Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

November 15, 2010

10 CFR 50.73

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

Browns Ferry Nuclear Plant, Unit 1
Facility Operating License No. DPR-33
NRC Docket No. 50-259

Subject: **Licensee Event Report 50-259/2010-002-00**

The enclosed Licensee Event Report provides details of operation with inoperable drywell pressure channels for longer than allowed by the Browns Ferry Nuclear Plant Technical Specifications. The Tennessee Valley Authority is submitting this report in accordance with 10 CFR 50.73(a)(2)(i)(B), any operation or condition which was prohibited by the plant's Technical Specifications.

There are no new regulatory commitments contained in this letter. Should you have any questions concerning this submittal, please contact James Emens, Nuclear Site Licensing Manager, at (256) 729-2636.

Respectfully,

K. J. Polson
Vice President

Enclosure: Drywell Pressure Instrument Channel Inoperability Due to Improper Instrument Tubing Slope

cc (w/ Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant

IE22
NRR

Enclosure

Browns Ferry Nuclear Plant Unit 1
Docket 50-259

Drywell Pressure Instrument Channel Inoperability
Due to Improper Instrument Tubing Slope

SEE ATTACHED

NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 08/31/2010

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Browns Ferry Nuclear Plant Unit 1	05000259	1 of 8

4. TITLE: Drywell Pressure Instrument Channel Inoperability Due to Improper Instrument Tubing Slope

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
									N/A	N/A
09	16	2010	2010	- 002 -	00	11	15	2010	FACILITY NAME: N/A	DOCKET NUMBER: N/A

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)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☒ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☐ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER *(Include Area Code)*
Eric Bates, Licensing Engineer	256-614-7180

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

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
NA	NA	NA

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

On September 16, 2010 it was determined that a condition initially identified on December 8, 2008 reflected inoperability of a drywell pressure channel for longer than allowed by Technical Specifications. Subsequent review for extent of this condition identified the inoperable condition existed from October 2, 2008 until corrected on December 9, 2008. Additionally, a subsequent occurrence of an inoperable drywell pressure channel between May 25, 2010 and October 6, 2010 was discovered. Corrective actions taken on December 9, 2008 and October 6, 2010 involved purging trapped water in the instrumentation sensing line. The immediate cause was improperly sloped instrument sensing lines that allowed water to condense and collect in the sensing lines, resulting in non-conservatively biased instrumentation output signals. The instrument sensing lines are being modified during the current refueling outage to eliminate water traps and provide proper slope to assure no accumulation of condensed water. The condition resulted from modifications in 2005 which did not assure adherence to the design specifications for proper instrument sensing line slope. The cause for improper instrument slope is attributed to human error and unclear procedural guidance. The Browns Ferry procedures and processes are being revised to clearly require the verifications for proper slope.

I. PLANT CONDITION(S)

At the time of discovery, Browns Ferry Nuclear Plant (BFN), Unit 1 was at approximately 100 percent power (3458 MWT).

II. DESCRIPTION OF EVENT

A. Event:

Event #1: 1-PT-064--56C (October - December 2008)

On December 8, 2008 at 1130 hours Central Standard Time (CST), during performance of shiftly instrument checks, operations personnel noted that a drywell pressure indication, 1-PIS-064-56C [JC], was reading 0.25 psig lower than redundant channels 1-PIS-064-56A, -56B, and -56D. Troubleshooting was initiated on the drywell pressure transmitter loop. The drywell pressure transmitters 1-PT-064-56C and 1-PT-064-58F [JE] (which provide the analog signal to 1-PIS-064-56C and 1-PIS-064-58F, respectively) share a common instrument line from the drywell penetration. Comparisons of meter readings (1-PIS-064-56C = 0.8 psig and 1-PIS-064-58F = 1.25 psig) indicated the potential for moisture in the sensing line leading to 1-PT-064-56C.

On December 9, 2008 at 1825 hours CST, troubleshooting personnel recorded as-found readings reflecting 1-PIS-064-56C reading 0.5 psig lower than redundant channels 1-PIS-064-56A, -56B, and -56D. Operations declared 1-PIS-064-56C and 1-PIS-064-58F inoperable. Operations entered Technical Specification (TS) Actions for the following Limiting Conditions for Operation (LCOs): LCO 3.3.1.1 Reactor Protection System (RPS) Instrumentation, LCO 3.3.6.1 Primary Containment Isolation System (PCIS) Instrumentation, LCO 3.3.6.2 Secondary Containment Isolation System (SCIS) Instrumentation, and LCO 3.3.7.1 Control Room Emergency Ventilation System (CREVS) Instrumentation. Each of these TS Actions requires placing the inoperable channel in trip within 12 hours.

