AUG 0 9 2019

L-2019-160
10 CFR 50.4
10 CFR 50.55a

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Re: St. Lucie Unit 2
Docket No. 50-389
Inservice Inspection Plan
Forth Ten-Year Interval Unit 2 Relief Request 16

Pursuant to 10 CFR 50.55a(z)(2), Florida Power & Light (FPL) requests relief from ASME Section XI Code, subsection IWC, "Requirements for Class 2 Components of Light-Water Cooled Power Plants," subparagraph IWB-3142.3, "Acceptance by Corrective Measures or Repair/Replacement Activity," which states in part that a component with flaws that exceed the acceptance standards of Table IWB-3410-1 is acceptable for continued service if the component is corrected by a repair/replacement activity.

On August 6, 2019, dry boric acid residue was found on the 2B boric acid pump casing. The pump was declared inoperable due to evidence of through wall leakage. Of the three ASME Code options available for acceptance of the relevant condition, a repair/replacement per IWB-3142.3 is the only viable option for addressing the current observed condition. Repair of the 2B pump casing is not considered a viable option, as repair of casting material is problematic. Additionally, a replacement part is not readily available. Compliance with the applicable code requirement would result in a hardship without a compensating increase in the level of quality or safety, as it would result in an extended un-planned shutdown of the unit.

The basis for relief is provided in the attachment. FPL requests that the attached relief request be approved by August 9, 2019 to support the continued operation of St. Lucie Unit 2.

Please contact Ken Frehafer at (772) 467-7748 if there are any questions about this submittal.

Very truly yours,

Wyatt Godes
Licensing Manager
St. Lucie Plant

WG/kwf

Attachment

cc: St. Lucie NRC Program Manager, USNRC
Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, St. Lucie Plant

Proposed Relief Request RR-16

In Accordance with 10 CFR 50.55a(z)(2)

--Hardship or Unusual Difficulty
Without Compensating Increase in Level of Quality or Safety--

1. ASME Code Components Affected

ASME Code Class:	Code Class 2
Reference:	ASME XI, IWC-2500
Examination Category:	Table IWC-2500-1, Category C-H
Item Number:	C7.10
Description:	St. Lucie Unit 2 (PSL2) 2B boric acid make-up pump (BAMP). (2998-2229 R2 & 2998-2410 R5)
Component:	The BAM PP 2B boric acid makeup pump casing is a casting of type 316 austenitic stainless steel per ASME SA351 CF8M.
Temperature:	Design - 250F (CE Spec 13172-PE-404, R1) Operating - 120F (Discharge)/120F (Suction)
Pressure:	Design - 150psig (CE Spec 13172-PE-404, R1)
	Operating - Approx. 130psig (Discharge)/0-9psig (Suction)

COMPONENT FUNCTION

The BAM PP 2B boric acid makeup (BAMP) pump is one of two redundant pumps provided to support boron injection to the reactor coolant system (RCS). The availability of one BAMP is required to satisfy the Technical Specification (TS) 3.5.2 requirement to provide a flow path through the charging pump to the RCS.

During normal online operation the pump is run quarterly for a 15-minute In-Service Testing run to monitor pump performance, and weekly for a 30-minute run to support chemistry sampling.

The BAMPs are credited in the PRA for emergency boration function. PRA results for taking both BAMPs A and B out of service indicate no change in frequency for delta CDF/LERF in the internal events model and Fire PRA model.

2. Applicable Code Edition and Addenda

The Code of Record for the St Lucie Unit 2 Fourth 10-year in-service inspection interval is the 2007 Edition of the ASME XI Code with Addenda through 2008 as modified by 10CFR50.55a. The current interval began on August 8, 2013 and ends on August 7, 2023.

3. Applicable Code Requirement

ASME Section XI Code, subsection IWC, "Requirements for Class 2 Components of Light-Water Cooled Power Plants," subparagraph IWB-3142.3, "Acceptance by Corrective Measures or Repair/Replacement Activity," which states in part that a component with flaws that exceed the acceptance standards of Table IWB-3410-1 is acceptable for continued service if the component is corrected by a repair/replacement activity.

4. Reason for Request

On August 6, 2019, a boric acid follow-up walkdown was performed and dry boric acid residue was found at a previously identified and programmatically tracked location on the Unit 2 2B boric acid makeup pump casing. A dye penetrant (PT) exam was performed with inconclusive results. No indications were identified, however, water weepage was observed through the developer in the area of the residue. To further investigate, the pump was run for one hour. Following the run, a 1/32" diameter deposit of boric acid was visually identified in the same area. The pump was declared inoperable due to evidence of through wall leakage.

