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DTE Energy

10 CFR 50.73

March 16, 2017
NRC-17-0020

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

Reference: Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

Subject: Licensee Event Report (LER) No. 2017-002

Pursuant to 10 CFR 50.73(a)(2)(i)(B) and 10 CFR 50.73 (a)(2)(v)(D), DTE Electric Company (DTE) is submitting LER No. 2017-002, High Water Level Indications at Low Reactor Pressures Causes Some Functions of High Pressure Coolant Injection System and Reactor Core Isolation Cooling System to be Inoperable.

No new commitments are being made in this LER.

Should you have any questions or require additional information, please contact Mr. Scott A. Maglio, Manager –Nuclear Licensing, at (734) 586-5076.

Sincerely,

Keith J. Polson
Site Vice President

Enclosure: Licensee Event Report No. 2017-002, High Water Level Indications at Low Reactor Pressures Causes Some Functions of High Pressure Coolant Injection System and Reactor Core Isolation Cooling System to be Inoperable

cc: NRC Project Manager
NRC Resident Office
Reactor Projects Chief, Branch 5, Region III
Regional Administrator, Region III
Michigan Public Service Commission
Regulated Energy Division (kindschl@michigan.gov)

Enclosure to
NRC-17-0020

Fermi 2 NRC Docket No. 50-341
Operating License No. NPF-43

Licensee Event Report (LER) No. 2017-002, High Water Level Indications at Low Reactor Pressures Causes Some Functions of High Pressure Coolant Injection System and Reactor Core Isolation Cooling System to be Inoperable

NRC FORM 366 (06-2016) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

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

High Water Level Indications at Low Reactor Pressures Causes Some Functions of High Pressure Coolant Injection System and Reactor Core Isolation Cooling System to be 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
									N/A	05000
01	19	2017	2017	- 002 -	00	03	16	2017	FACILITY NAME N/A	DOCKET NUMBER 05000

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 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)
	☐ 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)*
Fermi 2 / Scott A. Maglio – Manager, Nuclear Licensing	(734) 586-5076

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	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 January 19, 2017, a condition was identified that impacted the operability of certain functions associated with the High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) systems under low reactor pressure conditions. HPCI and RCIC both have automatic and manual actuation functions to inject water into the reactor vessel. HPCI and RCIC also both have an automatic function (i.e. Level 8 trip signal) to prevent injection to the reactor vessel so that water does not reach the steam lines. This Level 8 trip signal comes from instrumentation that is calibrated to be most accurate at normal operating conditions. Under low reactor pressure conditions (i.e. below 600 psig), the high drywell pressure automatic actuation of HPCI and the manual initiation of both HPCI and RCIC are prevented by a Level 8 trip signal such that the affected HPCI and RCIC functions should be considered inoperable per Technical Specifications (TS). This can cause HPCI to also be considered inoperable, which could prevent the fulfillment of a safety function since HPCI is a single train system. Fermi 2 was at a pressure above 600 psig at the time of discovery and, therefore, the condition did not exist. However, a review of past operating conditions identified twelve instances in the past three years where the condition did exist. Based on an engineering analysis, the affected HPCI and RCIC functions are not required to perform a safety function at low reactor pressures; therefore, there was no adverse impact to public health and safety or to plant employees. There were no radiological releases. The cause of the event was an inconsistency between the Fermi 2 TS and the original design and licensing basis of the HPCI and RCIC systems. For corrective actions, Fermi 2 has submitted a license amendment request to clarify the TS.

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
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Fermi 2	05000-341	2017	- 002	- 00

NARRATIVE

INITIAL PLANT CONDITIONS

Mode – 1
Reactor Power – 100 percent

There were no structures, systems, or components (SSCs) that were inoperable at the start of this event that contributed to this event.

DESCRIPTION OF THE EVENT

On January 19, 2017, while performing a review of Fermi 2 design and licensing basis information in support of a potential license amendment, DTE Electric Company (DTE) identified a condition impacting the operability of certain functions associated with the High Pressure Coolant Injection (HPCI) [[BJ]] and Reactor Core Isolation Cooling (RCIC) [[BN]] systems under certain plant conditions. This condition was entered into the Fermi 2 Corrective Action Program at approximately 1545 EST on January 19, 2017. The condition had previously been entered into the Fermi 2 Corrective Action Program in August 2016 as a result of a similar condition identified at another plant. However, the impact on operability of HPCI and RCIC system functions was not confirmed until January 19, 2017; hence this is considered the time of discovery.