While performing the troubleshooting, a "trap" was found where moisture or condensate could collect. The sensing line between 1-PT-064-56C and 1-PT-064-58F was blown down with nitrogen. Between 1/2 and 3/4 cups of water was removed from the sensing line.

On December 9, 2008 at 2214 hours CDT, 1-PT-064-56C and 1-PT-064-58F were unisolated with readings returned to normal; at that time Operations personnel declared 1-PIS-064-56C and 1-PIS-064-58F operable and Actions for LCO 3.3.1.1, LCO 3.3.6.1, LCO 3.3.6.2, and LCO 3.3.7.1 were exited.

The functional evaluation for this condition was completed July 19, 2010 and concluded that the 0.5 psig bias resulted in a condition where 1-PT-064-56C would not have performed its TS required function; the non-conservative bias would have resulted in the channel not reaching its trip setpoint until actual drywell pressure would exceed the TS allowable value as well as the analytical limit of the analyses. This evaluation however did not provide adequate basis to determine specifically when operability would not be maintained during the period when the bias was less than the peak of 0.5 psig.

Further analysis of the readings and uncertainties established a past operability criteria that allowed the determination that the water trap bias affecting 1-PT-064-56C had rendered the associated functions inoperable for longer than allowed by the Technical Specifications. This conclusion was formally made on September 16, 2010. The period of inoperability without the channel being place in trip within 12 hours is judged to have existed beginning October 2, 2008 until resolved on December 9, 2008. This period included a unit startup and associated Mode changes, which would have required performance of a risk assessment addressing the inoperable components.

Event #2: 1-PIS-064-56B (May - October 2010)

On October 5, 2010 at 1630 hours CDT operations personnel declared 1-PIS-064-56B [JC], 1-PT-064-50 [IP], and 1-PT-064-58G [JE] (all associated with a common sensing line) inoperable. This resulted in entering Actions for LCO 3.3.1.1, Reactor Protection System (RPS) Instrumentation, LCO 3.3.6.1 Primary Containment Isolation System (PCIS) Instrumentation, LCO 3.3.6.2 Secondary Containment Isolation System (SCIS) Instrumentation, and LCO 3.3.7.1 Control Room Emergency Ventilation System (CREVS) Instrumentation. Each of these TS Actions requires placing the inoperable channel in trip within 12 hours. The condition also resulted in entering Actions for LCO 3.3.3.1, Post Accident Monitoring (PAM) Instrumentation, and LCO 3.3.3.2, Backup Control System; each of these actions requiring restoration within 30 days.

This declaration was a result of Engineering notifying the Operations Shift Manager that based on similar potential for a water trap and an ongoing non-conservative bias in the reading, 1-PIS-064-56B had been determined to be not capable of tripping within its TS required Allowable Value. The monitoring instrumentation requirements associated with PAM and Backup Control System were conservatively considered inoperable for the indication function.

On October 6, 2010 at 0348 hours CDT the issue was corrected by purging trapped water in the common sensing line back into the drywell, at which time Operations personnel declared 1-PIS-064-56B, 1-PT-064-50, and 1-PIS-064-58G operable and Actions for LCO 3.3.1.1, LCO 3.3.3.1, LCO 3.3.3.2, LCO 3.3.6.1, LCO 3.3.6.2, and LCO 3.3.7.1 were exited.

Utilizing the established past operability criteria for the evaluation of the 2008 event, it was determined that the water trap bias affecting 1-PT-064-56B, 1-PT-064-50, and 1-PIS-064-58G rendered the associated functions inoperable for longer than allowed by the Technical Specifications. The period of inoperability is judged to have existed beginning May 25, 2010 until resolved on October 6, 2010. This period also included an instance where 1-PIS-64-56D was removed from service (on 8/17/2010 from 23:47 to 8/18/2010 at 01:16) for surveillance testing. With both -56B and -56D inoperable, the associated automatic RPS, PCIS, SCIS, and CREVS functions would have been incapable of actuating within the analytical limit; however, since the instrumentation continued to track normal variations in drywell pressure, the -56B channel would have tripped on increasing drywell pressure such that the actual impact would have been to the response time and not a complete failure to actuate.