Similar indications were also identified on the Unit 2 2A BAMP casing, which was simultaneously declared inoperable. These declarations resulted in entry of Action a.2 for Technical Specification 3.5.2.

Visual examination at 10X magnification characterized the area with the deposit as a roughly 1/32" rounded indication with no branching or crack-like characteristics.

FPL has researched the original purchase order to identify initial testing associated with the boric acid pump. The pump was constructed in accordance with the ASME Section III Code, 1974 Edition with no Addenda, as Class 2, and Combustion Engineering specifications 00000-PE-404 dated May 9, 1970 and 13172-PE-404, dated November 16, 1973. The Combustion Engineering specifications refers to the ASME Section III code, 1974 Edition/No Addenda for material testing requirements. Paragraph NC-2571 of this code specifies dye penetrant or magnetic particle testing for pumps with inlet connections between 2 and 4 inches in diameter. (The 2B

BAMP inlet connection is 3 inches in diameter). No volumetric inspections were required for the cast pump casing material.

The 2007 Edition/2008 Addenda ASME Section XI code was reviewed for acceptance standards associated with the casing leak. Table IWC-3410-1, Acceptance Standards, indicates for pressure retaining components (examination category C-H), the acceptance standard is IWC-3516. IWC-3516 refers to IWB-3522. IWB-3522 refers to IWB-3142 for corrective actions.

Article IWB-3142, Acceptance, specifies that a component with a relevant condition is unacceptable for continued service unless the requirements of IWB-3142.2, 3 or 4 have been satisfied. All three options have been considered. IWB-3142.2 is related to acceptance by performing supplemental examinations. This section is about sizing of defects for comparison to ASME criteria to allow leaving a flaw in service. This option is not applicable to a through-wall condition. IWB-3142.4 is related to determining acceptance by analytical evaluation. This option is not possible because there is not a code-specified methodology for analyzing the condition and flaw characterization is limited.

Of the three options available for acceptance of a relevant condition, a repair/replacement per IWB-3142.3 is the only viable option for addressing the current observed condition. However, a replacement part is not readily available. Repair of the 2B pump casing is not considered a viable option, as repair of casting material is problematic. At the time of this submittal, the repair of the 2A pump casing, which has similar flaws, was in progress.

Based on engineering assessment provided in 5.2, there is high confidence that structural integrity of the casing will be maintained for the duration of the required period of continued operation.

5. Proposed Alternative and Basis for Use

5.1 Proposed Alternative

Referencing ASME XI Code subparagraph IWB-3142.4, "Acceptance by Analytical Evaluation," FPL proposes to temporarily accept the as-found relevant condition (through-wall flaw) to allow continued service instead of performing immediate flaw correction by a repair/replacement activity described in Code subparagraph IWC-3142.3, "Acceptance by Repair/Replacement Activity." This proposed alternative is based on FPL actions similar to those required by ASME XI Code Case N-513-3 for flaws without a growth rate analysis. These actions are:

1. Operations personnel shall observe and measure the flaw leakage rate and record a value in a retrievable format during each weekly sampling run and

quarterly in-service test run to ensure early detection of an increased leak rate and to ensure the assumptions used in the component operability evaluation remain valid. Note that the current leakage rate is immeasurable, and the leakage rate will be documented as such until it can be measured in a drops/minute format.

a. Per the UFSAR Table 12.2-39, the maximum allowable leakage rate is 6.12 gallons per day, or conservatively assumed to be approximately 16 drops per minute. As a conservative measure, this request will only be considered valid for leakage rates of up to 8 drops per minute.

2. NDE personnel shall conduct a visual examination at 10X magnification of the flaw location to identify any change in flaw characterization (from rounded to linear) every 30 days until the component is replaced.

   a. FPL believes periodic measurement of the flaw diameter is not necessary, as any increase in flaw size will result in an increased leakage rate, which is measured at a greater frequency than 30 days. The primary purpose of the visual inspection is to ensure no crack-like formations occur.

3. In addition to 5.1.2, NDE personnel will take ultrasonic thickness measurements every 30 days. Any measured wall loss greater than the error of the device will be trended to ensure the minimum design thickness is maintained for the duration of relief.

4. The component will be replaced when an acceptable replacement is identified or fabricated.

This relief will no longer be valid, and any applicable action statements will be declared if any of the following occur:

1. The measured leak rate exceeds the condition of 5.1.1a above.

2. Visual examination identifies a change in flaw characteristics (rounded to linear).

3. Trending of measured wall loss concludes the minimum design thickness of the casing will not be maintained for the duration of relief.

Based on the following, compliance with the applicable code requirement would result in a hardship without a compensating increase in the level of quality or safety, as it would result in an extended un-planned shutdown of the unit resulting in thermal stress cycling of plant components and emergent equipment issues that incur during shutdown and startup evolutions.

