



October 25, 2002

10 CFR 50.55a(g)(5)(iii)

SERIAL: BSEP 02-0175

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325 AND 50-324/LICENSE NOS. DPR-71 AND DPR-62
INSERVICE INSPECTION PROGRAM RELIEF REQUEST - SERVICE WATER
SYSTEM PIPING THROUGH-WALL FLAW

Ladies and Gentlemen:

In accordance with 10 CFR 50.55a(g)(5)(iii) and NRC Generic Letter 90-05, "Guidance For Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping," Carolina Power & Light (CP&L) Company is requesting relief from requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, for the Brunswick Steam Electric Plant, Units 1 and 2. CP&L is requesting relief from the requirements of Article IWA-4000 regarding repair of a through-wall leak identified on Service Water System line 2-SW-29-6-046. The technical basis supporting the request for relief is provided in Enclosure 1. A copy of the CP&L structural integrity assessment is provided in Enclosure 2. A list of regulatory commitments contained in this letter is provided in Enclosure 3.

Please refer any questions regarding this submittal to Mr. Leonard R. Beller, Supervisor - Licensing/Regulatory Programs, at (910) 457-2073.

Sincerely,

Edward T. O'Neil
Manager - Regulatory Affairs
Brunswick Steam Electric Plant

1047

Document Control Desk
BSEP 02-0175 / Page 2

WRM/wrm

Enclosures:

1. Relief Requested In Accordance with 10 CFR 50.55a(g)(5)(iii)
2. Structural Integrity Assessment
3. List of Regulatory Commitments

cc (with enclosures):

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U. S. Nuclear Regulatory Commission
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U. S. Nuclear Regulatory Commission **(Electronic Copy Only)**
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INSERVICE INSPECTION PROGRAM RELIEF REQUEST - SERVICE WATER SYSTEM
PIPING THROUGH-WALL FLAW

Relief Requested
In Accordance with 10 CFR 50.55a(g)(5)(iii)

1. American Society of Mechanical Engineers (ASME) Code Component Affected

The defect is located in a blind flange in Service Water System line 2-SW-29-6-046. Service Water System line number 2-SW-29-6-046 is part of a moderate energy system and operates at a pressure and temperature of less than 275 psig and 200°F, respectively. The piping, including the blind flange, is classified as ASME Code Class 3 for purposes of inservice inspection. The blind flange is American National Standards Institute 16.5, 6-inch 150 pounds, American Society for Testing and Materials (ASTM) A-105 carbon steel.

2. Applicable Code Edition and Addenda

ASME Boiler and Pressure Vessel Code, Section XI, 1989 Edition with no addenda (i.e., Reference 1).

3. Applicable Code Requirement

The ASME Code, Section XI, 1989 Edition, subparagraph IWA-4120(a), which states:

Repairs shall be performed in accordance with the Owner's Design Specification and the original Construction Code of the component or system.

4. Impracticality of Compliance

Generic Letter 90-05, "Guidance For Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping," (i.e., Reference 2) defines impracticality to exist if "... the flaw detected during plant operation is in a section of Class 3 piping that cannot be isolated for completing a code repair within the time period permitted by the limiting condition for operation (LCO) of the affected system as specified in the plant Technical Specifications, and performance of code repair necessitates a plant shutdown."

On October 3, 2002, a through-wall, pin-hole leak was identified in a blind flange on Brunswick Steam Electric Plant (BSEP), Unit 2 Service Water System line number 2-SW-29-6-046. The leak is located in a section of piping that is designed to be isolable, but replacement of the blind flange is currently impractical due to leakage at the isolation boundary. Replacement of the blind flange will require isolation and draining portions of the Unit 2 Nuclear Service Water header. With the Unit 2 Nuclear Service Water header inoperable due to isolation of the affected component, operation may continue for up to 7 days provided the Unit 1 Nuclear Service Water pumps remains operable. After the 7 day period, both units would then enter Condition I of Technical Specification 3.7.2. Condition I would then require Unit 1 and Unit 2 to be in Mode 3 in 12 hours and Mode 4 in 36 hours. Due to leakage at the isolation boundary, the replacement cannot be completed within the applicable LCO completion time in the BSEP, Unit 1 and 2 Technical Specifications.

