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

November 9, 2012

MEMORANDUM TO: Sher Bahadur, Deputy Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

FROM: William Jones, Deputy Director ***/RA/***
Division of Reactor Projects

SUBJECT: TASK INTERFACE AGREEMENT (CONCURRENCE) – OPERABILITY OF BRUNSWICK UNIT 2, REACTOR WATER CLEANUP SYSTEM ISOLATION INSTRUMENTATION WITH THE INLET FLOW ORIFICE INSTALLED BACKWARDS (TIA 2012-09)

1.0 INTRODUCTION

This Task Interface Agreement (TIA) documents the U.S. Nuclear Regulatory Commission (NRC) staff's position that the Brunswick Nuclear Power Plant, Unit 2 (Brunswick-2), Reactor Water Cleanup (RWCU) System Isolation Instrumentation was not operable while the inlet flow orifice was installed backwards. The orifice was installed backwards during the Unit 2 refueling outage in April 2011, until August 2011, when the orifice was oriented correctly. Region II staff issued a licensee-identified violation (LIV) of technical specification (TS) 3.3.6.1 (see Enclosure 1) in Inspection Report 05000325,324/2011004 as a result of the maintenance error. The licensee initially submitted a Licensee Event Report (LER) for the issue as a condition prohibited by TS 3.3.6.1. After further analysis, the licensee retracted the LER and contested the LIV stating that the error did not render the RWCU isolation instrumentation inoperable (see Enclosure 2). Region II consulted with the Office of Nuclear Reactor Regulation (NRR) staff and has concluded that the LIV of TS 3.3.6.1 is valid. Region II seeks to document this position via this concurrence TIA.

2.0 BACKGROUND

The Brunswick-2 Updated Final Safety Analysis Report (UFSAR), states RWCU System Isolation on Differential Flow-High is provided to detect gross leakage resulting from a pipe or component rupture and initiate automatic isolation that will prevent excessive loss of reactor coolant and release of significant amounts of radioactive material, with the analytical flow rate limit being no greater than 300 gallons per minute (gpm). Flow measurement is a critical component in the measurement of RWCU differential flow to ensure RWCU system isolation functions as designed.

Technical Specifications require that the RWCU differential flow instrumentation be demonstrated operable by performance of Surveillance Requirement (SR) 3.3.6.1.5, Functional Test once every 184 days, and SR 3.3.6.1.6, Channel Calibration once every 24 months. RWCU instrument channels are usually considered operable if the SRs verify that the channels are capable of isolating the RWCU System at equal to or less than a value of 73 gpm differential flow. The 73 gpm TS differential flow rate provides an adequate margin considering all instrument uncertainties to ensure that the 300 gpm analytical limit is not exceeded during accidents, transients or anticipated operational occurrences.

In August 2011, the licensee discovered a significant difference between indicated RWCU inlet and return flows. Upon investigation, the licensee found that the inlet flow orifice was installed backwards, causing the inlet flow rate to be approximately 18 percent lower than the expected value when compared to the system return flow rate. This 18 percent error in RWCU inlet flow rate resulted in instrument readings to be 46 gpm non-conservative with respect to actual RWCU differential flow rate. Combining the 46 gpm attributed to the 18 percent error in RWCU inlet flow rate with the nominal 43 gpm RWCU high differential flow instrument readings exceeds the TS Allowable Value (AV) of 73 gpm. This condition was introduced during the Unit 2 refueling outage, which ended in April 2011. Upon discovery of the incorrectly installed flow orifice on August 2, 2011, the licensee declared TS 3.3.6.1 Function 5.a not met and manually isolated the RWCU system.

The licensee also reported the condition in an LER. However, after further review, the licensee concluded that the RWCU differential flow isolation function was Operable with the inlet flow orifice installed backwards, retracted the LER, and formally contested the LIV. Region II staff then held discussions with NRR staff from the Technical Specifications Branch and the Instrumentation and Control Branch and concluded that the LIV is valid.

Licensee's Position

The licensee contends that the error associated with the incorrectly installed RWCU inlet flow orifice is within the margin to the safety limit of 300 gpm and that the error should be allocated to the available margin between the TS AV (73 gpm) and the safety limit (300 gpm), as opposed to allocating the error to the margin between the nominal setpoint (43 gpm) and the TS AV. The licensee justifies the allocation of the error in this manner by characterizing the error as "unmeasurable uncertainties." The term "unmeasurable uncertainties" is used in the licensee's setpoint calculation and is defined as those uncertainties not directly measured or affected by the instrument calibration surveillance. For example, manufacturing tolerances and normal flow element wear are given as examples of unmeasurable uncertainties. Unmeasurable uncertainties are allocated against the available margin between the TS AV and the safety limit in the licensee's RWCU high differential flow isolation setpoint calculation. The licensee's position is fully explained in their operability determination (Enclosure 3) and the LIV denial letter (included in Enclosure 2).

NRC Staff Evaluation

The NRR staff evaluation included review of the Brunswick-2 UFSAR; Brunswick-2 Technical Specifications for Limiting Conditions for Operation applicability, Surveillance Requirement applicability and Table 3.3.6.1-1, Primary Containment Isolation Instrumentation, Function 5.a,

RWCU Differential Flow – High; the licensee documentation withdrawing Licensing Event Report 2-2011-001; the licensee's operability determination (AR 479248-21) and the regulations under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50.36, Technical Specifications.

The licensee's contested violation letter BSEP 11-0108, dated December 14, 2011, stated that operability of the RWCU Differential Flow – High instrumentation is dependent upon: (1) meeting the TS required AV of ≤ 73 gpm and (2) the overall ability of the instrument loop to perform its intended safety function. … The flow safety function of the instrument loop is met when it can be demonstrated that the analytical limit is met. …the staff's evaluation of the information provided by the licensee in Enclosures 2 and 3 confirms that sufficient safety margin was available and the additional error did not prevent the loop from meeting the analytical limit for the RWCU Differential Flow – High function.