TVA is submitting this report in accordance with 10 CFR 50.73(a)(2)(i)(B), any operation or condition which was prohibited by the plant's Technical Specifications.

B. Inoperable Structures, Components, or Systems that Contributed to the Event:

During the Event #1 period of inoperability there were no inoperable structures, components, or systems that contributed to the event. During the Event #2 period of inoperability, normally scheduled surveillance testing rendered redundant instrument channels inoperable for a brief period such that the safety function was not capable of being actuated as assumed in the safety analysis.

C. Dates and Approximate Times of Major Occurrences:

October 2, 2008	The beginning of ≥ 3 consecutive days with a non-conservative deviation on a 1-PIS-064-56C instrument channel ≥ 0.10 psig
November 30, 2008 at 1755 hours CST	Unit startup commenced by entering MODE 2 (STARTUP)
December 1, 2008 at 1433 hours CST	Unit entered MODE 1 (RUN)
December 8, 2009 at 1130 hours CST	Operations noted that 1-PIS-064-56C was reading 0.25 psig lower than channels 56A, 56B, and 56D
December 9, 2009 at 1825 hours CST	Troubleshooting activities resulted in isolating 1-PT-064-56C and 1-PT-064-58F. Operations personnel declared 1-PIS-064-56C and 1-PIS-064-58F inoperable and entered TS Actions for LCO 3.3.1.1, LCO 3.3.6.1, LCO 3.3.6.2, and LCO 3.3.7.1 that require placing the inoperable channel in trip in 12 hours
December 9, 2009 at 2214 hours CST	Water is purged from sensing line to 1-PT-064-56C. Operations declared 1-PIS-064-56C and 1-PIS-064-58F operable and exited Actions for LCO 3.3.1.1, LCO 3.3.6.1, LCO 3.3.6.2, and LCO 3.3.7.1
May 25, 2010	The beginning of ≥ 3 consecutive days with a non-conservative deviation on a 1-PIS-064-56B instrument channel ≥ 0.10 psig
October 5, 2010 at 1563 hours CDT	Engineering notified Operations Shift Manager that 1-PIS-064-56B has been determined to be not capable of tripping at its TS required Allowable Value. 1-PIS-064-56B, 1-PT-064-50, and 1-PT-064-58G are declared inoperable and TS Actions for LCO 3.3.1.1, LCO 3.3.3.1, LCO 3.3.3.2, LCO 3.3.6.1, LCO 3.3.6.2, and LCO 3.3.7.1 are entered that require placing the inoperable channel in trip in 12 hours
October 6, 2010 at 0348 hours CDT	Water is purged from common sensing line. Operations declared 1-PIS-064-56B, 1-PT-064-50, and 1-PT-064-58G operable and exited Actions for LCO 3.3.1.1, LCO 3.3.3.1, LCO 3.3.3.2, LCO 3.3.6.1, LCO 3.3.6.2, and LCO 3.3.7.1

D. Other Systems or Secondary Functions Affected

None

E. Method of Discovery

Engineering evaluation of the impact of drywell pressure reading deviations greater than 0.2 psig determined the non-conservative bias resulted in affected instruments not meeting TS operability criteria.

F. Operator Actions

None

G. Safety System Responses

None

III. CAUSE OF THE EVENT

A. Immediate Cause

The immediate cause for the non-conservative bias affecting operability of the drywell pressure transmitters was improperly sloped instrument sensing lines. The improperly sloped sensing lines allowed water to condense and collect in the sensing lines, which resulted in non-conservatively biased instrumentation output signals.

B. Root Cause

The cause of the improperly sloped instrument sensing lines is attributed to human error and unclear procedural guidance to assure modification installation meets engineering design specifications.

C. Contributing Factors

None.

IV. ANALYSIS OF THE EVENT

During 2005, as part of BFN Unit 1 restart, there were various design change notices (DCN) that included refurbishment of the instrument panels affecting 1-PT-064-56A, -56B, -56C, and -56D. One DCN provided a design information package on the refurbishment of components and cabling to the affected panels. A second DCN replaced various valves and fittings on the affected panels, and a third provided sensing line installation and modification in accordance with sensing line support drawings for small bore piping.