5. Burden Caused by Compliance

Replacement of the blind flange will require isolation and draining of portions of the Unit 2 Nuclear Service Water Header because of leakage at the isolation boundary. The replacement cannot be completed with the applicable LCO completion time in the BSEP, Unit 1 and Unit 2 Technical Specifications, therefore requiring shut down of both units.

6. Proposed Alternative and Basis for Use

In accordance with 10 CFR 50.55a(g)(5)(iii) and NRC Generic Letter 90-05, Carolina Power & Light (CP&L) Company proposes the continued operation of the component in the as-found condition until a Code repair/replacement is performed. CP&L currently plans to complete the Code repair/replacement by November 30, 2002.

Service Water System line number 2-SW-29-6-046 is part of a moderate energy system and is classified as ASME Code Class 3. The defect is located in a blind flange in line 2-SW-29-6-046. Line number 2-SW-29-6-046 provides cooling water supply to the jacket cooling of the emergency diesel generators. Ultrasonic examination (i.e., UT) of the blind flange has determined that the inside face of the flange has suffered metal loss resulting in a "scalped" area. Through wall leakage has developed where the material has experienced the most degradation. The leak rate currently is approximately 5 drops per minute.

Until line 2-SW-29-6-046 can be isolated and examined from the inside, the cause of the defect cannot be definitely confirmed. However, the defect is believed to be the result of salt water contact with the carbon steel blind flange.

In accordance with the guidance contained in NRC Generic Letter 90-05, the defect has been examined using UT and wall thickness measurements have been taken. Based on the examination, the defect has been characterized as localized corrosion of the pipe blind flange.

For Code Class 3 piping, Generic Letter 90-05 identifies two flaw evaluation approaches that should be considered, the "through-wall flaw" approach and the "wall thinning" approach. Generic Letter 90-05 states that a temporary non-code repair may be proposed if a defect is found acceptable by the "through-wall flaw" approach. The Generic Letter 90-05 approaches are limited to use for a cylindrical shell only, and thus are not appropriate for a blind flange configuration. As an alternative to the Generic Letter 90-05 flaw evaluation, CP&L performed a structural integrity assessment based on the original code of construction, using United States of America Standard (USAS) B31.1.0-1967. This assessment compares a conservatively determined average flange thickness to the minimum required wall thickness based on longitudinal pressure. A conservative wear rate was then calculated. As a result, CP&L has determined that operation for up to 132 days is justified. The structural integrity assessment is provided in Enclosure 2. By November 30, 2002, CP&L plans to complete a Code repair/replacement of the component.

Generic Letter 90-05 stipulates that if a defect is evaluated and found acceptable by one of the two evaluation approaches, an augmented inspection using UT or radiographic examination (i.e., RT) to assess overall degradation of the affected system should be performed. The generic letter indicates that an augmented inspection should be performed within 15 days of detection of the defect, and that the augmented inspection is a part of the relief acceptance criteria of the temporary non-code repair of the Class 3 pipe. Only one other configuration involving a Service Water System blind flange with similar material exists (i.e., the same location on Unit 1 Service Water line 1-SW-494-6-046). The results of a UT inspection of this location indicated some degradation; however, the amount of degradation was less severe than the Unit 2 location and the Unit 1 blind flange currently meets minimum wall thickness requirements of the original code of construction (i.e., USAS B31.1.0, "Power Piping" - 1967). Augmented inspections have also been performed for three additional Service Water System locations with blind flanges fabricated from more corrosion-resistant materials; no degradation was identified.