Under 10 CFR 50.36(c)(2) Limiting conditions for operation, (i) "Limiting conditions for operation are the lowest functional capability or performance levels of equipment required for safe operation of a facility. When a limiting condition for operation is not met, the licensee shall […] follow any remedial action permitted by the technical specifications until the condition can be met." Whether a TS LCO is satisfied cannot solely be determined by the successful performance of licensee surveillance procedures. It is possible that the surveillance procedures are not adequate to demonstrate a system, subsystem, component, or device is capable of performing its specified safety function(s). The surveillance procedures corresponding to the Surveillance Requirements for RWCU System differential flow-high presume that the flow element is installed correctly. SR 3.3.6.1.6 requires performance of a channel calibration once every 24 months. The TS definition for Channel Calibration establishes requirements to verify that channel safety functions will be met. The pertinent part of the definition of Channel Calibration is:

> A Channel Calibration shall be the adjustment, as necessary, of the channel output such that it responds within the necessary range and accuracy to known values of the parameter that the channel monitors. The Channel Calibration shall encompass all devices in the channel required for channel Operability and the Channel Functional Test. Calibration of instrument channels with resistance temperature detector (RTD) or thermocouple sensors may consist of an inplace qualitative assessment of sensor behavior and normal calibration of the remaining adjustable devices in the channel.

Thus, the TS AV does not account for an incorrectly installed flow element unless the calibration procedure adjusts the channel output to respond within the necessary range and accuracy to known values of the parameter that the channel monitors.

The NRC staff reviewed the licensee's description of the RWCU high differential flow surveillance procedure documents. The procedure for SR 3.3.6.1.6 does not evaluate the channel sensor (flow element), does not compare the calculated flow to a known value of the actual plant flow rate, and does not include an in situ qualitative assessment of sensor behavior similar to the comparison required to be performed for RTD or thermocouple sensors. RWCU high differential flow surveillance procedures neither address an incorrectly installed flow element nor require the TS AVs to be verified to ensure that passing the channel calibration test

validates that the TS LCO has been satisfied. Therefore, the incorrectly installed flow element created an unaccounted-for error, because the calculated TS AV did not address the condition of an incorrectly installed sensor and no in-situ qualitative assessment of sensor behavior was performed. Furthermore, the Channel Calibration did not compare calculated flow to a known value of actual flow. In this instance, there is a valid argument for stating that the safety significance of this degraded condition is low, because the estimate of the magnitude of the unaccounted for error is small compared to the remaining safety margin after accounting for all identified errors. The regulations under 10 CFR 50.36(b) require plant-specific TSs be derived from the analyses and evaluations included in the UFSAR. The Brunswick-2 TSs AV is the LCO (10 CFR 50.36(c)(2)(i)) and it is the AV that establishes an appropriate margin to the UFSAR Analytical Limit for RWCU system isolation on high differential flow. The purpose of SR 3.3.6.1.6 is to verify that the RWCU Differential Flow – High instrumentation is operable when channel output is such that it responds within the necessary range and accuracy to known values of the RWCU flow to isolate RWCU on a sensed differential flow of ≤ 73 gpm.

Region II staff consulted the NRR Technical Specifications Branch and the Instrumentation and Control Branch. NRR concurs with the RII position outlined in this assessment. The assessment, in summary, states that the licensee's assertion that the instrument inaccuracy associated with the flow orifice installation error is not applicable to the TS AV is not appropriate because allocation of instrument inaccuracy introduced by maintenance errors is not accounted for in the licensee's calculation and should be evaluated as a degraded condition. This degraded condition has a clear and quantifiable impact on the instrument's ability to perform its TS-required function of isolating the RWCU system piping with a setpoint of less than or equal to 73 gpm.

3.0 CONCLUSION

Based on the Region II and NRR assessment of the condition of the Brunswick-2 RWCU system with the inlet flow orifice installed backwards, the NRC staff has concluded that TS Table 3.3.6.1-1, Function 5.a was inoperable from the date the orifice was installed backwards during the Unit 2 refueling outage in April 2011 until the date in August 2011, when the orifice was reinstalled correctly. The licensee's evaluation of the condition is not correct and the LIV issued by Region II is valid. Furthermore, the condition is reportable as a condition prohibited by TS per 10 CFR Part 50.73(a)(2)(i)(B).

Contacts:
Region II POCs: Phillip Niebaum, Acting Senior Resident Inspector –
Brunswick (910-457-9531)
Randall Musser, Chief, Division of Reactor Projects Branch 4 – Region II (404-997-4603)
Bernard Dittman, Instrumentation & Controls Engineer, NRR
David Rahn, Senior Instrumentation & Controls Engineer, NRR
Carl Schulten, Senior Reactor Engineer, Technical Specifications Branch, NRR

Enclosures:
1. LIV of TS 3.3.6.1 issued in Inspection Report 05000325,324/2011004.
2. Carolina Power & Light Company initiated correspondence (LER, LER retraction, and LIV denial letter).
3. Carolina Power & Light Company Operability Determination.

of an incorrectly installed sensor and no in-situ qualitative assessment of sensor behavior was performed. Furthermore, the Channel Calibration did not compare calculated flow to a known value of actual flow. In this instance, there is a valid argument for stating that the safety significance of this degraded condition is low, because the estimate of the magnitude of the unaccounted for error is small compared to the remaining safety margin after accounting for all identified errors. The regulations under 10 CFR 50.36(b) require plant-specific TSs be derived from the analyses and evaluations included in the UFSAR. The Brunswick-2 TSs AV is the LCO (10 CFR 50.36(c)(2)(i)) and it is the AV that establishes an appropriate margin to the UFSAR Analytical Limit for RWCU system isolation on high differential flow. The purpose of SR 3.3.6.1.6 is to verify that the RWCU Differential Flow – High instrumentation is operable when channel output is such that it responds within the necessary range and accuracy to known values of the RWCU flow to isolate RWCU on a sensed differential flow of ≤ 73 gpm.