The HPCI system provides coolant to the reactor vessel following a small break loss of coolant accident (LOCA) until reactor pressure is below the pressure at which the low pressure coolant injection systems maintain core cooling. The RCIC system is designed to ensure that sufficient reactor water inventory is maintained in the reactor vessel to permit adequate core cooling in the event of a loss of normal feedwater flow. HPCI and RCIC system controls automatically start the systems from the receipt of a reactor vessel water level low-low signal (Level 2). In addition, the HPCI system is designed to automatically start on high primary containment (drywell) pressure. The HPCI and RCIC systems can also be initiated manually. In all actuation modes, the systems are prevented from operating above high reactor vessel water level (Level 8) using trip logic that originates from wide range reactor vessel level instrumentation. The HPCI and RCIC system controls function to provide design makeup water flow to the reactor vessel until the amount of water delivered to the reactor vessel is adequate (i.e. Level 8), at which time the HPCI and RCIC systems automatically shut down. The HPCI and RCIC systems are designed to automatically cycle between the low-low (i.e. Level 2) and high (i.e. Level 8) reactor vessel water levels.

Low reactor vessel water level is monitored by level sensors that sense the difference between the pressure of the water column in a constant reference leg (which is independent of reactor water level and density) and the pressure of the water column in the variable leg which varies linearly with the reactor vessel water level but is also dependent on the reactor water density. Each level sensor provides input to a trip unit and associated logic to provide an automatic HPCI and RCIC actuation signal. The reactor vessel low-low water level setting for HPCI and RCIC system actuation (Level 2) is selected high enough above the active fuel to start the HPCI and RCIC systems in time to maintain level above the top of the active fuel.

The same wide range reactor vessel water level sensors that provide the HPCI and RCIC low-low water level actuation signals also provide the HPCI and RCIC high reactor vessel water level trip signals. Sensors are used with associated logic to automatically shut down the HPCI and RCIC systems. High water level in the reactor vessel indicates that the HPCI and RCIC systems have performed satisfactorily in providing makeup water to the reactor vessel and core cooling requirements are satisfied. The reactor vessel high water level setting that shuts down HPCI and RCIC (Level 8) is near the top of the steam separators and is sufficient to prevent gross moisture carry over to the HPCI and RCIC turbines.

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

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NARRATIVE

To prevent potential turbine damage due to flooding the reactor vessel above the main steam lines, the HPCI and RCIC systems are prevented from operating above the high reactor vessel water level (Level 8) setting in all actuation modes. Once actuated, the HPCI high reactor vessel water level trip is sealed in and will inhibit automatic (or manual) system actuation until indicated water level drops below the Level 8 setting and the high reactor vessel water level trip is manually reset, or the trip signal is automatically reset when indicated reactor vessel water level reaches the Level 2 actuation setting. For RCIC, there is no seal-in circuit for the Level 8 trip, so once reactor vessel water level drops below the Level 8 setting, the RCIC system can be manually initiated, or the system is automatically initiated when indicated reactor vessel water level reaches the Level 2 actuation setting.

The Fermi 2 wide range reactor vessel level instruments are differential pressure type instruments that are reactor coolant density sensitive and are calibrated to be most accurate at normal reactor operating conditions. As a result, at low reactor coolant temperatures and pressures, because the reactor vessel water density is higher than at calibration conditions, these instruments read higher than actual water level. This level indication condition at low reactor pressures is acknowledged in plant procedures and training material. As a result of this level instrumentation condition, a high reactor vessel water level (Level 8) trip signal is present for the HPCI and RCIC systems at low reactor pressures (up to 600 psig), but above the pressure at which the systems are required to be operable (150 psig) per Technical Specifications (TS) 3.5.1 and 3.5.3.