1. The current leakage rate is immeasurable, and is unlikely to degrade due to the infrequent operation of the pump.

2. Leakage can be observed during the entirety of the pumps operation to ensure early detection of an increased leak rate.

3. Failure of the component results in no impact to the plant's PRA model.

5.2 Basis for Use

Specific Considerations

Flaw Characterization - Because of limited access and complex surface geometry, direct volumetric examination of the leakage location is not feasible. However, to characterize the leak path and condition of the material surrounding the defect the following inspections were performed.

- A dye penetrant (PT) examination was performed on the affected area of the pump casing. As described in Section 4, this examination was inconclusive.

- Leakage was confirmed visually following a pump run, and the location was visually examined with 10X magnification. The flaw was determined to be a rounded indication approximately 1/32" in diameter, with no crack-like characteristics.

Based on the results of the above inspections, the pressure boundary leakage is likely due to small casting void defects or porosity that enabled a through-wall pathway for leakage. This characterization is also supported by the repair attempt on the 2A pump casing, as the flaw was observed to have characteristics of porosity during excavation. Alternate explanations have been considered, but determined to be unlikely, as discussed below.

STRUCTURAL EVALUATION

Operating Conditions –

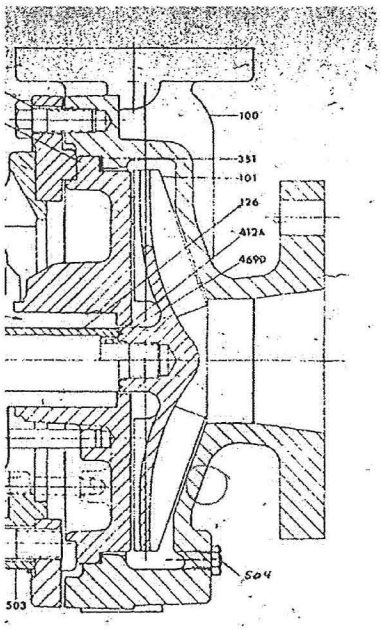
As noted in section 1, the operating temperature and pressure of the BAMP is:

Operating temperature - 120F at discharge and suction.
Operating Pressure - 150psig at discharge and 0-9psig and suction.

As noted in section 1, during normal plant operation the BAMPs are run weekly to support chemistry sampling and quarterly to support In-Service Testing.

Based on vibration data taken during In-Service Testing, the 2B BAMP has low vibratory loads, with no negative trends. Note that the infrequent operation of the pump also results in a minimal impact of vibratory loads.

Material Performance and Degradation Potential



The figure at the right shows the configuration of the BAMP and the general location of the flaw. The boric acid makeup pump has been in service since initial plant operation. The pump casing is made from cast type 316 austenitic stainless steel per specification ASTM A351-CF8M. Type 316 stainless steel has excellent general corrosion resistance to the boric acid solution that is the process fluid for this pump. Based on testing done for Electric Power Research Institute (Reference 8.2), the general corrosion rate in the process fluid is too small to measure. The other internal parts of the pump are mode from cast or wrought type 316 stainless steel. Type 316 stainless steel, either cast or wrought, is not susceptible to pitting or stress corrosion cracking in this environment. The cast version of type 316 stainless steel is not susceptible to thermal aging at the low temperature at which this pump operates. Additionally, mechanical loads due to normal operation, include pump vibration, are low and would not be anticipated to result in service induced flaw growth. With these considerations, it is concluded that there are no active aging degradation mechanisms for this component that would cause initiation and through-wall growth of a planar flaw. The remaining reasonable explanation for leakage is that there is a leakage pathway via small voids, or porosity, originally present in the cast material. Other instances of this phenomenon in the industry are referenced in section 7, Precedents. As discussed below, such small imperfections do not significantly affect the structural integrity of the component.

The absence of an active degradation mechanism also supports the conclusion that the currently observed leak rate will remain nearly constant for the duration of this relief request.

Structural Integrity - Ultrasonic thickness measurements of the pump casing in the area of the leak resulted in thickness readings of 0.282", 0.289" and 0.292". Per the vendor technical manual this exceeds the design required minimum wall thickness of 0.25". Also, observation of the disassembled 2A BAMP casing did not identify any appreciable general corrosion or "wash-out" in the area of the flaw.

Additionally, while there is no Code-specified methodology for evaluating the structural integrity of this type of component when through-wall leakage is detected, the pump casing can be conservatively bounded as a cylindrical section similar to a cylindrical vessel with localized leakage. Considered as equivalent to a cylindrical vessel, the minimum wall thickness would be calculated per ASME III NC-3324 ('74 Edition) as:

tmin = P R / (S - 0.6 P)

P = design pressure = 150psig
R = radius of the pump casing = 4.7 inches
S = allowable stress (including a casting quality factor of 0.8) = 0.8 x 17.5 = 14ksi

The result is tmin = 0.051 inches.