Generic Letter 90-05 states that until a code repair is completed, the integrity of an affected component should be assessed at least once every three months using a non-destructive examination technique. By November 30, 2002, CP&L plans to complete a Code repair/replacement which will fully restore compliance of the affected component; therefore, the Generic Letter 90-05 assessment of the affected area using a non-destructive examination technique will not be necessary. As stipulated by Generic Letter 90-05, a qualitative assessment of leakage through the defect area will be performed at least once every week to identify any degradation of structural integrity until the Code repair is completed.

In conclusion, the overall degradation of the affected portion of the Service Water System has been assessed and evaluated as acceptable.

7. Duration of Proposed Alternative

Use of the proposed alternative is requested until November 30, 2002, by which time CP&L will install the Code repair/replacement.

8. References

1. American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, 1989 Edition with no addenda.
2. NRC Generic Letter 90-05, "Guidance For Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping," June 15, 1990

Structural Integrity Assessment

Introduction:

The objective of this assessment is to document the structural evaluation of the Unit 2 through-wall leak identified by Action Request (AR) 73455. This through-wall leak was discovered in the Unit 2 Service Water line 2-SW-29-6-046 blind flange. The installed flange is American National Standards Institute (ANSI) 16.5, 6 inch–150 pound, American Society for Testing and Materials (ASTM) A-105 Carbon Steel. The flange was ultrasonically (i.e., UT) examined to determine the thickness of the existing material and the report is included as Attachment 1.

Quality Class Determination:

The 6 inch–150 pound flange is installed on line 2-SW-29-6-046. This line and its interfacing structures and components are Quality Class A (i.e., safety related).

Minimum required blind flange wall thickness (t):

Per B31.1.0-1967, section 104.5.2 the qualification of a blind flange shall be based on requirements of the Section VIII of the ASME B&PV Code (1968).

In accordance with Section VIII of the ASME B&PV Code (1968), UG-34 sketch (p), the flat flange wall thickness can be calculated as follows:

$$t = d * \sqrt{\frac{CP}{S}}$$

Although the above formula is specified for a blind flange, this formula is not applicable for evaluating degraded components. The intent of the formula above is to design components outside of the ANSI 16.5 standards.

Since the review of examination results revealed that the wall thickness around the bolting was within design and only the wetted surface was affected by corrosion, the B31.1.0-1967, Section 104.5.3 formula was determined to be more applicable for verifying structure integrity of a component.

The use of the B31.1.0-1967, Section 104.5.3 formula is based on the fact the gasket is compressed and only the wetted part of the blind flange is subject to the pressure. Since this is a blind flange connection-free end, there are no other loads (e.g., thermal, dead weight, seismic or bolt/gasket set loads) that need to be considered in flange wall thickness evaluation.

In addition, the corroded component was evaluated for short-term operability, and a Code repair/replacement is currently scheduled to be implemented by November 30, 2002.

Per B31.1.0-1967, Section 104.5.3, the wall thickness (t) is equal to:

$$t = d_6 * \sqrt{\frac{3P}{16 * S}}$$

Where:

$d_6 = 6.065$ (in) is flange wetted diameter

$\sqrt{\frac{3}{16}} = .43$ factor to account for end condition

$S = 0.9 * SY = 0.9 * 30000 = 27000$ (psi)

$P = 80$ (psig) maximum operating pressure

For clarification, the value “ d_6 ” and “ P ” will only be equal to the exposed wetted surfaces (i.e., 6.065 inches) and operating pressure, respectively. The use of the value 6.065 inches is based on the fact the gasket is compressed and the wetted part of the blind flange is all that is subjected to the maximum operating pressure (i.e., 80 psig). Design pressure (i.e., specified in Reference 2.1) was not used since the degraded surfaces would not be subject to this higher pressure. Based on the hydraulic model for this system (i.e., Reference 5.3), the maximum operating pressure for this section of piping would not be greater than 80 psig.