Adherence to TVA Engineering Specifications for instrument and instrument line installation criteria for most of the routing of the sensing lines was evident. Specifically, the routing of piping going from the instrument panels through the floor penetrations (adjacent to the local panels) to the primary containment penetration wall penetration was detailed in isometric drawings and do not exhibit instances of "water trap" routing. However, the piping sensing lines from the floor penetration to the local panels did not adhere to the applicable specification and thus did not preclude the presence of water traps. The Unit 1 piping configurations were duplicated from the Unit 3 design (Panels 3-25-5B and -6B), which have also been found to not adhere to the design specifications to preclude water traps. (Note that no instances of actual trapped water and related instrument bias impact have been identified during Unit 3 operation.) Unit 2 sensing line configurations conform to the applicable instrument slope design specifications.

The piping "water traps" in Unit 3 were not previously reported as a non-conformance. These non-conformances can be attributed to human error and inadequate procedural guidance, which included not properly reviewing the completed work. The duplication during the Unit 1 Restart effort can also be attributed to human error and inadequate procedural guidance, which included not properly reviewing the completed work. The as-implemented design should be verified to preclude "water traps" per the design specification criteria.

Furthermore, the Unit 1 panel instrument tubing also presented routing that did not adhere to the applicable specification and thus did not preclude the presence of water traps. The Unit 1 panel tubing is field routed (not routed in accordance with isometrics) and therefore, while Unit 3 tubing does conform to the design specifications, Unit 1 tubing routing exhibited additional human error and inadequate procedural guidance, which included not properly reviewing the completed work.

With the presence of improperly sloped sensing lines, natural condensation within the lines would allow the formation of trapped water.

The only available data to review for past operability are the twice-daily remote readings on 1-PIS-064-56A, -56B, -56C, and -56D recorded on operator rounds. The remote readings are displayed on analog meters with 0.1 psig scaling divisions and some potential for parallax inaccuracies that engineering judgment suggests could approach 0.05 psig. The manufacturer stated accuracy for these indicators is +/- 0.5% (= 0.02 psig). As such, based on engineering judgment, a maximum-to-minimum deviation between the four readings that occasionally reaches 0.10 psig would be within the overall combined accuracy of a single instance of readings. Historical trending shows the majority of time that maximum-to-minimum deviation of 0.10 psig are reported, subsequent readings return to differences less than 0.10 psig. The random nature of these occurrences also tends to coincide with differing instruments or more than one instrument reflecting the minimum value. These random occurrences are judged not to reflect evidence of a water trap bias.

On two occasions, extended periods of a maximum-to-minimum deviation at or above 0.10 psig occurred, where one instrument was consistently reading the minimum value. In each of these occurrences a maintenance activity to purge a potential water trap in the sensing line of that instrument resulted in a return to normal and continual reading differences less than 0.10 psig. As such, it is reasonable to conclude that continued periods of maximum-to-minimum differences of 0.10 psig and greater (with occasionally drops below 0.10 psig for similar uncertainty reasoning) where a single reading was consistently the minimum value, reflect a basis for identifying a historical non-conservative water-trap-induced bias. A period of 3 consecutive days with the majority of maximum-to-minimum deviations greater than or equal to 0.10 psig is selected. This criterion is consistent with both the limitations of the accuracy of these readings, and the historical data associated with positive finding of trapped water.

Since an actual water-trap bias creates a non-conservative instrument reading, and a non-conservative bias of 0.05 psig exceeds the difference between setpoint calculation determination of the nominal trip and allowable value, it is assumed, based on engineering judgment, that any past extended period (3 or more days) where a majority of the maximum-to-minimum deviations are greater than or equal to 0.10 psig and where a single reading was consistently the minimum value, also reflected inoperability of that instrument channel.

V. ASSESSMENT OF SAFETY CONSEQUENCES

The affected drywell pressure instrumentation provides a drywell high pressure input for automatic functions in RPS [JC], PCIS [JE], SCIS [JE], SBGT [JE], and CREVS [JE]. The Event #2 affected instrumentation also provides indication-only for the PAM and Backup Control System. Since the negative bias that resulted in the automatic initiation being inoperable caused less than a 0.25 psig

error in the indication-only functions, there is judged to be no appreciable safety consequence for the PAM or Backup Control System function.