Region II staff consulted the NRR Technical Specifications Branch and the Instrumentation and Control Branch. NRR concurs with the RII position outlined in this assessment. The assessment, in summary, states that the licensee's assertion that the instrument inaccuracy associated with the flow orifice installation error is not applicable to the TS AV is not appropriate because allocation of instrument inaccuracy introduced by maintenance errors is not accounted for in the licensee's calculation and should be evaluated as a degraded condition. This degraded condition has a clear and quantifiable impact on the instrument's ability to perform its TS-required function of isolating the RWCU system piping with a setpoint of less than or equal to 73 gpm.

3.0 CONCLUSION

Based on the Region II and NRR assessment of the condition of the Brunswick-2 RWCU system with the inlet flow orifice installed backwards, the NRC staff has concluded that TS Table 3.3.6.1-1, Function 5.a was inoperable from the date the orifice was installed backwards during the Unit 2 refueling outage in April 2011 until the date in August 2011, when the orifice was reinstalled correctly. The licensee's evaluation of the condition is not correct and the LIV issued by Region II is valid. Furthermore, the condition is reportable as a condition prohibited by TS per 10 CFR Part 50.73(a)(2)(i)(B).

Contacts:
Region II POCs: Phillip Niebaum, Acting Senior Resident Inspector – Brunswick (910-457-9531)
Randall Musser, Chief, Division of Reactor Projects Branch 4 – Region II (404-997-4603)
Bernard Dittman, Instrumentation & Controls Engineer, NRR
David Rahn, Senior Instrumentation & Controls Engineer, NRR
Carl Schulten, Senior Reactor Engineer, Technical Specifications Branch, NRR

Enclosures:
1. LIV of TS 3.3.6.1 issued in Inspection Report 05000325,324/2011004.
2. Carolina Power & Light Company initiated correspondence (LER, LER retraction, and LIV denial letter).
3. Carolina Power & Light Company Operability Determination.

X PUBLICLY AVAILABLE ☐ NON-PUBLICLY AVAILABLE ☐ SENSITIVE X NON-SENSITIVE

ADAMS: ☐ Yes ACCESSION NUMBER: ML12177A430 X SUNSI REVIEW COMPLETE

OFFICE	RII:DRP	RII:DRP	RII:DRP	NRR: DSS/STSB	NRR: DE/EICB	NRR: DPR/PLPB	NRR: DPR/PLPB	NRR: DPR: D
NAME	PNiebaum via email	RMusser via email	RMusser for WJones via email	RElliott	RStattel for JThorp	HCruz	SStuchell (A)	SBahadur
Date	10/16/12	10/24/12	10/24/12	10/25/12	10/15/12	10/15/12	10/25/12	11/6/12

OFFICIAL RECORD COPY DOCUMENT NAME:
HTTPS://ADAMSXT.NRC.GOV/WORKPLACEXT/IBMGETCONTENT?OBJECTSTORENAME=MAIN.__.LIBRARY&ID=CURRENT&VSID={46CA3F7C-4905-4C98-BBAA-57239D0ECF93}&OBJECTTYPE=DOCUMENT

Distribution w/encls:

S. Stuchell, NSIR
R. Elliott, NRR
R. Musser, DRP
C. Schulten, NRR
H. Cruz, NRR
P. Niebaum, DRP
M. Catts, DRP
D. Rahn, NRR
S. Stuchell, NRR
S. Bahadur, NRR
D. Baxley, NRR
P. Obrien, DRP
J. Thorp, NRR
B. Dittman, NRR
RidsNrrDpr
RidsNrrLA
RidsRgn2MailCenter
RidsAcrsAcnwMailCtr
RidsRgn3MailCenter
RidsRgn4MailCenter
RidsNrrDssStsb
RidsResOd Resource
RidsNroMailCenter Resource
RidsRgn1MailCenter

Licensee-Identified Violation Issued By Region II to Brunswick in IR 05000325,324/2011004

Technical Specification (TS) 3.3.6.1, Primary Containment Isolation Instrumentation, requires that the reactor water cleanup (RWCU) high differential flow instrumentation be operable in modes 1, 2, or 3. If the instrumentation is not operable, then TS 3.3.6.1 requires that the RWCU penetration flow path be isolated within 1 hour. Contrary to the above, the licensee identified that the RWCU high differential flow instrumentation was not operable and the penetration flow path was not isolated when the unit entered mode 1 on April 16, 2011 until August 2, 2011, because the RWCU inlet flow sensing element was installed backwards, causing the flow sensing element to be inaccurate. The resulting inaccuracy caused the instrumentation to be unable to isolate within the required TS limit of less than or equal to 73 gallons per minute differential flow. The finding was determined to be of very low safety significance per Appendix A of Inspection Manual Chapter 0609, Significance Determination Process, because the finding: 1) did not represent a degradation of the radiological barrier function provided for the control room, auxiliary building, spent fuel pool, or the standby gas treatment system, 2) did not represent a degradation of the barrier function of the control room against smoke or a toxic atmosphere, and 3) did not represent an actual open pathway in the physical integrity of reactor containment. Upon discovery of the condition, the licensee isolated the affected penetration flow path and installed the flow sensing element correctly. The issue is in the licensee's corrective action program (CAP) as nonconformance report (NCR) #479248.

