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Serial No: MNS-14-051

July 24, 2014

U.S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, D.C. 20555

10 CFR 50.73

Subject: Duke Energy Carolinas, LLC
McGuire Nuclear Station (MNS), Unit 2
Docket No. 50-370
Licensee Event Report 370/2014-01, Revision 1
Problem Investigation Process Number M-14-03153

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 370/2014-01, Revision 1, regarding an American Society of Mechanical Engineers (ASME) rejectable flaw discovered on the MNS Unit 2 Safety Injection piping.

This revision to LER 370/2014-01 supersedes the LER previously submitted on June 2, 2014. The cause analysis has been completed, which included final management review and approval. Completion of the cause analysis has not affected the original reporting criteria, which was in accordance with 10 CFR 50.73(a)(2)(ii)(A), a degradation of a principal safety barrier.

Additionally, the revision did not affect the significance of the event, which was considered to be of no significance with respect to the health and safety of the public. There are no regulatory commitments contained in this LER revision.

If questions arise regarding this LER, please contact Brian Richards of Regulatory Affairs at 980-875-5171.

Sincerely,

Steven D. Capps

Attachment

IE22
NRR

U.S. Nuclear Regulatory Commission
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LICENSEE EVENT REPORT (LER)

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

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 infocollections.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.

1. FACILITY NAME

McGuire Nuclear Station, Unit 2

2. DOCKET NUMBER

05000- 370

3. PAGE

1 OF 5

4. TITLE

Degraded Condition due to Rejectable Flaw on Safety Injection Piping

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	03	2014	2014-01	1		07	24	2014	None	
9. OPERATING MODE No Mode			11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)							
			<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)				
10. POWER LEVEL 000			<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input checked="" type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)				
			<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)				
			<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)				
			<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)				
			<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)				
			<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)				
			<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER				
			<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> Specify in Abstract below or in NRC Form 366A				

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME

Brian H. Richards, Regulatory Affairs

TELEPHONE NUMBER (Include Area Code)

980-875-5171

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
X	BQ	PSP	X000	Y					

14. SUPPLEMENTAL REPORT EXPECTED

YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO
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15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

While Unit 2 was in a refueling outage on April 1, 2014, manual ultrasonic (UT) examinations identified indications on Safety Injection (NI) system piping. On April 3, 2014, phased-array UT techniques confirmed one indication as a rejectable flaw. Because the flaw was rejectable under American Society of Mechanical Engineers (ASME) Code requirements, it is reportable as a degraded condition. Stress analysis showed that the crack would not have prevented the piping from performing its safety function, so this event did not impact public health and safety.

The cause of the flaw is a legacy issue of previous leakage past valve 2NI-3 (Unit 2 Cold Leg Injection Isolation) creating a high frequency thermal cycle condition. This condition initiated the fatigue crack identified during the UT examination. Additionally, this flaw was missed during the previous refueling outage as a result of a probable skill-based human performance error.

Actions were taken to repair the NI piping on Unit 2 and to re-inspect other susceptible lines before the unit restarted from its refueling outage. Based on an extent of condition evaluation, a reasonable assurance of operability exists for similar Unit 1 configurations. As part of planned corrective actions, 2NI-3 (and its Unit 1 equivalent) will be isolated from the safety injection line.

LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET

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17. NARRATIVE

BACKGROUND:

Applicable Energy Industry Identification [EII] system and component codes are enclosed within brackets. McGuire-specific system and component identifiers are contained within parentheses.

Safety Injection System [BQ](NI):

The NI system is designed to provide Emergency Core Cooling for the Reactor Coolant System [AB](NC) in order to prevent fuel clad melting to assure that the core remains in place and substantially intact in case of an accident. Each unit's NI system contains an "A" and "B" train pump that both actuate automatically upon a safety injection signal following low pressurizer pressure or high containment pressure.

Chemical and Volume Control System [CB](NV):

The NV system is designed to maintain required water inventory in the NC system; maintain seal-water injection flow to the reactor coolant pumps; control water chemistry conditions; and provide emergency core cooling (part of the system shares piping with the NI system).

The flaw discovered in the Unit 2 NI piping was reported per 10 CFR 50.72 (b)(3)(ii)(A), "Any event or condition that results in the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded." An Emergency Notification System report was made to the Nuclear Regulatory Commission (NRC) on April 3, 2014, at 0244 hours. A 10 CFR 50.73 (a)(2)(ii)(A) licensee event report is also required due to this degraded condition.

This flaw was detected during normal inspections required by the Non-Destructive Examination (NDE) Augmented Examination program, which is driven by MRP-146 ("Thermal Fatigue in Normally Stagnant Non-Isolable Reactor Coolant System Branch Lines"). MRP-146 is an Electric Power Research Institute (EPRI) document that provides guidance on the mechanisms causing the initiation and growth of thermal fatigue cracks. Non-isolable branch lines connected to the NC system are susceptible to high cycle thermal fatigue if exposed to specific operational conditions and configurations. Examples of susceptible locations are horizontal lines where in-leakage past a valve is present and lines see turbulent swirl penetration from adjacent piping flow. Initial MRP-146 inspections were performed in 2008 and did not include the area where the flaw was discovered. The MRP-146 inspection performed in 2012 was the first opportunity to identify this flaw.

