Sht. 8, Rev. 16
HBR2-11260, Zone Map for Environmental Parameters, Reactor Building El. 254.00' (N), Sht. 6, Rev. 6
Isometric B-8, HBR2- Aux Building Blowdown Piping 3-B-3, Sht. 2, Rev. 0

Calculations

RNP-E-5.030, Crouse-Hinds Electrical Penetration Ampacity, Short Circuit, and Heat Generation Calculation, Rev. 6
RNP-M/MECH-1792, Transient pH Analysis of Containment Spry and ECCS Sump, Rev. 0
RNP-M/MECH-1913, REACTOR AUXILIARY BUILDING NON-REGENERATIVE HEAT EXCHANGER ROOM CHEMICAL VOLUME CONTROL SYSTEM HIGH ENERGY LINE BREAK Rev. 1
RNP-R-EQ-0002, Environmental Qualification for RNP Inside Containment Percent Operating Time, Rev. 0

Self-Assessment Reports

Focused Self-Assessment Report 01985578-05, Environmental Qualification (EQ) Program Focused Self-Assessment (DEP Program), dated 5/27/2016
Formal Self-Assement Report 505333, Fleet Formal EQ Program Self Assessment of the Shearon Harris and HB Robinson Nuclear Plants, dated 10/4/2012
Quick-Hitter Self-Assessment Report 02089147-05, Environmental Qualification (EQ) Program Readiness Self-Assessment (RNP), dated 5/26/2017

Corrective Action Documents

00089619	689067	2044679
534531	712316	2093318
570550	714851	2122926
601677	718088	2128371
608143	730534	2145569
625657	740064	2155152
626257	740233	
628762	744555	
665669	2040644	

Work Orders

01439385
11441488

Miscellaneous Documents

41175-1, Nuclear Environmental Qualification Test Program on Conduit Seals, Penetration Splices, Raychem Seals, Quick Disconnects, A Control Cable Specimen, An RTD Head/Sealant Specimen, And Gray Boot Connectors, Volume 1 and 2

45307-01, Preliminary Qualification Plan for Incontainment Cables for Carolina Power and Light Raleigh, Nc 27602 for Use in H. B. Robinson Nuclear Power Plant, Rev. 0

45592-3, Nuclear Environmental Qualification Test Program on Rosemount 1153 Series D Pressure Transmitters, Rev. 0

48881-02, Qualification Test Program on Cable and Splice Assemblies for Patel Engineers, Rev. 0

71-1C2-RADMC-R1, The Effect of Radiation on Insulating Materials Used in Westinghouse Medium Motors, Rev. 1

AB-11/12/73, Qualification Tests for A Modular Penetration 5" Diameter (Prototype BI), Rev 0

ASCO Report 359, Measurement of Heat Rise for the Coil, Core Disc & Lower Disc of the NP8320A185 120/60 in Various Orientations

DR 5.1, ISOMEDIX Test Report No. AQS 21673/TR Qualification Tests of Solenoid Valves by Environmental Exposure to Elevated Temperature, Rev. B

DR 5.2, ASCO Test Report No. AQR-67368, "Report on Qualification of ASCO Catalog No. NP-1 Solenoid Valves for Safety Related Applications in, Rev. 2

Discusses environ qualification of electrical equipment No. replacement equipment or addl Justifications for continued operation required issue considered closed, 1984 Oct 12, HB8410180148

EC 300174, Revise Qualified Life of Hardline Potting Adaptors in EQDP-1801, Rev. 0

EC 403230, ADOPTION OF GL 87-11 FOR POSTULATED PIPE RUPTURE OUTSIDE OF CONTAINMENT, Rev. 0

EC 407652, STEAM GENERATOR BLOWDOWN RESTRAINTS MODIFICATION, Rev. 1

EC 407783, EVALUATE AND REPAIR (IF NEEDED) SGBD SUPPORTS DUE TO STRESS REANALYSIS, Rev. 0

EE-90-73, Replacement of Rosemount 1153A and 1153D Series Transmitters With 1154 Series Transmitters, Rev. 0

EGS-TR-903200-04, Test Report for Nuclear Environmental Qualification/Submergence Testing of Conduit Seals, Penetration Splice. Victoreen Raychem Seal, Cable, Raychem WCSF-N and Thread Sealants for Carolina Power and Light Company, Rev 0

Environmental Qualification of Electrical Equipment – Justification for Continued Operation for Unqualified Equipment at H. B. Robinson Steam Electric Plant Unit No. 2, dated 3/29/1983

Environmental Qualification of Electrical Equipment H. B. Robinson E. G. Plant Unit 2 IE Bulletin 79-01B (90 Day Report), dated June 1980