Initial LER, LER Retraction, and LIV Denial Letter

Acn. ML11277A025

Progress Energy

September 26, 2011

SERIAL: BSEP 11-0094

10 CFR 50.73

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

Subject: Brunswick Steam Electric Plant, Unit No. 2
Renewed Facility Operating License No. DPR-62
Docket Nos. 50-324
Licensee Event Report 2-2011-001

Ladies and Gentlemen:

In accordance with the Code of Federal Regulations, Title 10, Part 50.73, Carolina Power & Light Company, now doing business as Progress Energy Carolinas, Inc., submits the enclosed Licensee Event Report (LER). This report fulfills the requirement for a written report within sixty (60) days of a reportable occurrence.

Please refer any questions regarding this submittal to Ms. Annette Pope, Supervisor - Licensing/Regulatory Programs, at (910) 457-2184.

Sincerely,

Joseph M. Frisco, Jr.
Plant General Manager
Brunswick Steam Electric Plant

LJG/ljg

Enclosure:

Licensee Event Report

Progress Energy Carolinas, Inc.
Brunswick Nuclear Plant
P O Box 10429
Southport, NC 28461

Enclosure 2

cc (with enclosure):

U. S. Nuclear Regulatory Commission, Region II
ATTN: Mr. Victor M. McCree, Regional Administrator
245 Peachtree Center Ave. N.E., Suite 1200
Atlanta, GA 30303-1257

U. S. Nuclear Regulatory Commission
ATTN: Mr. Philip B. O'Bryan, NRC Senior Resident Inspector
8470 River Road
Southport, NC 28461-8869

U. S. Nuclear Regulatory Commission **(Electronic Copy Only)**
ATTN: Mrs. Farideh E. Saba (Mail Stop OWFN 8G9A)
11555 Rockville Pike
Rockville, MD 20852-2738

Chair - North Carolina Utilities Commission
P.O. Box 29510
Raleigh, NC 27626-0510

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Brunswick Steam Electric Plant (BSEP), Unit 2	05000324	1 of 1

4. TITLE
Condition Prohibited by Technical Specifications due to RWCU Instrumentation Inoperable

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
07	28	2011	2011	– 001 –	00	09	26	2011	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE: 1

10. POWER LEVEL: 100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
Lee Grzeck, Senior Engineer - Licensing	(910) 457-2487

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☒ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☐ NO		11	25	2011

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On July 28, 2011, in response to a recent trip of the Unit 2 Reactor Water Cleanup (RWCU) System, engineering personnel performed a comprehensive review of system data and identified that the system inlet flow rate was significantly lower (i.e., approximately 18%) than the system outlet flow rate. Investigation subsequently determined that the inlet flow was inaccurate because the flow orifice for the system inlet flow element, 2-G31-FE-N035, had been installed backwards during maintenance activities performed on March 19, 2011. It was concluded that the lower flow readings from the RWCU inlet flow instrumentation would result in non-conservatism and, as a result, the RWCU system isolation on Differential Flow–High (i.e., Technical Specifications Table 3.3.6.1-1, "Primary Containment Isolation Instrumentation," Function 5.a) was inoperable.

This condition is being reported as an operation or condition prohibited by Technical Specifications. The safety consequences of this event were minimal.

Corrective action was taken to reinstall the flow orifice in the correct orientation. Additional evaluation is in progress to substantiate the operability of the RWCU system instrumentation. This LER will be supplemented based on the results of the evaluation.

NRC FORM 366 (10-2010)

Progress Energy

NOV 2 0, 2011

SERIAL: BSEP 11-0102

10 CFR 50.73

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

Subject: Brunswick Steam Electric Plant, Unit No. 2
Renewed Facility Operating License No. DPR-62
Docket Nos. 50-324
Licensee Event Report 2-2011-001, Supplement (Withdrawal)

Ladies and Gentlemen:

On September 26, 2011, Carolina Power & Light Company, now doing business as Progress Energy Carolinas, Inc., submitted Licensee Event Report (LER) 2-2011-001 in accordance with 10 CFR 50.73(a)(2)(i)(B). The LER reported a condition prohibited by Technical Specifications (TS) due to inoperable Reactor Water Cleanup (RWCU) system instrumentation, and that an evaluation was in progress to substantiate the operability of the RWCU instrumentation.

The evaluation is now complete and it concluded that the RWCU system instrumentation was operable, and no condition existed that was prohibited by TS.

Based on the above, LER 2-2011-001 is formally withdrawn.

Please refer any questions regarding this submittal to Ms. Annette Pope, Supervisor - Licensing/Regulatory Programs, at (910) 457-2184.

Sincerely,

Joseph M. Frisco, Jr.
Plant General Manager
Brunswick Steam Electric Plant

LJG/ljg

Enclosure:

Licensee Event Report

Progress Energy Carolinas, Inc.
Brunswick Nuclear Plant
P.O. Box 10429
Southport, NC 28461

cc (with enclosure):

U. S. Nuclear Regulatory Commission, Region II
ATTN: Mr. Victor M. McCree, Regional Administrator
245 Peachtree Center Ave. N.E., Suite 1200
Atlanta, GA 30303-1257

U. S. Nuclear Regulatory Commission
ATTN: Mr. Philip B. O'Bryan, NRC Senior Resident Inspector
8470 River Road
Southport, NC 28461-8869

U. S. Nuclear Regulatory Commission **(Electronic Copy Only)**
ATTN: Mrs. Farideh E. Saba (Mail Stop OWFN 8G9A)
11555 Rockville Pike
Rockville, MD 20852-2738

Chair - North Carolina Utilities Commission
P.O. Box 29510
Raleigh, NC 27626-0510