Therefore, using the above values, the wall thickness required for structure integrity of the degraded surfaces is:

$$t = 0.143 \text{ inches}$$

Determination of actual (average) wall thickness (T_{av}) of blind flange:

Based on UT inspection data (i.e., see Attachment 1, band RK-RT), the average wall thickness in the center 4-inch portion of the blind flange can be conservatively estimated as follows:

$$T_{av} = 0.25 * \{ .5 * (.274 + .221) * 1 + .5 * (.221 + .168) * 1 + .5 * (.168 + .146) * 1 + .5 * (.146 + .222) * 1 \} \\ = 0.196 \text{ inch}$$

Since this is greater than 0.143 inches, the blind flange has adequate design margin to perform its design function.

Corrosion Rate Calculation (C_{cor}):

Since the subject flange was installed in 1996 under Plant Modification (PM) 91-071, the corrosion rate can be conservatively calculated based on 5.5 years of the operation, assuming the metal loss is uniform.

The corrosion rate (C_{cor}) is equal to:

$$C_{cor} = \frac{T_{nom} - T_{ins}}{Y} = \frac{1.0 - 0.196}{5.5} = 0.146 \text{ (in/yr)}$$

where:

T_{nom} = 1.0 (inch) 6-inch 150 pound ANSI B16.5 Blind Flange

Y = 5.5 years of operation

T_{ins} = 0.196" average inspected wall thickness calculated above

Determine remaining life (K_L) of the blind flange:

The remaining life (K_L) of the flange is equal to:

$$K_L = \frac{(T_{av} - t) * 365}{C_{cor}} = \frac{(0.196 - 0.143) * 365}{0.146} = 132.5 \text{ days}$$

Conclusion:

The degraded blind flange has adequate wall thickness to perform its design function for at least 132 more days.

References:

1. Industry Standards:

1.1 USAS B31.1.0 - 1967 Power Piping

2. Specifications:

2.1 Spec 248-117 Installation Of Piping Systems

3. Drawings:

3.1 P&ID's:

3.1.1 D-02274, Sht 2, DG Bldg. SW & Demin. Water System Unit 2

3.2 FSP/FP Drawings

3.2.1 FSP-04232, Sht 5, DG Bldg. SW Supply Piping Isometric Units 1 & 2

4. NGGC Procedures:

4.1 EGR-NGGC-0320, Civil/Structural Operability Reviews

5. Others:

5.1 PM 91-071 DG SW Piping Replacement

5.2 Calculation SA-SW-B442, Pipe stress Analysis. Unit 2

5.3 Calculation G0050A-12, Unit 2 Service Water Hydraulic Model

5.4 AR 73455

ATTACHMENT 1

Page 1
10/03/02
SWFLANGE.TXT

Notes

[SHEET 16]

IDENTIFIER	THICKNESS	UNITS	FLAGS	SU #				
SU #	VEL(/uS)	DIFF	LO-ALM	HI-ALM	EXT-BLANK	UNITS	TRANSDUCER	GAIN dB
7	0.2339	0 000	0.000	10.000	0 000	IN	D790/791	53
8	0.2339	0 000	0.000	10.000	0.000	IN	D790/791	63
9	0.2339	0 000	0.000	10.000	0.000	IN	D790/791	57
10	0.2339	0 000	0 000	10.000	0 000	IN	D790/791	59

OK

CODE COMMENT

OK

Filename: SWFLANGE.TXT

Operator: GEORGE LININGER

Location: SW BLDG.

Date 10/3/2002

Time: 17:55

Probe ID: D790/791 for SU# 7

Probe ID: D790/791 for SU# 8

Probe ID: D790/791 for SU# 9

Probe ID: D790/791 for SU# 10

Comments:

THROUGH WALL LEAK ON SW FLANGE 1" SPACING FOR READINGS LINE2-SW-29-6-046

WR/322150

ATTACHMENT 1

Main Section (0)

