CP&L

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SERIAL: BSEP 95-0161

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

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325 AND 50-324/LICENSE NOS. DPR-71 AND DPR-62
ASME CODE RELIEF REQUEST
IN-SERVICE TESTING TEST GAUGE ACCURACY

Gentlemen:

The purpose of this letter is to request relief from the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, in accordance with 10 CFR 50.55a(a)(3)(ii), for the Brunswick Steam Electric Plant, Units 1 and 2. The relief request applies to range requirements for test gauges used for in-service pump testing of the Core Spray, High Pressure Coolant Injection, Reactor Core Isolation Cooling, Residual Heat Removal (RHR), and RHR Service Water Systems.

The detailed request for relief is provided in Enclosure 1. A copy of the In-Service Testing Gauge Accuracy Requirements Evaluation (Engineering Evaluation Report 94-0243) supporting the relief request is provided in Enclosure 2.

Implementation of the alternate testing requirements described in the relief request is expected to reduce site personnel exposure by 400 millirem per year and will save approximately 240 man-hours per year.

Please refer any questions regarding this submittal to Mr. George Honma at (910) 457-2741.

Sincerely,

G. D. Hicks
Manager — Regulatory Affairs
Brunswick Nuclear Plant

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WRM/ap

Enclosures

1. Relief Request
2. In-Service Testing Gauge Accuracy Requirements Evaluation (Engineering Evaluation Report 94-0243)

cc: Mr. S. D. Ebneter, Regional Administrator, Region II
Mr. D. C. Trimble, NRR Project Manager - Brunswick Units 1 and 2
Mr. C. A. Patterson, NRC Senior Resident Inspector - Brunswick Units 1 and 2
The Honorable H. Wells, Chairman - North Carolina Utilities Commission
Mr. Billy Walker, Assistant Director - Boiler & Pressure Vessel Division

ENCLOSURE 1

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325 AND 50-324
LICENSE NOS. DPR-71 AND DPR-62
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COMPONENTS:

Core Spray Pumps:
1CS-P-1A, 1B
2CS-P-2A, 2B

High Pressure Coolant Injection Main and Booster Pumps:
1-HPCI-P-MN-1, 1-HPCI-P-BST-1
2-HPCI-P-MN-2, 2-HPCI-P-BST-2

Reactor Core Isolation Cooling Pumps:
1-RCIC-P-1, 2-RCIC-P-2

Residual Heat Removal Pumps:
1-RHR-P-1A, 1B, 1C, 1D
2-RHR-P-2A, 2B, 2C, 2D

Residual Heat Removal Service Water Pumps:
1-RHR-SW-P-1A, 1B, 1C, 1D
2-RHR-SW-P-2A, 2B, 2C, 2D

FUNCTION:

Emergency Core Cooling
Safety-related equipment cooling
Safe reactor shutdown

CLASS:

2 and 3

TEST REQUIREMENT:

ASME Code, Section XI, IWP-4120 requires that the full scale range of each instrument shall be three times the reference value or less.

BASIS FOR RELIEF:

The ASME Code, Section XI requires that the full-scale range of each instrument be three times the reference value or less. The permanently installed plant instrumentation does not meet the requirements of ASME Code, Section XI, IWP-4120. For this reason, Carolina Power & Light Company is installing temporary test gauges which meet the above code requirements each time the above referenced pumps are tested.

As an alternative to the requirements of IWP-4120, CP&L would like to use permanently installed plant instrumentation. The use of the permanently installed plant instruments is an acceptable alternate for the following reasons:

1. NUREG-1482 provides guidelines for development and implementation of programs for in-service testing of pumps and

valves at nuclear power plants. Section 5.5.1, "Range and Accuracy of Analog Instruments" discusses situations where the range of permanently installed instrumentation is greater than 3 times the reference value but the accuracy of the instrument is more conservative than the ASME Code. Under such circumstances, the NUREG indicates that the NRC Staff will grant relief when the combination of range and accuracy yields a reading at least equivalent to the reading achieved from the instruments that meet the ASME Code requirements.