Considering the actual wall thickness is measured as having margin within design requirements, and significant margin within a calculated tmin, this portion of the pump casing will not be challenged by the operating pressures.

Functionality - The above structural integrity evaluation supports the conclusion that the pump is capable of performing its intended function of transferring concentrated boric acid from the boric acid storage tank to the suction of the charging pumps and will retrain this capability for the duration of the requested relief. The overall mechanical integrity of the pump will be maintained such that the pump will be able to generate sufficient head for the required flow, and since the pressure boundary is maintained there would be no significant diversion of boric acid intended for injection into the charging pump suction.

Flooding Evaluation - The design basis internal flooding event for the U2 RAB bounds any leakage associated with the BAMP. The design basis internal flooding event is the catastrophic failure of all four 40,000 gallon holdup tanks during a seismic event concurrent with the failure of all other non-seismic Category I components.

The monitoring actions specified in section 5.1, and the low operating pressure of the pump provide reasonable assurance that the leakage will not increase to a rate that cause spraying, however, in the unlikely event this would occur no sensitive components would be impacted. The 2B BAMP is located in an isolated room surrounded by Boric Acid Makeup piping and components, and walls.

CONCLUSION

The structural integrity of the BAMP casing cannot be demonstrated in accordance with a Code-specified methodology. However, by comparison with typical ASME code design rules, it is concluded that there is reasonable assurance that the structural integrity and functional requirements of the pump will be maintained during the requested period of relief.

6. Duration of Proposed Alternative

This relief is requested to be effective for the 2B BAMP upon approval and until the Unit 2A BAMP is returned to service. This may be achieved by either restoring the 2A pump casing to an operable condition, or installation of an operable pump in the 2A location. This duration is bounded by the potential need for fabrication of a new pump, which should not extend beyond December, 2020.

It is the intent of FPL to procure and install a replacement component at the earliest opportunity.

This relief request is contingent on the actions, allowable leak rate, and measured wall loss described in section 5.1

As stated in section 5.1, this relief will no longer be valid, and any applicable action statements will be declared if any of the following occur:

- The measured leak rate exceeds the condition of 5.1.1a above.
- Visual examination identifies a change in flaw characteristics (rounded to linear).
- Trending of measured wall loss concludes the minimum design thickness of the casing will not be maintained for the duration of relief.

7. Precedents

A search of the industry OE was performed for similar instances of casting voids associated with relief requests. The search did not find any that directly applied. However, the following items are related to cast voids and are listed for reference.

1. NRC Letter from J. Danna (USNRC) to D. Stoddard (DNC), dated May 25, 2017, "Millstone Power Station, Unit No. 2 - Alternative Relief Request RR-04-25 RE: Boric Acid Pump P-19B Stuffing Box Cover (CAC No. MF9497)" [ADAMS Accession Number ML 17135A296]

2. NRC letter from J. Quichocho (USNRC) to W. Gideon (CP&L), dated December 12, 2012·, "H. B. Robinson Steam Electric Plant, Unit No. 2 - Relief Request-07 from Immediate ASME Code Repair of Refueling Water Storage Tank Drain Valve (Safety Injection-837) for Fifth10-year Inservice Inspection Program Plan (TAC NO. ME9747)." [ADAMS Accession Number ML 12325A612]

8. References

1. ASME Code Section XI, Division 1, 2007 Edition with 2008 Addenda.

2. 2012 EPRI Technical Report: Materials Reliability Program: Boric Acid Corrosion Guidebook, Revision 2: Managing Boric Acid Corrosion Issues at PWR Power Stations (MRP-058, Rev 2).

3. ASME Code Section III, NC, 1974 Edition, no Addenda.

4. Combustion Engineering Specification 00000-PE-404: "General Engineering Specification for Miscellaneous Nuclear Service Centrifugal Pumps," dated May 9, 1970.

5. Combustion Engineering Specification 13172-PE-404, Revision 01: "Project Specification for Miscellaneous Nuclear Service Centrifugal Pumps For St. Lucie Plant, Unit No. 2 1978-890 MW Extension," dated February 23, 1978.

6. Drawing 2998-2229 R2: Florida Power and Light Company; St. Lucie Plant; Boric Acid Makeup Pumps: dated September 9, 1983.

7. Drawing 2998-2410 R5: Florida Power and Light Company; St. Lucie Plant; Boric Acid Makeup Pump Sectional Assembly: dated February 5, 1991.