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

June 1, 2015

10 CFR 50.73

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

Browns Ferry Nuclear Plant, Unit 3
Renewed Facility Operating License No. DPR-68
NRC Docket No. 50-296

Subject: **Licensee Event Report 50-296/2015-003-00**

The enclosed Licensee Event Report provides details of Traversing Incore Probe operation which rendered the Primary Containment Isolation Valves inoperable for longer than allowed by Technical Specifications. The Tennessee Valley Authority is submitting this report in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.73(a)(2)(i)(B), as any operation or condition prohibited by Technical Specifications.

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

Respectfully,

S. M. Bono
Site Vice President

Enclosure: Licensee Event Report 50-296/2015-003-00 - Traversing Incore Probe Operation Caused Inoperability of Primary Containment Isolation Valves for Longer Than Allowed by Technical Specifications

cc (w/ Enclosure):

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

ENCLOSURE

Browns Ferry Nuclear Plant
Units 3

Licensee Event Report 50-296/2015-003-00

Traversing Incore Probe Operation Caused
Inoperability of Primary Containment Isolation Valves
for Longer Than Allowed by Technical Specifications

See Enclosed

NRC FORM 366 (02-2014) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 01/31/2017

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 FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@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 3	05000296	1 of 7

4. TITLE: Traversing Incore Probe Operation Caused Inoperability of Primary Containment Isolation Valves for Longer Than Allowed by Technical Specifications

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	
1	7	2015	2015	- 003	- 00	06	01	2015	FACILITY NAME: N/A	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)
- ☐ 20.2201(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

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
James Stone, Licensing Engineer	256-614-7155

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
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

14. SUPPLEMENTAL REPORT EXPECTED

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

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
N/A	N/A	N/A

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

On January 7, 2015, Browns Ferry Nuclear Plant (BFN), Unit 3, 3D and 3E Traversing Incore Probes (TIPs) stopped responding to automatic controls. The TIPs were left outside of their in-shield positions to decay for 24 hours, and the 3D and 3E TIP Primary Containment Isolation ball valves were left open. On January 8, 2015, the 3D and 3E TIPs were returned to their in-shield positions and their ball valves were closed.

On April 2, 2015, it was determined that, with the identified condition the 3D and 3E TIPs were incapable of automatically retracting in the event of an accident. The impact to the Primary Containment Isolation Valves (PCIVs) function was not recognized on January 7, 2015, and the required PCIV actions were not taken. Therefore, BFN, Unit 3, operated with two inoperable PCIVs, in violation of Technical Specifications (TS).

The apparent cause of this event was operations procedure 3-OI-94, Traversing Incore Probe System, lacked the appropriate guidance and relevant information to address TIP problems and associated TS applicability. Corrective actions include revising the procedure to provide additional guidance on responding to TIP probe malfunctions, and conducting briefings with operations.

NARRATIVE

I. Plant Operating Conditions Before the Event

At the time of discovery, Browns Ferry Nuclear Plant (BFN), Unit 3, was in Mode 1 at approximately 100 percent power.

II. Description of Event

A. Event:

On January 7, 2015, at 1010 hours Central Standard Time (CST), the BFN, Unit 3, valve control monitor [MON] for the 3E Traversing Incore Probe (TIP), BFN-3-MON-094-0101E was being operated in accordance with Operating Instructions 3-OI-94, Traversing Incore Probe System. During operation, the detector went past the core limit by 2 inches and became unresponsive. The TIP was unresponsive to both automatic and manual control. Instrument Mechanics (IMs) were notified and moved the detector by hand crank. When the detector returned to the core limit the TIP remained unresponsive to automatic and manual controls. IMs hand-cranked the TIP to the indexer position, where it could decay for 24 hours before being hand cranked to the in-shield position.