2. Pump differential pressure measurements are determined by subtracting a suction pressure from a discharge pressure obtained at locally installed pressure gauges. The range of the plant installed analog instrumentation is greater than 3 times the reference value, but the accuracy of the instrumentation is ± ½ percent of full scale which is more conservative than ASME Code, Section XI, IWP-4110 . Since differential pressure is the value of concern, the overall accuracy of the differential pressure value determined by the permanently installed test equipment was compared to the requirement for a differential pressure gauge for each case.

   The comparison found that with the higher accuracy requirements, the total possible error from plant installed equipment was significantly less than a comparable code allowable pressure differential gauge. Readability concerns associated with the higher range gauges were also evaluated for impact on overall test results. The evaluation performed concluded that the combination of range and accuracy for the permanently installed plant instrumentation yields readings which are at least equivalent to the readings achieved from instrumentation that meet the ASME Code, Section XI requirements.

3. The installation and removal of temporary test gauges creates a hardship in the area of site personnel exposure. In addition, the use of temporary test gauges is undesirable due to the inherent risks associated with the breaking and re-assembly of mechanical connections, the additional calibration requirements associated with temporary instrumentation, and the additional man-hours required to install and remove the temporary instrumentation.

ALTERNATE TESTING: Use permanently installed plant instrumentation to perform in-service testing that will yield readings (i.e., combination of the range and accuracy) which are at least equivalent to the readings achieved from instrumentation that meet the ASME Code, Section XI requirements.

REFERENCES: Engineering Evaluation Report 94-0243, "IST Gauge Accuracy Requirements Evaluation"

ENCLOSURE 2

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325 AND 50-324
LICENSE NOS. DPR-71 AND DPR-62
ASME CODE RELIEF REQUEST
IN-SERVICE TESTING TEST GAUGE ACCURACY

IN-SERVICE TESTING GAUGE ACCURACY
REQUIREMENTS EVALUATION
(ENGINEERING EVALUATION REPORT 94-0243)

ENGINEERING EVALUATION

PROBLEM DESCRIPTION

Currently BNP is using temporary test gauges to complete In Service Testing (IST) testing on HPCI, RCIC, RHR, CS and RHR Service Water pumps. This involves a significant effort by the Operations and has led to problems such as leaky test hose connections, ruptured test hoses spilling contaminated water, contamination of clean test gauges, damage to test gauges (the test gauges used are expensive and sensitive instruments) and testing delays.

The use of temporary gauges has been required by the procedures since 1985. Use of temporary test gauges was required due to the accuracy of RTGB gauges (loop accuracy approx ± 2.5%) instead of local gauges (± 0.5% accuracy) and testing method problems.

Further review of the IST testing program indicates that permanently installed local gauges can be used in a number of applications where temporary test gauges are currently being used. This EER provides technical justification to support a Code Relief Request. With this EER and the Code Relief Request, BNP will be able to use permanently installed gages and still be in compliance with the requirements of ASME Section XI, 1980 edition through the winter 1981 addenda. This effort will allow closure of EWRs 08783, 08786, 09434 and 09435 written by Ops due to the problems they have had using temporary gauges.

EVALUATION

Article IWP-4240 of the code requires that the differential pressure across a pump shall be determined by use of either a differential pressure gauge or a differential pressure transmitter that provides a direct measurement of the pressure difference or by taking the difference between the pressure at a point in the inlet pipe and the pressure at a point in the discharge pipe.

Article IWP-4110 requires that instrument accuracy shall be within ± 2% of full scale for pressure and differential pressure. It also states that station instruments meeting these requirements shall be acceptable.

Article IWP-4120 requires that the full scale range of each instrument shall be three times the reference value or less.

If a differential pressure gauge is used, the accuracy and range requirements are easily understood. However, if the value is determined by subtracting a suction pressure from a discharge pressure the limitations can be confusing, difficult to comply with and/or inappropriate. For example, should the range limitation for the gauges be based on the reference values for the readings of the individual gauges when the reference data was taken or the differential pressure value determined by subtraction. Also, if the reference conditions for a pump were taken with a 4 psia suction pressure and the range selected on an individual reading basis then the range would need to be no more than 12 psia which is less than 0 psig. If the reference conditions for a pump had a 50 psig suction pressure and a 60 psig discharge pressure, and the reference differential pressure were used to determine the range, then only a 30 psig wide range would be allowed.

