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Brian R. Sullivan
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JAFP-16-0018
February 16, 2016

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Subject: LER: 2015-008, Containment Atmosphere Dilution System Reliability Degraded due to Manufacturer Defect in Temperature Transmitters

James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
License No. DPR-59

Dear Sir or Madam:

This report is submitted in accordance with 10 CFR 50.73(a)(2)(v)(D), 10 CFR 50.73(a)(2)(vii)(D), and 10 CFR 50.73(a)(2)(i)(B).

There are no new regulatory commitments contained in this report.

Questions concerning this report may be addressed to Mr. Chris M. Adner, Regulatory Assurance Manager, at (315) 349-6766.

Sincerely,

Brian R. Sullivan
Site Vice President

BRS/CMA/mh

Enclosure(s): JAF LER 2015-008, Containment Atmosphere Dilution System Reliability Degraded due to Manufacturer Defect in Temperature Transmitters

cc: USNRC, Region 1
USNRC, Project Directorate
USNRC, Resident Inspector
INPO Records Center (ICES)

NRC FORM 366 (11-2015) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2018

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE

Containment Atmosphere Dilution System Reliability Degraded due to Manufacturer Defect in Temperature Transmitters

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
12	18	2015	2015	- 008	- 00	2	16	2016	FACILITY NAME N/A	DOCKET NUMBER N/A

9. OPERATING MODE	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)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
1	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
100	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☑ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☑ 50.73(a)(2)(i)(B)	☑ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Mr. Chris M. Adner, Regulatory Assurance Manager	315-349-6766

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
B	BB	TT	M422	N					

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 December 18, 2015, James A. FitzPatrick Nuclear Power Plant (JAF) was operating at 100 percent power when a 10 CFR 21.21(d)(3)(ii) Notification was received from Nutherm International. It identified a defect in Moore Industries temperature transmitters. Specifically, insulation was damaged in the T2 transformer during assembly which could result in premature failure.

These components were installed starting in June 2015 at 27TT-113A and 27TT-113B in the Containment Atmosphere Dilution (CAD) system. The defect caused failures in July and November which resulted in either the “A” or “B” CAD subsystem isolating. Corrective actions included replacing both temperature transmitters with ones that were confirmed to not contain this defect.

Even though these defective temperature transmitters function appropriately until they fail, this defect reduced the reliability of the CAD system to perform its function for its entire mission time. Therefore, this deficiency resulted in a loss of safety function to mitigate the consequences of an accident, reportable per 10 CFR 50.73(a)(2)(v)(D). Also, a single cause affected the safety function of independent CAD trains, reportable per 10 CFR 50.73(a)(2)(vii)(D); and, this condition existed longer then allowed by Technical Specifications 3.6.3.2, reportable per 10 CFR 50.73(a)(2)(i)(B).

NARRATIVE

Background

The Containment Atmosphere Dilution (CAD) system [EIIS designation: BB] functions to maintain combustible gas concentrations within the Drywell and Torus [BT] at or below the flammability limits following a postulated loss of coolant accident (LOCA) by diluting hydrogen and oxygen with nitrogen. Also, the CAD system provides the pneumatic supply to instruments and controls inside the Drywell; including the long term (100 day) pneumatic supply to the Automatic Depressurization System (ADS) valves [SB] and accumulators following a LOCA.

The CAD system consists of two independent subsystems. Each subsystem includes a supply tank containing liquid nitrogen. An ambient vaporizer transforms the liquid to gaseous nitrogen. An electric heater is available to increase the nitrogen gas temperature further if the ambient vaporizer has not increased the temperature to greater than -20 degrees Fahrenheit. The nitrogen gas is then supplied to the Drywell, the suppression chamber, or other instruments in the Drywell.

From the liquid nitrogen tanks to the electric heaters, materials in contact with low temperature (<-20°F) nitrogen are made of austenitic stainless steel. Components downstream of the electric heaters are composed of other materials not appropriate for temperatures less than -20 degrees Fahrenheit, such as carbon steel which is prone to embrittlement at low temperatures. The ambient vaporizers and electric heaters act to thermally protect the piping and components downstream of the electric heaters from potential brittle failures.