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Brunswick Steam Electric Plant (BSEP), Unit 2	05000324	1 of 1

4. TITLE
Condition Prohibited by Technical Specifications due to RWCU Instrumentation Inoperable

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
07	28	2011	2011	– 001 –	01	11	20	2011	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE: 1

10. POWER LEVEL: 100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
Lee Grzeck, Senior Engineer - Licensing	(910) 457-2487

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On July 28, 2011, in response to a trip of the Unit 2 Reactor Water Cleanup (RWCU) System, engineering personnel performed a comprehensive review of system data and identified that the system inlet flow rate was significantly lower (i.e., approximately 18%) than the system outlet flow rate. Investigation subsequently determined that the inlet flow was inaccurate because the flow orifice for the system inlet flow element, 2-G31-FE-N035, had been installed backwards during maintenance activities performed on March 19, 2011. It was concluded at that time that the lower flow readings from the RWCU inlet flow instrumentation would result in non-conservatism and, as a result, the RWCU system isolation on Differential Flow–High (i.e., Technical Specifications Table 3.3.6.1-1, "Primary Containment Isolation Instrumentation," Function 5.a) was inoperable.

This condition was initially reported as an operation or condition prohibited by Technical Specifications.

An evaluation has been completed and has concluded that the RWCU system instrumentation was operable, and therefore, Technical Specifications were met. Based on the results of the evaluation, this LER is formally withdrawn.

Progress Energy

Michael J. Annacone
Vice President
Brunswick Nuclear Plant

December 14, 2011

Serial: BSEP 11-0108

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

Subject: Brunswick Steam Electric Plant, Unit No. 2
Renewed Facility Operating License No. DPR-62
Docket No. 50-324
Response to Integrated Inspection Report Nos.: 05000325/2011004 and 05000324/2011004

Reference: Letter from Randall A. Musser, Chief Reactor Projects Branch 4 Division of Reactor Projects (U.S. NRC) to Michael Annacone, Vice President - Brunswick Steam Electric Plant, "Brunswick Steam Electric Plant - NRC Integrated Inspection Report Nos.: 05000325/2011004 and 05000324/2011004," dated November 14, 2011

Ladies and Gentlemen:

Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., contests the licensee identified violation (LIV), concerning Technical Specification 3.3.6.1, Primary Containment Isolation Instrumentation, discussed in section 4OA7 of Integrated Inspection Report Nos.: 05000325/2011004 and 05000324/2011004, dated November 14, 2011. The basis for this disagreement is provided in the enclosure to this submittal.

No regulatory commitments are contained in this submittal. Please refer any questions regarding this submittal to Ms. Annette Pope, Supervisor - Licensing/Regulatory Programs, at (910) 457-2184.

Sincerely,

Michael J. Annacone

Progress Energy Carolinas, Inc.
P.O. Box 10429
Southport, NC 28461

T > 910.457.3698

MAT/mat

Enclosure:
Denial of Licensee Identified Violation
Technical Specification 3.3.6.1, Primary Containment Isolation Instrumentation

cc (with enclosure):

U. S. Nuclear Regulatory Commission, Region II
ATTN: Mr. Victor M. McCree, Regional Administrator
245 Peachtree Center Avenue, NE, Suite 1200
Atlanta, GA 30303-1257

U. S. Nuclear Regulatory Commission
ATTN: Director, Office of Enforcement
Washington, DC 20555-0001

U. S. Nuclear Regulatory Commission
ATTN: Mr. Philip B. O'Bryan, NRC Senior Resident Inspector
8470 River Road
Southport, NC 28461-8869

U. S. Nuclear Regulatory Commission **(Electronic Copy Only)**
ATTN: Mrs. Farideh E. Saba (Mail Stop OWFN 8G9A)
11555 Rockville Pike
Rockville, MD 20852-2738

Chair - North Carolina Utilities Commission
P.O. Box 29510
Raleigh, NC 27626-0510

Denial of Licensee Identified Violation
Technical Specification 3.3.6.1, Primary Containment Isolation Instrumentation

Licensee Identified Violation (LIV) Details

Section 4OA7 of Integrated Inspection Report Nos.: 05000325/2011004 and 05000324/2011004, dated November 14, 2011, contains the following LIV.

> Technical Specification (TS) 3.3.6.1, Primary Containment Isolation Instrumentation, requires that the RWCU high differential flow instrumentation be operable in modes 1, 2, or 3. If the instrumentation is not operable, then TS 3.3.6.1 requires that the RWCU penetration flow path be isolated within 1 hour. Contrary to the above, the licensee identified that the RWCU high differential flow instrumentation was not operable and the penetration flow path was not isolated when the unit entered mode 1 on April 16, 2011 until August 2, 2011, because the RWCU inlet flow sensing element was installed backwards, causing the flow sensing element to be inaccurate. The resulting inaccuracy caused the instrumentation to be unable to isolate within the required TS limit of less than or equal to 73 gallons per minute differential flow. The finding was determined to be of very low safety significance per Appendix A of Inspection Manual Chapter 0609, Significance Determination Process, because the finding: 1) did not represent a degradation of the radiological barrier function provided for the control room, auxiliary building, spent fuel pool, or the standby gas treatment system, 2) did not represent a degradation of the barrier function of the control room against smoke or a toxic atmosphere, and 3) did not represent an actual open pathway in the physical integrity of reactor containment. Upon discovery of the condition, the licensee isolated the affected penetration flow path and installed the flow sensing element correctly. The issue is in the licensee's CAP as NCR #479248.

Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., is contesting the LIV.

Basis for Denial

CP&L has evaluated the impact of the improperly installed Unit 2 Reactor Water Cleanup (RWCU) inlet flow sensing element and determined that the uncertainty introduced by the condition was not sufficient to render the RWCU Differential Flow - High instrumentation (i.e., Function 5.a of TS Table 3.3.6.1-1) inoperable.