ENGINEERING EVALUATION

EVALUATION

As can be seen from the above, the specific guidance provided requires clarification when using individual gauges to compute a differential pressure. Therefore a standard based on the intent of the code is appropriate. Since differential pressure is the value of concern, the overall accuracy of the differential pressure value determined by the test will be compared to the requirement for a differential pressure gauge. This may require that the rated accuracy of a gauge be better than 2% in order to offset inaccuracy associated with the range of an instrument. In NUREG-1482 Section 5.5, the NRC has provided guidance consistent with this approach. Specifically the NUREG states:

"The Code requires an accuracy for analog instruments of ± 2 percent full scale, ± 2 percent of total loop accuracy for a combination of instruments, or ± 2 percent over the calibrated range for digital instruments."

And

"When the range of a permanently installed analog instrument is greater than 3 times the reference value but the accuracy of the instrument is more conservative than the Code, the staff will grant relief when the combination of range and accuracy yields a reading at least equivalent to the reading achieved from instruments that meet the Code requirements."

The maximum allowed inaccuracy for a differential pressure instrument would be 2% of range where the range is 3 times the reference value. This would result in a potential inaccuracy of 6% of the value at the reference differential pressure. If the inaccuracy of a suction pressure gauge is added to the inaccuracy of a discharge pressure gauge and this total is kept below 6% of the reference value, then the intent of the accuracy/range requirements of the code will be maintained.

The above discussion does not account for readability concerns. Using an instrument where the reading is less than 1/3 of scale can increase errors associated with readability. Readability depends on a variety of factors such as scale resolution, needle width, needle fluctuation, lighting and parallax. Typically gages with better accuracy ratings have larger scales, finer needles and other provisions to minimize readability concerns. Since most readability problems affect calibration efforts as well as data taking, the expected accuracy of the test data should be very close to the calibration tolerance requirement. The one problem most likely to reduce test data accuracy more than calibration accuracy is needle fluctuations. Some of the affected instruments have pulsation dampeners and all of the procedures allow supply valve throttling. These provisions minimize the fluctuation problems. However, to assure that total accuracy of the data is within 6%, any application using this EER as a basis will require that the total maximum expected error of the calculated differential pressure is held to 5% of the differential pressure. This will compensate for any accuracy reduction associated with use of gages at less than 1/3 of scale.

ENGINEERING EVALUATION

EVALUATION

A review of applicable gages found the following:

SYSTEM	SERVICE	GAUGE	RANGE (PSIG)		ACCURACY (±%)	(±PSI)
HPCI	SUCTION	E41-PI-R004	-14.7	100	0.5%	0.6
HPCI	DISCHARGE	E41-PI-R001	0	1500	0.5%	7.5
RCIC	SUCTION	E51-PI-R002	-14.7	100	0.5%	0.6
RCIC	DISCHARGE	E51-PI-R001	0	1500	0.5%	7.5
RHR	SUCTION	E11-PI-R002(A-D)	-14.7	150	0.5%	0.8
RHR	DISCHARGE	E11-PI-R003(A-D)	0	600	0.5%	3.0
CS	SUCTION	E21-PI-R001A(B)	-14.7	30	0.5%	0.2
CS	DISCHARGE	TEMPORARY/NEW				5.0*
RHR SW	SUCTION	TEMPORARY/NEW				1.0*
RHR SW	DISCHARGE	E11-PI-R004(A-D)	0	1000	0.5%	5.0

* To be controlled by the test procedure unless a new permanent gauge can be installed.

Comparing system reference differential pressures, the stated limitation on gauge accuracy (5% of reference differential pressure) and the actual maximum expected instrument error based on calibration tolerances gives:

SYSTEM	REF dP	3 X REF	ALLOWABLE ERROR (5%)	ACTUAL TOTAL ERROR
UNIT 1 HPCI	375	1125	18.7	8.1
UNIT 2 HPCI	367	1101	18.3	8.1
UNIT 1 RCIC	275	825	13.7	8.1
UNIT 2 RCIC	283	849	14.1	8.1
UNIT 1 RHR A	127.5	382.5	6.4	3.8
UNIT 2 RHR A	132.5	397.5	6.6	3.8
UNIT 1 RHR B	135.8	407.4	6.8	3.8
UNIT 2 RHR B	132.3	396.9	6.6	3.8
UNIT 1 RHR C	139.4	418.8	7.0	3.8
UNIT 2 RHR C	132.4	397.2	6.6	3.8
UNIT 1 RHR D	130.3	390.9	6.5	3.8
UNIT 2 RHR D	130.2	390.6	6.5	3.8
UNIT 1 CS A	290.1	870.3	14.5	5.2
UNIT 2 CS A	282.3	846.9	14.1	5.2
UNIT 1 CS B	286.6	859.8	14.3	5.2
UNIT 2 CS B	286.2	858.6	14.3	5.2
UNIT 1 RHR SW A	246.6	739.8	12.3	6.0
UNIT 2 RHR SW A	245.3	735.9	12.3	6.0
UNIT 1 RHR SW B	258	774	12.9	6.0
UNIT 2 RHR SW B	247	741	12.3	6.0
UNIT 1 RHR SW C	252.5	757.5	12.6	6.0
UNIT 2 RHR SW C	249.2	747.6	12.5	6.0
UNIT 1 RHR SW D	258.3	774.9	12.9	6.0
UNIT 2 RHR SW D	254	762	12.7	6.0

ENGINEERING EVALUATION

EVALUATION

Since the instrumentation is capable of producing a differential pressure value with an accuracy better than required by the code, the gages above are technically acceptable for IST testing.

The above discussion was based on the vendor ratings for the installed instrumentation. In order to assure that the instrumentation performs as required, calibration requirements will be reviewed and revised as needed prior to relying on an instrument. If desired, a tolerance slightly greater than 0.5% can be used as long as the final accuracy of the computed differential pressure is acceptable (this may be needed due to tick mark spacing). Also, the tight tolerance for calibration only applies to that portion of the range associated with taking data for IST purposes.

CORRECTIVE ACTIONS

An action item will be issued to process a Code Relief Request. This will allow BNP to use gauges for IST testing where the total maximum expected error of a calculated differential pressure (based on calibration tolerance requirements) is less than 5% of the reference differential pressure.

After the code relief request is approved, the action item will require that the following actions be initiated (i.e issue PMRs, PARs ESRs etc):

1. Ensuring appropriate calibration tolerances are specified
2. Have IST test procedures revised
3. Evaluate other applications for design changes to install new gages if appropriate to convert to use of permanent gages.

ACCEPTANCE TESTING

No acceptance testing is required for this EER

Will the evaluation, on either a temporary or permanent basis:

1. Justify the deletion of equipment/common components from the BSEP EQ program?

   [ ] Yes [✓] No

2. Justify the addition of (already existing) equipment/common components to the BSEP EQ program?

   [ ] Yes [✓] No

3. Authorize the repair of EQ equipment/common components with other than qualified like-in-kind equipment/components parts?

   [ ] Yes [✓] No

4. Affect the existing installation or interface (of EQ equipment/common component applications) as may be designated in EDBS and/or in the qualification data package (including changing the type of interface/ installation)?

   [ ] Yes [✓] No

5. Justify the (quality class) upgrade of equipment/common components or component parts which could be utilized in EQ applications?

   [ ] Yes [✓] No

6. (Re)Define qualification parameters (e.g., normal or LOCA/HELB environmental conditions, postaccident operating time requirements, essential passive/active postaccident operating requirements, qualified life assumptions/results, etc.) for specific EQ equipment?

   [ ] Yes [✓] No

7. Provide an EQ-related justification for continued operation (as required per PLP-02, Section 4.4.3.3 or 4.4.4)?

   [ ] Yes [✓] No

8. Provide the resolution of a qualification problem (as required per PLP-02, Section 4.4.4)?

   [ ] Yes [✓] No

Notes:

1. If all no, then no further EQ consideration is required. Mark the EER Traveler accordingly as required by ENP-12 and include this completed EER-EQIF within the EER package. An EQ Technical Review is not required.

2. If any yes, an EQ impact assessment (per Section 5.3) must be performed during the evaluation process. Mark the EER Traveler accordingly and include this completed EER-EQIF within the EER package. An EQ technical review is required.