The high drywell nominal setpoint is 2.45 psig. With the analytical limit of 2.6 psig and TS Allowable Value of less than or equal to 2.5 psig, there is a very small margin between the setpoint and these limits. A non-conservative bias on the order of 0.05 psig would result in a channel tripping at drywell pressures above the TS required Allowable Value. A non-conservative bias on the order of 0.15 psig would result in a channel tripping at drywell pressures above the Analytical Limit. The majority of the indicated negative bias for both Event #1 and Event #2 ranged between 0.15 and 0.20 psig. It is conservatively assumed that the affected channels would not have tripped within the analytically assumed drywell pressure value. However, since the instrumentation continued to track normal variations in drywell pressure, these channels would have tripped on increasing drywell pressure such that the actual impact would have been to the response time and not to a complete failure to actuate.

Note that the drywell high pressure input for automatic functions in RPS and SCIS (including SBGT) are not credited in the accident analysis. While the PCIS and CREVS automatic functions do take credit for being actuated on high drywell pressure, the response time for the protection afforded is not immediate in nature. The primary containment isolation total response time includes signal delay, diesel generator startup (for loss of offsite power), and isolation valve stroke times. The CREVS initiation on drywell pressure is performed as a precursor to a potential radiation release and subsequent radiation exposure to control room personnel. As such, the delayed channel trip is judged to not have a significant impact on the credited safety functions.

The logic for each function described above is arranged in a one-out-of-two, taken-twice logic, such that the failure of one pressure transmitter (1-PT-064-56A, -56B, -56C, or -56D) would not prevent the associated reactor trip, primary or secondary containment isolation, Standby Gas Treatment, and CREVS initiation functions. However, for brief periods on 8/12/2010 and 8/17/2010, both channels of one division of logic (one of the "taken-twice" logics) were inoperable; one channel (-56B) inoperable for the negative bias, and one channel (-56D) inoperable for scheduled surveillance testing. The scheduled surveillance testing periods were 5 hours and 15 minutes (8/12/2010) and 1 hour and 29 minutes (8/17/2010). While these brief periods reflect an inoperable condition that potentially impacted the fulfillment of the safety function of structures or systems that are needed to control the release of radioactive material (PCIS inoperable), and mitigate the consequences of an accident (CREVS initiation inoperable), as discussed above the actual impact was to the response time of the negative bias channel (-56B). This condition would have still provided the function delayed by the time for increasing drywell pressure to exceed the small negative bias.

As such, TVA concludes that there was no significant reduction in the protection of the public by this event.

VI. CORRECTIVE ACTIONS

The corrective actions are being managed within TVA's Corrective Action Program.

A. Immediate Corrective Actions

Instrument sensing lines were purged of water to restore operability.

B. Corrective Actions to Prevent Recurrence

Human error events have been addressed by various TVA improvement plans. No additional corrective actions to address the human error cause have resulted from this event. Additional corrective actions as a result of this event include:

1. Implement Unit 1 and Unit 3 design changes that reconfigure sensing lines to eliminate water traps. Unit 1 modifications are being made during the current refueling outage. Unit 3 modifications will be scheduled within the corrective action program.
2. Revise the general modifications procedure to specifically address implementation requirements to assure the design specification standards for instrument sensing line slopes are met. This change is scheduled within the corrective action program.
3. Engineering design specifications were revised to require Quality Control inspection of sensing lines associated with instruments which perform a primary safety function. This change was completed subsequent to Unit 1 Restart modifications.

VII. ADDITIONAL INFORMATION

A. Failed Components

None

B. PREVIOUS LERS ON SIMILAR EVENTS

None

C. Additional Information

The corrective action documents for this report are PER 159710, PER 219150, PER 242068, and PER 279760. The BFN corrective action program is also addressing issues associated with untimely evaluations of the condition and operability determination.

D. Safety System Functional Failure Consideration:

This event is not classified as a safety system functional failure according to NEI 99-02.

E. Unplanned Scrams With Complications:

This event did not include a reactor scram.

VIII. COMMITMENTS

None