Environmental Qualification of Electrical Equipment H. B. Robinson E. G. Plant Unit 2 Response to Amended Regulation on Environmental Qualification of Electrical Equipment Important to Safety 10 CFR 50.49 (February 22, 1983) Response to NRC Safety Evaluation Report for Environmental Qualification of Safety Related Electrical Equipment for H. B. Robinson Steam Electric Plant Unit No. 2 (January 5, 1983), dated May 1983

Environmental Qualification Of Safety Related Electrical Equipment (List of Qualified Equipment), 1983 May 20, HB8305270008

Environmental Qualification Of Safety-Related Electrical Equipment (RAI Response), 1984 May 31, HB8406120332

EQDP-0100, ASCO NP8316 and 206-318-2F Series Solenoid Valves, Rev. 1

EQDP-0401, Rosemount 1154 Pressure Transmitter, Rev. 16

EQDP-0803, Environmental Qualification Document Package for Westinghouse Motors, Rev. 4

EQDP-0803, Environmental Qualification Document Package for Westinghouse Motors, Rev. 5

EQDP-0900, Crouse-Hinds Electrical Penetration Assembles, Rev. 11

EQDP-1700, CONAX Electrical Penetration Assemblies, Rev. 9
EQDP-1801, Environmental Qualification Document Package for Westinghouse Reference Junction Boxes, Rev. 9
EQDP-2200, NAMCO EA 180 Switches, EC 210 and 290 Connector Assemblies, Rev. 12
F-C4020-2, Tests of Electrical Cables Under Simultaneous Exposure to Gamma Radiation, Steam and Chemical Spray While Electrically Energized, Rev. 0
H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2 DOCKET NO.50-261 LICENSE NO. DPR-23 IE BULLETIN 79-O1B -NINETY-DAY REPORT, dated 7/7/1980
LAP-83-185, H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2 DOCKET NO. 50-261 LICENSE NO. DPR-23 IE BULLETIN 79-OIB -NINETY-DAY REPORT, dated 5/20/1983
NUREG-1785, Safety Evaluation Report Related to the License Renewal of H.B. Robinson Steam Electric Plant, Unit 2
QTR 105, Qualification of EA180-Series Limit Switches for Use in Nuclear Power Plants in Compliance with IEEE Standards 323-I974, 382-1972, and 344-L975, Rev. 0
Resolution Of Safety Evaluation Reports For Environmental Qualification Of Safety-Related Electrical Equipment, 1984 Mar 2, HB8403130093
REW worksheet for CR # 2044679
REW worksheet for CR # 2093318
REW worksheet for CR-534531-16
REW worksheet for CR-712316
SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION REGARDING THE CONSEQUENCES OF HIGH ENERGY PIPING FAILURES OUTSIDE CONTAINMENT CAROLINA POWER AND LIGHT COMPANY OPERATING LICENSE DPR-23 H. B. ROBINSON UNIT NO. 2 DOCKET NO. 50-261, dated 11/21/1975
SAFETY EVALUATION REPORT BY THE OFFICE OF NUCLEAR REACTOR REGULATION EQUIPMENT QUALIFICATION BRANCH FOR CAROLINA POWER AND LIGHT COMPANY H. B. ROBINSON UNIT 2 DOCKET NO. 50-261 ENVIRONMENTAL QUALIFICATION OF SAFETY-RELATED ELECTRICAL EQUIPMENT, dated 5/21/1981
SAFETY EVALUATION REPORT FOR ENVIRONMENTAL QUALIFICATION OF SAFETY-RELATED ELECTRICAL EQUIPMENT FOR H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2, dated 1/5/1983
SAFETY EVALUATION REPORT FOR FINAL RESOLUTION OF ENVIRONMENTAL QUALIFICATION OF ELECTRIC EQUIPMENT IMPORTANT TO SAFETY - H. B. ROBINSON UNIT 2, TAC NO. 42466, dated 3/19/1985
SAFETY EVALUATION REPORT FOR FINAL RESOLUTION OF ENVIRONMENTAL QUALIFICATION OF ELECTRIC EQUIPMENT IMPORTANT TO SAFETY - H. B. ROBINSON UNIT 2, TAC NO. 42466, dated 3/19/1985
Steam Incident and Helium Leakage Test, Rev. 0
Supplemental Response Concerning Environmental Qualification Of Safety-Related Electrical Equipment, 1984 April 16, HB8404200106
Technical Evaluation Report Review of Licensees' Resolution of Outstanding Issues from NRC Equipment Environmental Qualification Safety Evaluation Reports (F-11 and B-60),1982, July 8, HB8207130575
TMM-036, Environmentally Qualified (EQ) Electrical Equipment Required Maintenance, Rev. 44
WCAP-8687, EQDP-ESE-43G, Hardline Potting Adaptor/Cable Splice Assemblies, Rev. 0
WCAP-8687, EQDP-ESE-44A, Incore Thermocouple Reference Junction Box, Rev. 3
WCAP-8687, Supplement 2 EQDP-ESE-44A, Incore Reference Junction Box (Seismic and Environmental Testing), Rev. 3