On January 7, 2015, at 1032 hours CST, the valve control monitor for the BFN, Unit 3, 3D TIP, BFN-3-MON-094-0101D, was being operated in accordance with 3-OI-94. During operation, the TIP started moving from the indexer position toward the in-shield position. The operator changed the Drive Control Unit [MCBD] mode switch to the MANUAL position to stop TIP movement to prevent local dose rates from increasing. When the detector continued to move, another operator was called in to verify the condition. Both operators agreed that the only way to stop movement under these conditions was to place the mode switch to the OFF position. Once this was done, the motion stopped and the channel powered down. A 24 hour hold for the detector to decay was allowed before it could be placed back to the in-shield position.

On January 8, 2015, at 1156 CST, all TIPs were verified to be back in the in-shield position.

On April 2, 2015, an operability evaluation determined that the while the actions taken addressed this event with respect to the TIP system requirements, the impact on the associated Primary Containment Isolation Valve (PCIV) function was not addressed. The 3D TIP ball valve [ISV], BFN-3-FCV-094-0501, and the 3E TIP ball valve, BFN-3-FCV-094-0502, are Unit 3 PCIVs and both were determined to be inoperable during the event. Since the TIPs would not have withdrawn automatically, BFN, Unit 3, Technical Specifications (TS) 3.6.1.3, Primary Containment Isolation Valves, conditions C and E should have been entered. Therefore, BFN, Unit 3, operated with two inoperable PCIVs for longer than allowed by TS 3.6.1.3 required action completion times.

NARRATIVE

B. Status of structures, components, or systems that were inoperable at the start of the event and that contributed to the event:

There were no structures, systems, or components (SSCs) whose inoperability contributed to this event, other than the 3D and 3E TIP detector ball valves.

C. Dates and approximate times of occurrences:

Dates & Approximate Times	Occurrence
January 7, 2015, at 1010 hours CST	3E TIP overshoots Top of Core position in Channel 2 during performance of 3-OI-94, Traversing Incore Probe System, and became unresponsive.
January 7, 2015, at 1032 hours CST	Operations turned 3D TIP off to stop movement.
January 8, 2015, at 1156 hours CST	Operations reported 3E and 3D TIPs returned to in-shield position.
April 2, 2015	Operability evaluation determined that 3D and 3E TIP ball valves were inoperable.

D. Manufacturer and model number (or other identification) of each component that failed during the event:

The failed components were General Electric valve control monitors 3-MON-094-0101D, model number 112C3706G4, and 3-MON-094-0101E, model number 112C3706G5.

E. Other systems or secondary functions affected:

TIP system operation, in response to equipment issues, resulted in the inoperability of their associated PCIVs.

F. Method of discovery of each component or system failure or procedure error:

Failures were self-revealing during the performance of procedure 3-OI-94, Traversing Incore Probe System.

G. The failure mode, mechanism, and effect of each failed component, if known:

TIP issues are the result of general system degradation and obsolescence.

In the initial event, the 3E TIP drive mechanism became unresponsive to both automatic and manual control after overshooting the top of core position. Operability was restored when the overload on the motor starter was reset.

The 3D TIP also would not respond to automatic and manual controls, moving backwards without actuation due to a malfunctioning proxy switch.

H. Operator actions:

Operators responded to equipment issues with the malfunctioning TIPs. Operators withdrew the TIPs to their indexer positions, where they were allowed to decay for 24 hours before being withdrawn to the in-shield position. Because impacts to the PCIVs were not recognized at the time, TS Limiting Condition for Operation (LCO) 3.6.1.3 was not entered.

I. Automatically and manually initiated safety system responses:

There was no automatic safety system responses associated with this event.

III. Cause of the Event / Problem Statement

A. The cause of each component or system failure or personnel error, if known:

The apparent cause was procedure 3-OI-94, Traversing Incore Probe System, did not contain adequate guidance to address TIP problems and associated TS applicability. The procedure references, but does not specify, the common practice of leaving probes at the indexer for 24-hour decays.