Rows : 1 Cols : 40 Direction : Clockwise Offset : 0

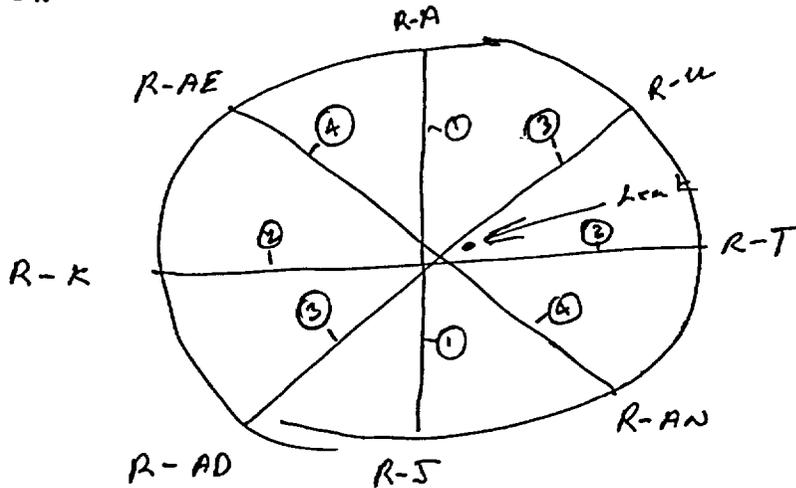
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	0.983	0.542	0.318	0.222	0.178	0.231	0.438	0.515	0.935	0.986	0.987	0.541	0.274	0.221	0.168	0.146	0.222	0.388	0.931	0.989	0.986
ColMx	0.983	0.542	0.318	0.222	0.178	0.231	0.438	0.515	0.935	0.986	0.987	0.541	0.274	0.221	0.168	0.146	0.222	0.388	0.931	0.989	0.986
ColMn	0.983	0.542	0.318	0.222	0.178	0.231	0.438	0.515	0.935	0.986	0.987	0.541	0.274	0.221	0.168	0.146	0.222	0.388	0.931	0.989	0.986
Delta	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ave	0.983	0.542	0.318	0.222	0.178	0.231	0.438	0.515	0.935	0.986	0.987	0.541	0.274	0.221	0.168	0.146	0.222	0.388	0.931	0.989	0.986

	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN
1	0.522	0.320	0.274	0.113	0.181	0.257	0.467	0.742	0.989	0.985	0.555	0.302	0.220	0.154	0.147	0.370	0.552	0.946	0.988
ColMx	0.522	0.320	0.274	0.113	0.181	0.257	0.467	0.742	0.989	0.985	0.555	0.302	0.220	0.154	0.147	0.370	0.552	0.946	0.988
ColMn	0.522	0.320	0.274	0.113	0.181	0.257	0.467	0.742	0.989	0.985	0.555	0.302	0.220	0.154	0.147	0.370	0.552	0.946	0.988
Delta	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ave	0.522	0.320	0.274	0.113	0.181	0.257	0.467	0.742	0.989	0.985	0.555	0.302	0.220	0.154	0.147	0.370	0.552	0.946	0.988

RowMx RowMn Delta Ave
1 0.989 0.113 0.876 0.507

Section Summary

Maximum Reading = 0.989 (1, T) Average = 0.507
Minimum Reading = 0.113 (1, Y) Standard Deviation = 0.322
Total Readings = 40



Readings started 1" in from Flange Edge on 1" spacings
Leak off of center line at Reading "P"

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List of Commitments

The following table identifies those actions committed to by Carolina Power & Light (CP&L) Company in this document. Any other actions discussed in the submittal represent intended or planned actions by CP&L. They are described for the NRC's information and are not regulatory commitments. Please notify the Manager - Regulatory Affairs at the Brunswick Steam Electric Plant of any questions regarding this document or any associated regulatory commitments.

Commitment	Committed date or outage
1. CP&L will install an additional Code-compliant blind flange assembly as an extension of the Code boundary.	No later than November 30, 2002.
2. Perform a qualitative assessment of leakage through the defect located on the blind flange on Service Water System line number 2-SW-29-6-046, in accordance with NRC Generic Letter 90-05, to identify any degradation of structural integrity.	At least once every week until completion of a code repair.