Temperature transmitters 27TT-113A and 27TT-113B are located downstream of the electric heaters. If they detect low nitrogen gas temperatures then they initiate a close signal to the CAD subsystem isolation valves 27AOV-128A and 27AOV-129A or 27AOV-128B and 27AOV-129B. The control valves used for the CAD system are pneumatic control valves using separate gaseous nitrogen tanks.

Event Description

On December 18, 2015, James A. FitzPatrick Nuclear Power Plant (JAF) was operating at 100 percent power when a 10 CFR 21.21(d)(3)(ii) Notification was received from Nutherm International. It identified a defect in Moore Industries Resistance Temperature Detector (RTD) temperature transmitters supplied to JAF. The transmitters were installed at 27TT-113A and 27TT-113B in the CAD System. A failure of 27TT-113A initiates a closure of CAD subsystem “A” isolation valves 27AOV-128A and 27AOV-129A. A failure of 27TT-113B initiates a closure of CAD subsystem “B” isolation valves 27AOV-128B and 27AOV-129B. Isolating either CAD subsystem impacts the containment makeup capability and the Instrument Nitrogen Header. An Operability Evaluation determined that this defect reduced the reliability of the CAD system such that it may not be able to meet its full 100 day mission time.

This condition was reported to the NRC per 10 CFR 50.72(b)(3)(v)(D), ENS 51613, as a condition which could have prevented the fulfillment of a safety function to mitigate the consequence of an accident.

Event Analysis

The previously installed Temperature Transmitters were Fisher Controls transmitters; model PM511, an original electronic transmitter from the 1970s. Model PM511 is obsolete and replacement parts were running out so an Engineering Equivalent Change evaluated using an alternative model. The new Moore Industries temperature transmitters, model RBT/3W20-40/4-20mA/117 AC/-EZ84.06-LNP-VTD[EX], were procured from Moore Industries International and Nutherm International performed the Commercial Grade Dedication.

The new Moore temperature transmitter contained a defect which first failed on 7/31/2015 in 27TT-113A. When 27TT-113A failed the “A” CAD subsystem automatically isolated by closing the supply valve 27AOV-

128A and backup valve 27AOV-129A. This failure was initially identified as component infant mortality and the component was replaced with a spare component.

On 11/11/2015, a second failure of a new Moore temperature transmitter occurred at 27TT-113B. In a similar fashion to the 7/31/2015 failure, "B" CAD subsystem automatically isolated by closing the supply valve 27AOV-128B and backup valve 27AOV-129B. Based on this now being the second failure of newly installed components, there was increased scrutiny placed on this failure. The components were returned to Nutherm to perform a failure analysis.

The December 18, 2015, Part 21 notification from Nutherm informed JAF that the wire insulation in T2 transformer on the Moore Industries RTD temperature transmitter was damaged during assembly. This damage reduced the insulation resistance and dielectric breakdown between the windings of the transformer; resulting in premature failure of the temperature transmitter.

It has been determined that no visual inspection of the transformer or testing after the transformer is installed will discover this defect. This defect can only be found by performing testing on the transformer prior to installation.

Installation History:				
27TT-113A	6-17-2015 Installed component with defect	7-31-2015 Failure resulting in CAD subsystem "A" isolation Replaced with spare	12-18-2015 Nutherm Part 21 Notification	12/19/2015 Replaced with spare confirmed not to contain this defect
27TT-113B	7-2-2015 Installed component with defect	11-11-2015 Failure resulting in CAD subsystem "B" isolation Replaced with spare		12/30/2015 Replaced with spare confirmed not to contain this defect

The investigation into the two failures on 7/31 and 11/11 became the driving force which led to the Part 21 Notification on 12/18. The replacement spares installed after the two failures were the two serial numbered components included in the Part 21 Notification made to JAF. The removed failed components were also determined to contain the same defect as the Part 21 Notification.

With no method available to inspect the potentially degraded subcomponent after installation, there is not a reasonable assurance the two components would have been able to meet their required 100 day mission time. This condition could have prevented the fulfillment of a safety function, reportable per 10 CFR 50.73(a)(2)(v)(D). This condition caused two independent trains to be Inoperable in a single system designed to mitigate the consequence of an accident, reportable per 10 CFR 50.73(a)(2)(vii)(D).