B. The cause(s) and circumstances for each human performance related root cause:

There were two human performance related contributing causes:

The first contributing cause was misjudgment and inattention to detail during TIP operation. Once the IMs had manually withdrawn the TIPs to their system Indexers, the Unit Supervisor (US) assumed that the situation had been fully corrected, the valves were operable, and the TIPs would have withdrawn to their shielded position upon receiving a Primary Containment Isolation Signal (PCIS). This was deemed to be a misjudgment based on not fully understanding the TIP system condition during the event.

The second contributing cause was ineffective and inadequate written and verbal communication. There is no complete record of this event, since the TIP issues were not included in the operations narrative log due to misunderstanding the condition. Because of the lack of documentation, the Shift Manger (SM), other Senior Reactor Operators (SROs), and the Shift Technical Advisor were unable to review the events to verify proper actions were taken. Verbal communication was lacking, and other SROs and SMs were not fully informed of the problems encountered. As a result, the US believed that the TIP would retract automatically, despite being in the indexer.

IV. Analysis of the event:

The Tennessee Valley Authority (TVA) is submitting this report in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.73(a)(2)(i)(B), as any operation or condition which was prohibited by the plant's TS.

BFN, Unit 3, TS 3.6.1.3 requires each PCIV (excluding reactor building-to-suppression chamber vacuum breakers) to be Operable when in Modes 1, 2, or 3, or when associated instrumentation is required to be Operable per LCO 3.3.6.1, "Primary Containment Isolation Instrumentation."

NARRATIVE

When a PCIV is inoperable in one or more penetration flow paths with a single PCIV, Required Action C.1 requires that the affected penetration flow path be isolated by using at least one closed and de-activated automatic valve, closed manual valve, or blind flange within 4 hours (or 12 hours for excess flow check valves). Required Action C.2 requires re-verification of flow path isolation every 31 days. If Required Actions and associated Completion times for Condition C are not met in Modes 1, 2, or 3, then Required Action E.1 requires entering Mode 3 within 12 hours and Required Action E.2 requires entering Mode 4 within 36 hours.

Problem Evaluation Reports (PERs) 975124 and 975130 were written in January 2015 to document the 3D and 3E TIP failures, respectively. In April 2015, operability determinations of these events (reported in PER 1008300) determined that TIP ball valves 3-FCV-094-0501 and 3-FCV-094-0502 were rendered inoperable by this condition. 3-FCV-094-0502 was inoperable from January 7, 2015 at 1010 CST to January 8, 2015, at approximately 1156 CST, and 3-FCV-094-0501 was inoperable from January 7, 2015 at 1032 CST to January 8, 2015, at approximately 1156 CST.

Because PCIV inoperability was not recognized, BFN, Unit 3 operated with two inoperable PCIVs for longer than allowed by TS 3.6.1.3 required action completion times.

V. Assessment of Safety Consequences

As a result of this event, the TIPs would not have withdrawn automatically when triggered by a Group 8 PCIS. This event rendered automatic control of the TIP detector ball valves inoperable with respect to PCIV requirements. No containment isolation signals occurred during the time the isolation valves were inoperable.

Although the automatic containment isolation function was inoperable, the TIPs could have been moved to the in-shield position and their ball valves closed manually.

In emergency cases where the TIP cable could not be withdrawn by any means, or if the TIP ball valves could not fully close, a redundant shear valve could be manually actuated from the control room to fulfill the required safety function. The TIP shear valves consist of one explosive-operated valve per penetration, which forces a metal wedge into the penetration opening. This wedge will cut the TIP cable and seal the penetration. The licensed operators are trained to follow procedure 1-AOI-64-2e, Traversing Incore Probe Isolation, to actuate the shear valves to ensure isolation in the event that the normal isolation ball valves do not fully shut. Therefore, the ability to isolate these penetrations was maintained.

Based on the discussion above, the safety significance of this condition is minimal and did not pose a threat to the health and safety of the public or plant personnel.