TS Table 3.3.5.1-1 requires HPCI "Drywell Pressure – High" and "Manual Initiation" actuation instrumentation to be operable when HPCI is required to be operable. Any challenge to the reactor coolant pressure boundary (RCPB) that results in a high drywell pressure condition will result in an automatic actuation of the HPCI system actuation logic; however, the system will not start (either automatically or manually) with the Level 8 trip present, as designed. The system would automatically start, without operator intervention, when a demand for inventory is sensed at reactor vessel water low-low level (Level 2). Similar to HPCI, TS Table 3.3.5.2-1 requires RCIC "Manual Initiation" actuation instrumentation to be operable when RCIC is required to be operable. However, as a result of the level instrumentation condition, a high reactor vessel water level trip signal is present for the RCIC system at low reactor pressures (up to 600 psig), but above the pressure at which the RCIC system is required to be operable (150 psig), and the system will not manually start with the Level 8 trip present, as designed. The system would automatically start, without operator intervention, when a demand for inventory is sensed at reactor vessel water low-low level (Level 2). This HPCI and RCIC operation is the same for a high reactor vessel water level occurring at rated pressure and temperature, or at low reactor vessel pressures and temperatures.

The TS Table 3.3.5.1-1 HPCI functions of "Drywell Pressure – High" (Function 3.b) and "Manual Initiation" (Function 3.f) and the TS Table 3.3.5.2-1 RCIC function of "Manual Initiation" (Function 4) should be considered inoperable when they are inhibited by a Level 8 trip signal at low reactor pressures (below 600 psig) based on the phenomena described above. At the time of this discovery, Fermi 2 was operating at 100% power and the Reactor Vessel Water Level – High (Level 8) signal was not present. Therefore, the HPCI and RCIC functions in TS Tables 3.3.5.1-1 and 3.3.5.2-1 were all operable such that the condition did not exist at the time of discovery. No immediate actions were required. However, Fermi 2 had operated in a region of low reactor pressure in the past three years. A past operability review for the three years prior to January 19, 2017 was performed to identify when the Reactor Vessel Water Level – High (Level 8) signal was present while operating at low reactor pressures but above 150 psig. The instances are listed below:

1) At approximately 1330 EST on February 10, 2014, Fermi 2 entered MODE 3 for a refueling outage. During the ensuing shutdown, the Reactor Vessel Water Level – High (Level 8) signal was present for approximately 2 hours.

NARRATIVE

2) At approximately 0130 EDT on March 28, 2014, Fermi 2 entered MODE 2 following a refueling outage. During the ensuing startup, the Reactor Vessel Water Level – High (Level 8) signal was present for approximately 19 hours.

3) At approximately 0230 EDT on April 16, 2014, Fermi 2 entered MODE 3 for an outage. During the ensuing shutdown, the Reactor Vessel Water Level – High (Level 8) signal was present for approximately 4 hours.

4) At approximately 1730 EDT on April 21, 2014, Fermi 2 entered MODE 2 following an outage. During the ensuing startup, the Reactor Vessel Water Level – High (Level 8) signal was present for approximately 9 hours.

5) At approximately 0700 EDT on March 19, 2015, Fermi 2 entered MODE 3 due to a reactor scram. During the ensuing shutdown, the Reactor Vessel Water Level – High (Level 8) signal was present for approximately 15 hours.

6) At approximately 0730 EDT on April 3, 2015, Fermi 2 entered MODE 2 following an outage. During the ensuing startup, the Reactor Vessel Water Level – High (Level 8) signal was present for approximately 8 hours.

7) At approximately 2300 EDT on September 13, 2015, Fermi 2 entered MODE 3 due to a reactor scram. During the ensuing shutdown, the Reactor Vessel Water Level – High (Level 8) signal was present for approximately 5 hours.

8) At approximately 1300 EST on November 25, 2015, Fermi 2 entered MODE 2 following a refueling outage. During the ensuing startup, the Reactor Vessel Water Level – High (Level 8) signal was present for approximately 15 hours.

9) At approximately 2300 EDT on May 3, 2016, Fermi 2 entered MODE 3 for an outage. During the ensuing shutdown, the Reactor Vessel Water Level – High (Level 8) signal was present for approximately 8 hours.