The calibration of this instrumentation, in accordance with Surveillance Requirement (SR) 3.3.6.1.6, does not include "unmeasurable" uncertainties that are related to effects that will not be present during surveillance testing (e.g., flow orifice effects). Rather, these unmeasurable uncertainties are accounted for in the margin between the TS allowable value and the analytical limit. The allowable value for the RWCU Differential Flow - High instrumentation, per TS Table 3.3.6.1-1, "Primary Containment Isolation Instrumentation," is $\leq$ 73 gpm. The analytical limit,

per Updated Final Safety Analysis Report (UFSAR) Table 7-9, "Isolation Signals and Setpoints," is ≤ 300 gpm. The RWCU Differential Flow - High instrumentation allowable value of ≤ 73 gpm was established in Amendments 166 and 197 to the Unit 1 and 2 TSs, respectively, issued October 14, 1993 (i.e., ADAMS Accession Number ML020350482). The Safety Evaluation (SE) for these amendments specifically addresses the application of measurable and unmeasurable uncertainties. Section 2.6.4 of the SE states:

> The licensee's calculation 0RWCU-0010 defines the magnitude of the uncertainty associated with the reactor water cleanup system isolation differential flow trip function setpoint. The uncertainties are characterized as either "measurable" or "unmeasurable." The measurable uncertainties are those attributable to effects that may be present during surveillance testing. The unmeasurable uncertainties are those related to effects that will not be present during surveillance testing (e.g., flow orifice effects, seismic events, post-accident environmental conditions).
>
> The requested increase in the TS allowable value is intended to establish a difference between the actual field calibration setpoint and the new allowable value that is large enough to bound the sum of the measurable uncertainties present during surveillance testing conditions and a nominal additional "LER avoidance" margin. The licensee's calculation demonstrates that satisfaction of the proposed allowable value during surveillance testing will assure that the 300 gal/min analytical limit will not be exceeded during any postulated plant events.
>
> The staff has reviewed the licensee's submittal as discussed above and finds the proposed changes to the RWCU system high differential flow, time-delay trip setpoint and allowable value will have no adverse impact on safety and will not pose an undue risk to the public because the calculated offsite and control room doses continue to be less than the limits of 10 CFR Part 100 and GDC 19.
>
> The staff has determined that this analysis is satisfactory.

Surveillance testing can only confirm a limited number of uncertainty components. The acceptable band between a setpoint and an allowable value only addresses uncertainties associated with the specific devices included within the bounds of the test and, even for those included devices, only the specific uncertainties that are expected to be applicable at the time of the test. Performance of the flow element is not included in surveillance testing of the instrument channel. Current industry guidance documents support the treatment of uncertainties as measureable or unmeasurable. Annex I, "Recommendations for inclusion of instrument uncertainties during normal operation in the as-found tolerance determination," of ISA-RP67.04.02-2010, "Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation," states, in part:

> Therefore, of the uncertainties listed in ANSI/ISA-67.04.01-2006, 4.4(b), only those associated with events expected to cause changes that would be discernible during those periodic surveillances should be included in the AFT [as-found tolerance] allowance.

The flow element contribution to overall function uncertainty is a process-dependent effect not present during surveillance testing.

This treatment of uncertainties is also consistent with the Bases for TS 3.3.6.1, for Units 1 and 2. The "Applicable Safety Analyses, LCO, and Applicability" section of the Bases states, in part:

> Trip setpoints are those predetermined values of output at which an action should take place. The setpoints are compared to the actual process parameter (e.g., reactor vessel water level), and when the measured output value of the process parameter exceeds the setpoint, the associated device (e.g., trip unit) changes state. The analytic limits are derived from the limiting values of the process parameters obtained from the safety analysis. The trip setpoints are determined from the analytic limits, corrected for process, calibration, and instrument errors. The Allowable Values are then determined, based on the trip setpoint values, by accounting for calibration based errors. These calibration based instrument errors are limited to instrument drift, errors associated with measurement and test equipment, and calibration tolerance of loop components. The trip setpoints and Allowable Values determined in this manner provide adequate protection because instrumentation uncertainties, process effects, calibration tolerances, instrument drift, and severe environment errors (for channels that must function in harsh environments as defined by 10 CFR 50.49) are accounted for and appropriately applied for the instrumentation.

The above discussion of setpoint methodology is also contained in Revision 3 of NUREG-1433, "Standard Technical Specifications General Electric Plants, BWR/4."

After it was discovered that the flow element was incorrectly installed, the SR 3.3.6.1.6 calibration of the associated flow instrument channel was performed satisfactorily and demonstrated to be within the TS allowable value.

Additionally, based on observation of operating data for the period when the flow element was incorrectly installed, the most limiting error introduced by this condition was 46 gpm. The differential between the TS allowable value (i.e., 73 gpm) and the analytical limit (i.e., 300 gpm) is 227 gpm. As determined from calculation 0RWCU-0010, "U1/U2 RWCU Flow Accuracy Calculation (G31-N012, N036, & N041 loops), unmeasurable uncertainties account for 136.67 gpm, leaving a margin of 90.33 gpm. This margin more than adequately bounds the 46 gpm error introduced by the incorrectly installed flow element and ensures that the analytical limit of 300 gpm would not have been exceeded.