NARRATIVE

A. Availability of systems or components that could have performed the same function as the components and systems that failed during the event:

While the TIPs could not automatically withdraw from the reactor, manual actions could have retracted or severed the TIP cables and sealed their penetrations, preventing any compromise to the plant's ability to contain and control potential radioactive releases.

B. For events that occurred when the reactor was shut down, availability of systems or components needed to shutdown the reactor and maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident:

The reactor was not shutdown during this event.

C. For failure that rendered a train of a safety system inoperable, an estimate of the elapsed time from discovery of the failure until the train was returned to service:

Inoperability of the 3E TIP began when it was observed to fail, on January 7, 2015 at 1010 CST. Inoperability of the 3D TIP began when it was observed to fail, on January 7, 2015 at 1032 CST. This resulted in inoperability of PCIVs 3-FCV-094-0501 and 3-FCV-094-0502. PCIV operability was restored on January 8, 2015 at 1156 CST when all TIPs were returned to their in-shield positions.

VI. Corrective Actions

Corrective Actions are being managed by TVA's corrective action program under PERs 975124, 975130, and 1008300.

A. Immediate Corrective Actions

- Developed and issued an Operations Excellence Communication (OEC) to clarify the requirements when a TIP will not withdraw and cause ball valve inoperability impacting primary containment isolation.

B. Corrective Actions that Prevent Recurrence or to Reduce the Probability of Similar Events Occurring in the Future

There are three corrective actions to reduce the probability of similar events from occurring in the future.

- Coaching Operators on the proper use of operator fundamentals and human performance tools to ensure the appropriate TS are addressed during plant equipment events.
- Briefings will be conducted with Licensed Operators regarding the importance of logging events and using effective verbal communication to describe events to ensure TS compliance.
- Revisions to procedures (1)(2)(3)-OI-94, Traversing Incore Probe System, will provide additional guidance for responding to malfunctioning TIPs by adding or clarifying precautions and limitations. These revisions will include additional information to strengthen the understanding of the PCIV status and associated TS.

NARRATIVE

VII. Additional Information:

A. Previous similar events at the same plant:

A search of the Corrective Action Program for BFN, Units 1, 2, and 3, identified twenty-seven TIP drive and/or ball valve failure events since 2010. These failures were captured by PERs 130407, 216292, 219034, 249496, 248538, 248082, 256409, 292382, 301303, 308350, 339930, 339945, 339928, 339940, 351975, 400823, 488110, 490827, 676038, 733586, 815715, 824763, 825921, 827113, 827119, 827140, 882273, 897840, 961173, and 997971. Among these failures have been several instances of stopped TIPs which had to be manually removed from the Top of Core position, or moved between the indexer and in-shield positions.

These events are caused by the degrading system health and obsolescence of the TIPs. Each failure is slightly different, and since new parts are no longer available, repair and refurbishment of existing equipment is the only available short-term option.

The repeated TIP failure issues have been logged in BFN's Long-Term Asset Management (LTAM) program (LTAM 10-0213). Upgrades to the Unit 1 TIP were completed in 2006, and upgrades to the Units 2 and 3 TIPs have been approved by the plant Change Control Board (CCB). The upgraded Unit 2 TIP is scheduled for installation in 2019, during the U2R20 refueling. The upgraded Unit 3 TIP is scheduled for installation in 2018, during the U3R18 refueling.

B. Additional Information:

There is no additional information.

C. Safety System Functional Failure Consideration:

In accordance with the guidance in NUREG-1022, this event does not constitute a safety system functional failure. The PCIV safety requirements could be met by manually operating the TIP and its associated ball valve, or by manually actuating a redundant shear valve. Both of these actions are governed by procedure and could be performed in the event of a Group 8 isolation signal actuation. The PCIVs would have been able to control releases of radioactive material and/or mitigate the consequences of an accident.

D. Scram with Complications Consideration:

This event did not result in a reactor scram.

VIII. Commitments

There are no commitments.