10) At approximately 1630 EDT on May 12, 2016, Fermi 2 entered MODE 2 following an outage. During the ensuing startup, the Reactor Vessel Water Level – High (Level 8) signal was present for approximately 9 hours.

11) At approximately 0300 EST on November 7, 2016, Fermi 2 entered MODE 3 for an outage. During the ensuing shutdown, the Reactor Vessel Water Level – High (Level 8) signal was present for approximately 4 hours.

12) At approximately 2245 EST on November 11, 2016, Fermi 2 entered MODE 2 following an outage. During the ensuing startup, the Reactor Vessel Water Level – High (Level 8) signal was present for approximately 7 hours.

The twelve occurrences identified above are conditions where Fermi 2 was operating at low reactor pressure but above 150 psig such that the Reactor Vessel Water Level – High (Level 8) signal was present in a manner which would have prevented the injection of HPCI by the "Drywell Pressure – High" function and prevented the injection of HPCI and RCIC by the "Manual Initiation" functions. Considering these functions inoperable results in entry to TS Limiting Condition for Operation (LCO) 3.3.5.1 Condition A and TS LCO 3.3.5.2 Condition A. A review of the consequences of entering these LCOs is provided in the paragraphs that follow.

TS LCO 3.3.5.1 Required Action A.1 requires immediate entry to the Condition referenced by TS Table 3.3.5.1-1 for the inoperable channel(s). TS Table 3.3.5.1-1 references Conditions B and C for Functions 3.b and 3.f, respectively. For TS LCO 3.3.5.1 Condition B, Required Action B.2 requires declaring HPCI inoperable within 1 hour from discovery of loss of HPCI initiation capability (this also results in entry to TS LCO 3.5.1 Condition E as discussed below). Required Action B.3 requires placing the channel(s) in trip within 24 hours. Note that Required Action B.1 does not apply to Function 3.b. For TS LCO 3.3.5.1 Condition C, Required Action C.2 requires restoring the channel(s) to operable status within 24 hours.

NARRATIVE

Note that Required Action C.1 does not apply to Function 3.f. If the Required Actions and associated Completion Times of TS LCO 3.3.5.1 Conditions B or C are not met, then Condition G applies and Required Action G.1 is to immediately declare associated supported feature(s) inoperable. Since Required Action A.1 has an immediate Completion Time and no entry to the LCO was made, Required Action A.1 was not met in any of the twelve occurrences. Required Action B.2 was also not met since all twelve occurrences exceeded 1 hour. Required Action B.3 would have been met since none of the twelve occurrences exceeded 24 hours. Since Required Action B.2 was not met, Condition G would have been entered and Required Action G.1 would not have been met since it has an immediate Completion Time. However, the action taken for Required Action G.1 would only have been to declare HPCI inoperable which was the same as already required by Required Action B.2.

TS LCO 3.3.5.2 Required Action A.1 requires immediate entry to the Condition referenced by TS Table 3.3.5.2-1 for the inoperable channel(s). TS Table 3.3.5.2-1 references Condition C for Function 4. For TS LCO 3.3.5.2 Condition C, Required Action C.1 requires restoring the channel(s) to operable status within 24 hours. Since Required Action A.1 has an immediate Completion Time and no entry to the LCO was made, Required Action A.1 was not met in any of the twelve occurrences. Required Action C.1 would have been met since none of the twelve occurrences exceeded 24 hours.

If HPCI is declared inoperable per TS LCO 3.3.5.1 Required Action B.2, entry to TS LCO 3.5.1 Condition E is required. Required Action E.1 is to immediately verify by administrative means that RCIC is operable and Required Action E.2 is to restore HPCI to operable status within 14 days. Although the RCIC instrumentation "Manual Initiation" function would have been inoperable, none of the TS LCO 3.3.5.2 actions described above would have resulted in declaring the RCIC system inoperable during any of the twelve occurrences (i.e. RCIC was operable). The duration of each of the occurrences was also much less than 14 days. Therefore, although no entry to TS LCO 3.5.1 Condition E was made, both Required Actions E.1 and E.2 would have been met.