Technical Specification (TS) 3.6.3.2 requires the CAD system to have two Operable subsystems. On June 17, 2015, when the first defective temperature transmitter was installed, "A" subsystem was Inoperable. Required Action A.1 of the TS requires that it be restored within 30 days. On July 2, 2015, a second CAD subsystem became Inoperable when a second defective temperature transmitter was installed. Required Action B.2 requires that one CAD subsystem be restored within 7 days. When this was not accomplished, Required Action C.1 requires that the plant be in Mode 3 within 12 hours. Since JAF was not in Mode 3 within the required completion time, this event was a condition prohibited by Technical Specifications, reportable per 10 CFR 50.73(a)(2)(i)(B).

Cause

The cause of this event is a defect introduced during the manufacturing of temperature transmitters 27TT-113A and 27TT-113B installed in the Containment Atmosphere Dilution system which resulted in decreased system reliability.

Similar Events

Internal

JAFP-12-0142, LER-2012-004 - Multiple control rods were declared Inoperable during plant shutdown when pressure decreased below 800 psig. This was a compensatory measure associated with a GE Hitachi Part 21 issue (SC-11-05).

JAFP-04-0182, Part 21 Notification - The failure of two General Electric (GE) auxiliary relays in a short period of time led to an investigation where a 10 CFR Part 21 Notification identified that the coil insulation and the underlying wire were damaged during coil manufacture. This defect led to an opening in the relay coil due to corrosion of the coil wire. This opening prevents the relay from changing state when it is energized.

External

Diablo Canyon Unit 1, LER-2012-002 - Operators declared two of the three steam generator narrow-range low-low level transmitter channels Inoperable as a result of evaluating a Rosemount pressure transmitter 10 CFR Part 21 Notification.

Braidwood Unit 1, LER-2011-002 - Incorrectly installed capacitor on the harmonic filter printed circuit module during manufacture of the relay resulted in degraded Emergency Diesel Generator undervoltage protection.

FAILED COMPONENT IDENTIFICATION:

Position Switch Manufacturer:	Moore Industries
Manufacturer Model Number:	RBT
NPRDS Manufacturer Code:	M422
NPRDS Component Code:	TT
FitzPatrick Component ID:	27TT-113A, 27TT-113B

Corrective Actions

Completed Actions

After Nutherm Part 21 Notification was received, 27TT-113A was replaced on December 19, 2015, and 27TT-113B on December 30, 2015. The replacement components are Moore Industries RDT temperature transmitters; which were tested prior to installation to confirm that the defect did not exist.

Safety Significance

There was no actual accident mitigating consequence during this event.

The potential accident mitigation consequence was only applicable during the time period in which defective temperature transmitters were installed in the CAD system; between June 17, 2015, and December 30, 2015. During this period, the CAD system functioned appropriately to add nitrogen to containment and instruments as needed; however, the defect could isolate the subsystem. Therefore, without corrective maintenance, this deficiency significantly reduced each subsystem's ability to reliably perform its function for the duration of its mission time (100 days). Each subsystem is redundant, so both temperature transmitters would need to fail in order to prevent the CAD system from responding to an accident. Defective components were installed in both subsystems, at the same time, from July 2, 2015, to December 19, 2015.

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The CAD system is manually controlled by plant Operators. In the event that the temperature transmitters failed and isolated one or both CAD subsystems, a keylock switch override is available to re-open the isolation valves. In addition, alternate hydrogen control capabilities may be provided by the Primary Containment Inerting System. TS 3.6.3.2 Required Action B.2 states that if both CAD subsystems were Inoperable, then hydrogen control function is verified every 12 hours. The inerting system is manually initiated following the unavailability of the CAD System.

References

- Part 21 Notification: ML15357A041, Nutherm International letter
- Condition Report: CR-JAF-2015-05453, Part 21 Notification received
- Condition Report: CR-JAF-2015-03458, 27TT-113A failure
- Condition Report: CR-JAF-2015-05025, 27TT-113B failure