The flaw was found on a 1.5 inch nominal diameter horizontal NI line connected to the 27.5 inch inside diameter 2D NC cold leg piping near weld NC2FW45-5. 2NI-3 (U2 NC Cold Leg Isolation), 2NI-9A (NC Cold Leg Injection from Chemical and Volume Control (NV)), and 2NI-10B (NC Cold Leg Injection from NV) are valves upstream of the flaw location. Additionally, the NI connection to the 2D NC cold leg piping is susceptible to swirl penetration. This phenomenon, in concert with cold water leakage (from the NV system) past any of these valves, can result in thermal stratification. In turn, this thermal stratification can lead to thermal fatigue cracking. Although 2NI-3 has had a history of leakage, it was replaced in 2006, and there has been no apparent leakage since then. Due to a different valve design, however, leakage past

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17. NARRATIVE

2NI-9A and 2NI-10B is not expected. Based on hydrostatic testing, no leakage past any of these three valves existed when the flaw was discovered.

No significant structures, systems, or components were out of service at the time of discovery such that they contributed to the event.

EVENT DESCRIPTION:

On April 1, 2014, while Unit 2 was in a refueling outage (no mode), manual ultrasonic (UT) examination of branch lines (connected to the NC system cold leg piping and in the Augmented Examination program) detected flaw-like indications. Use of phased-array UT techniques on April 3, 2014, confirmed that an axial indication on the 1.5 inch nominal diameter NI line connected to the 2D NC cold leg was a rejectable flaw under American Society of Mechanical Engineers (ASME) rules. This flaw was identified as a crack starting inside the pipe and extending greater than 50% of the piping wall thickness in the axial direction. The length of this crack was approximately 1.1 inches and extended through the weld material of weld NC2FW45-5 and into the nozzle.

The relevant sequence of events as pertaining to the identification of the piping flaw is as follows:

3/31/2014	Unit 2 entered No Mode
4/1/2014	UT examinations identified flaw-like indications on branch lines connected to the NC system
4/3/2014	Phased-array UT confirmed a reportable flaw on the 1.5 inch nominal NI line to the 2D NC cold leg
4/7/2014	Flaw was repaired
4/22/2014	Unit 2 entered Mode 3 on startup

CAUSAL FACTORS:

The cause evaluation concluded that the causal factors for this event are as follows:

A legacy issue with leakage through isolation valve 2NI-3 created the thermal stratification condition, which initiated the NI piping to the 2D NC cold leg nozzle fatigue cracks identified in the 2014 UT inspection. The metallurgy lab results indicate no evidence of recent crack growth.

A skill-based human performance error was identified as the probable reason that the NDE performed in 2012 missed the flaw. The size and age of the flaw, as determined by a metallurgy lab analysis, indicate that it has been present for several years. The examination of this line performed in 2012 (during the previous refueling outage) was ineffective and missed the significant flaw.



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CORRECTIVE ACTIONS:

Prior to the discovery of this piping flaw, industry operating experience with previously undetected flaws led to changes to NDE processes and procedures used at McGuire. These changes resulted in greater attention to detail and oversight when performing inspections associated with the Augmented Examination program.

Immediate:

1. Performed ASME Code repair of the 2D NI cold leg piping containing the flaw.
2. Performed extent-of-condition UT examinations on Unit 2 of all MRP-146 susceptible piping and three other 1.5 inch nominal NI pipes similar to the pipe with a flaw. No other rejectable indications were found.
3. Leak-tested valves 2NI-3, 2NI-9A, and 2NI-10B to ensure that they were not leaking past the seat. No leakage was detected.

Subsequent:

1. Entered the operability determination process on Unit 1. Although minor leakage through 1NI-3 was identified, analysis showed that there is a reasonable assurance of operability and confidence in the integrity of the evaluated piping.
2. Suspended qualifications of two examiners involved in the 2012 UT examination pending recertification under Duke Energy procedures and ASME requirements.

Planned:

1. Initiate and implement an engineering change to isolate valve 2NI-3 from the Safety Injection line by capping the location.
2. Initiate and implement an engineering change to isolate valve 1NI-3 from the Safety Injection line by capping the location (extent of cause).

SAFETY ANALYSIS:

The NI piping flaw found on Unit 2 had no impact on public health and safety. A stress analysis concluded that despite the presence of the piping flaw, the 1.5 inch nominal NI piping would not catastrophically fail when exposed to design basis loadings. The analysis further concluded that the piping would not leak under design basis loadings because the flaw would not have breached the wall.



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CONTINUATION SHEET**

APPROVED BY OMB: NO. 3150-0104

EXPIRES: 01/31/2017

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ADDITIONAL INFORMATION:

A review of the McGuire corrective action program was conducted to determine whether this was a recurring event (i.e., similar event with the same cause code). No other piping/welding flaws associated with thermal fatigue have been documented within the past five years. Therefore, this is not considered a recurring event.