Finally, TS LCO 3.0.4 prohibits entry into a Mode or other specified condition in the Applicability unless certain criteria are met. As a result, the occurrences associated with the six startups discussed above (i.e. #2, #4, #6, #8, #10, and #12) would have been prohibited by TS LCO 3.0.4. This LCO does not prevent changes in Modes that are part of a shutdown and therefore does not apply to the six shutdowns described above (i.e. #1, #3, #5, #7, #9, and #11).

In consequence of the above discussion, a Licensee Event Report (LER) is being made in accordance with Title 10 of the Code of Federal Regulations (10 CFR) Part 50.73. Since HPCI is a single train system, the inoperability of HPCI could have prevented the HPCI system from fulfilling its safety function to mitigate the consequences of an accident. Therefore, this LER is being made under 10 CFR 50.73(a)(2)(v)(D) as an "event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident." In addition, TS LCO Required Actions were not performed within their associated Completion Times for twelve of the occurrences and TS LCO 3.0.4 was not met for six of the occurrences. Therefore, this LER is also being made under 10 CFR 50.73(a)(2)(i)(B) as an "operation or condition which was prohibited by the plant's TS." No notification was made under 10 CFR 50.72 as the condition was not present at the time of discovery as previously described.

As discussed in the "Corrective Actions" subsection below, Fermi 2 submitted a license amendment request to revise the TS such that it will no longer be necessary to consider HPCI and RCIC functions inoperable due to the condition described in this LER.

NARRATIVE

SIGNIFICANT SAFETY CONSEQUENCES AND IMPLICATIONS

An engineering analysis was performed to evaluate the safety consequences and implications. The analysis determined that the HPCI functions of "Drywell Pressure – High" and "Manual Initiation" and the RCIC function of "Manual Initiation" are not required at reactor pressures below 600 psig in order for HPCI and RCIC to perform their intended safety functions. The analysis confirms that the HPCI and RCIC functions of "Reactor Vessel Water Level – Low-Low, Level 2" remain available and are sufficient to perform the intended safety functions. The details of the analysis were provided in the license amendment request submitted to the NRC on February 23, 2017 (see discussion in "Corrective Actions" subsection below). Since these functions of HPCI and RCIC are not required under low reactor pressure conditions, there are no safety consequences or implications associated with any of the twelve occurrences described above. In addition, the inoperability of the HPCI and RCIC functions described above was solely due to the presence of the Level 8 trip signal under low reactor pressure conditions, not due to any actual equipment problems or plant events. Fermi 2 procedures contain actions to defeat the Level 8 trip signal for HPCI and RCIC. Defeating the Level 8 trip would allow HPCI and RCIC to be manually initiated and HPCI to be automatically initiated on high drywell pressure. Therefore, these HPCI and RCIC functions were available during all of the periods described above even though they would have been considered inoperable. In conclusion, there was no adverse impact to public health and safety or to plant employees. There were no radiological releases.

CAUSE OF THE EVENT

The cause was that the specified conditions in the Applicability of certain functions in TS 3.3.5.1 and 3.3.5.2 were not consistent with the original design and licensing basis of the HPCI and RCIC systems. In addition, the TS Bases and/or Updated Final Safety Analysis Report (UFSAR) did not provide adequate description of the original design of the HPCI and RCIC systems with respect to the Level 8 trip signal. Per the original design, the reactor level instrumentation is calibrated for normal operating pressure conditions and therefore reads higher than the Level 8 trip signal under low pressure conditions.

CORRECTIVE ACTIONS

As discussed previously, no immediate action was required to restore compliance since the condition did not exist at the time of discovery. This LER is being submitted to report the previous occurrences of this condition. To prevent future occurrence of this condition, Fermi 2 submitted a license amendment request to the NRC on February 23, 2017, to modify TS 3.3.5.1 and 3.3.5.2 to clarify the applicability of certain HPCI and RCIC functions. In addition, Fermi 2 plans to modify the TS Bases and/or UFSAR to include additional details regarding the Level 8 trip signal.

PREVIOUS OCCURRENCES

The previous occurrences within the past three years were discussed in this LER.