Operability of the RWCU Differential Flow - High instrumentation is dependent upon: (1) meeting the TS required allowable value of ≤ 73 gpm and (2) the overall ability of the

instrument loop to perform its intended safety function. The flow element installation error did not affect the transmitter or trip device as confirmed by a calibration that found the setpoint to be in compliance with TS allowable value requirements. The safety function of the instrument loop is met when it can be demonstrated that the analytical limit is met. In this case, a sensor (i.e., the RWCU inlet flow element) was installed backwards. This produced a non-conservative error for the differential flow setpoint. However, the above evaluation confirms that sufficient margin was available and the additional error did not prevent the loop from meeting the analytical limit for the RWCU Differential Flow - High function.

Therefore, CP&L has concluded that RWCU Differential Flow - High instrumentation was operable and no TS 3.3.6.1 violation occurred.

The improperly installed flow element is appropriately characterized as a degraded condition, as defined in NRC Inspection Manual Part 9900: Technical Guidance, "Operability Determinations & Functionality Assessments for Resolution of Degraded or Nonconforming Conditions Adverse to Quality or Safety." A degraded condition is defined as:

> A degraded condition is one in which the qualification of an SSC or its functional capability is reduced. Examples of degraded conditions are failures, malfunctions, deficiencies, deviations, and defective material and equipment. Examples of conditions that can reduce the capability of a system are aging, erosion, corrosion, improper operation, and maintenance.

CP&L's setpoint methodology provides a mechanism that is specifically intended to compensate for potential defects that result in performance outside of what is expected, while still retaining required overall loop performance. General unassigned margin is provided in addition to the assigned uncertainties for components and parameters. For this loop, operating experience from both the industry and Brunswick, prior to the 1993 amendments (i.e., the NRC approved Amendments 166 and 197, discussed above), had demonstrated that precise quantification of uncertainties associated with the combined performance of the three flow elements that input into the trip signal was more challenging than typical. As such, a large difference between the TS allowable value and the analytical value (i.e., 227 gpm total, with 136.67 unmeasurable uncertainties and 90.33 margin) was established in Amendments 166 and 167. When a defect produces an adverse impact that is less than the applicable margin, it is considered a minor defect and the instrument loop retains the performance assumed by the design, the UFSAR, and the TSs. Although the reversed flow element resulted in a 46 gpm error, similar but smaller defects such as excessive wear or gouging of a correctly installed flow element can also result in performance outside of assigned uncertainty ranges. For this event, TS surveillance requirements were met for the components associated with measureable uncertainties and the flow element error, 46 gpm, was less than the applicable margin of 90.33 gpm. The above evaluation demonstrates that, although degraded, the instrumentation remained operable.

Conclusion

In summary, CP&L has determined that the incorrectly installed flow element did not render the RWCU Differential Flow - High instrumentation (i.e., Function 5.a of TS Table 3.3.6.1-1) inoperable. Operability of the RWCU Differential Flow - High instrumentation is dependent upon: (1) meeting the TS required allowable value of ≤ 73 gpm and (2) the overall ability of the instrument loop to perform its intended safety function. The flow element installation error did not affect the transmitter or trip device and, as such, did not prevent the RWCU Differential Flow - High instrumentation to meet the TS allowable value of ≤ 73 gpm. The amount of uncertainty introduced by this condition was not sufficient to render the instrument loop incapable of performing its intended safety function (i.e., assuring that the 300 gpm analytical limit would not be exceeded). Therefore, a violation of TS 3.3.6.1 did not occur.

Licensee's Operability Determination (AR 279248)

This past operability evaluation for the isolation function is based on the ability of RWCU instrumentation to meet Technical Specifications and UFSAR requirements. The RWCU inlet flow element was found to be installed backwards. No other equipment problem was found and all equipment is now working properly. The affected instrumentation includes:

2-G31-FE-N035, RWCU REGEN HX INLET LINE FLOW ELEMENT
2-G31-FT-N036, FLOW XMTR AT RWCU INLET TO HX
2-B21-XY-5949B, NUMAC STM LK DET MON
G31FA006, RWCU SYS U2 INLET FLOW

Tech Specs, the TRM, the UFSAR and the instrument uncertainty calc, 0RWCU-0010 all provided consistent information for the Analytical Limit (AL), Technical Specification Allowable Value (TSAV) and Nominal Trip Setpoint (NTS). Section 8.1 of the calc also provides assumed/calculated uncertainty information.

Item	Description	Value
1	AL (0RWCU-0010 item 8.1, UFSAR Table 7-9)	300 gpm
2	TSAV (0RWCU-0010 item 8.1, TS Table 3.3.6.1-1 item 5.a)	73 gpm
3	NTS (0RWCU-0010 item 8.1, TRM Table 3.3.6.1-1 item 5.a)	43 gpm
4	Total Uncertainty (0RWCU-0010 item 8.1)	146.47 gpm
5	Measurable Uncertainty (0RWCU-0010 item 8.1)	9.8 gpm
6	Non-Measureable Uncertainty (calc by this eval)	136.67 gpm

From EGR NGGC 0153, the uncertainties for items that can be detected during the routine surveillance (such as instrument drift) are to be less than the the margin between TSAV and NTS. As long as instrument calibration as found values comply with the TSAV, there is no loss of transmitter or trip device function. The uncertainties that can not be assessed during routine calibrations are to be less than the margin between the AL and the TSAV. Since the actual problem was a reversed flow element, the margin of concern was determined by conservatively assuming it would be in additional to the "Non-Measureable" uncertainties in the existing calc.

Item	Description	Value
7	FE Margin available (AL - TSAV - item 6 above)	90.33 gpm

OSI/PI data for the period of concern was reviewed (see last page of this eval). Note that with the associated time delay function, only steady state operating data was evaluated. The most limiting indication of a flow element error was found to be.

	G31FA009 Max Return (gpm)	G31FA006 Min Inlet (gpm)	Delta (gpm)
Data from 7/23/11	296	250	46

After the inlet flow element problem was corrected, OSI/PI data from 8/7/11 to 8/11/11 shows return flow as normally just higher than inlet flow. For conservatism, momentary readings during stable operation will be used for a "max conservative case".

Max non-conservatism	G31FA009 Max Return (gpm)	G31FA006 Min Inlet (gpm)	Delta (gpm)
	293	285	8

Max conservatism	G31FA009 Max Return (gpm)	G31FA006 Min Inlet (gpm)	Delta (gpm)
	291	293	-2

The change in performance from wrong installation (7/23/11) to correct installation (8/7/11) was used to quantify the impact of the backward flow element.

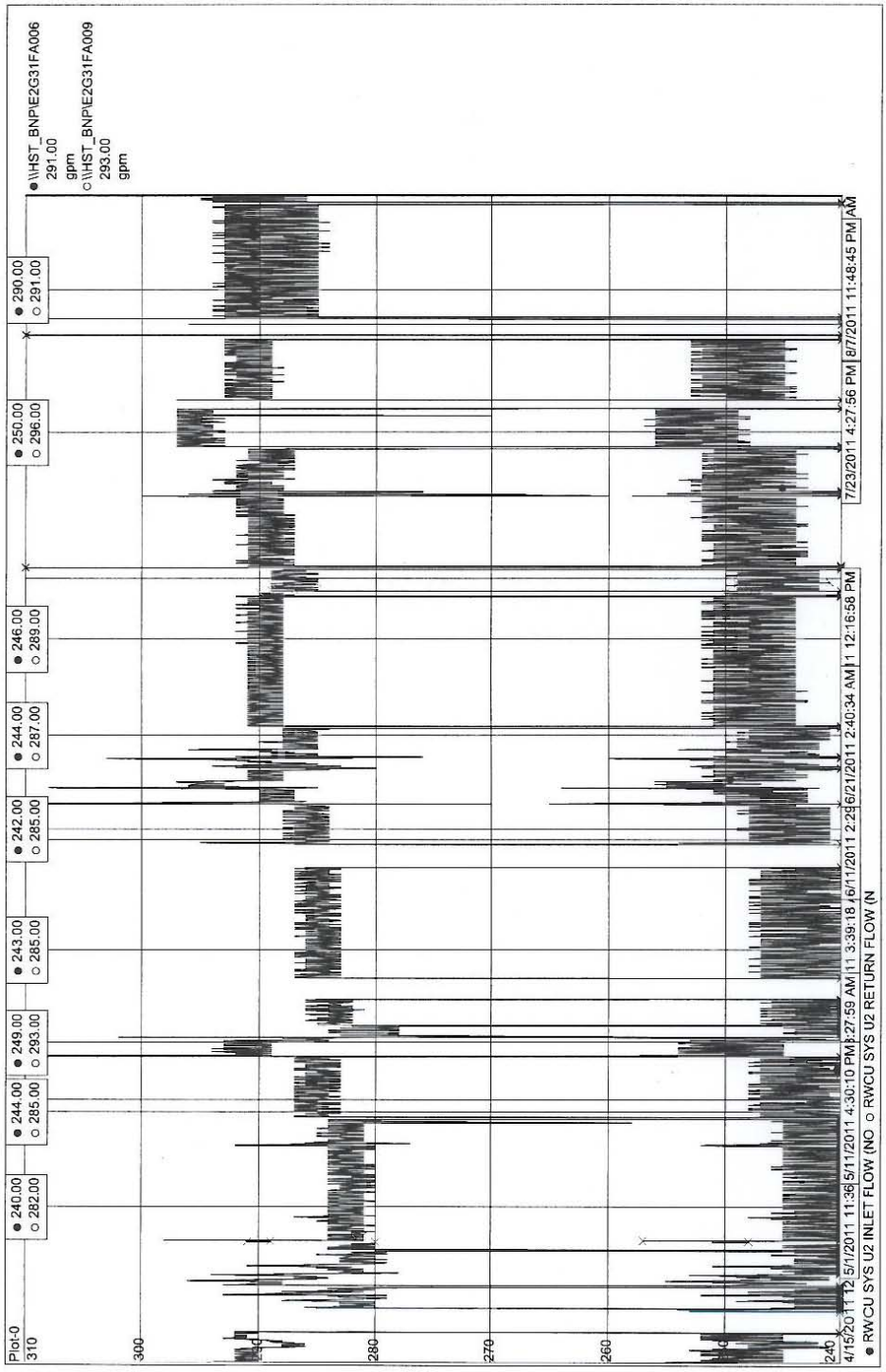
	Delta 7/23/2011 (gpm)	Delta 8/7/2011 (gpm)	FE Error (gpm)
Min error	46	8	38
Max error	46	-2	48

Summary:

Operability of the RWCU Differential Flow - High instrumentation (i.e., Function 5.a of TS Table 3.3.6.1-1) is dependent upon: (1) meeting the TS required allowable value of ≤ 73 gpm and (2) the overall ability of the instrument loop to perform its intended safety function.

For item 1, the flow element installation error did not affect the transmitter or trip device as confirmed by a calibration that found the setpoint to be in compliance with TSAV requirements.

For item 2, the safety function is met when it can be demonstrated that the Channel Operability Limit (setpoint less than AL) is met. As discussed in EGR-NGGC-0153, "Engineering Instrument Setpoints," the channel operability limit includes the whole loop, from sensor to final actuation device. In this case, a sensor (i.e., the RWCU inlet flow element) was installed backwards. This produced a non-conservative error for the differential flow setpoint. However, the above evaluation confirms that sufficient margin was available and the additional error did not prevent the loop from meeting the Channel Operability Limit for the RWCU Differential Flow - High.



Display try.pdi*, 8/22/2011 12:09:20 PM