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Serial No: MNS-14-073

October 20, 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 1
Docket No. 50-369
Licensee Event Report 369/2014-01, Revision 0
Problem Investigation Process Number M-14-07424

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 369/2014-01, Revision 0, regarding a condition prohibited by Technical Specification (TS) 3.8.1 due to Emergency Diesel Generator (EDG) 1B cylinder 5L inlet valve failure.

This report is being submitted in accordance with 10 CFR 50.73(a)(2)(i)(B), "Operation or Condition Prohibited by Technical Specifications". This event is considered to be of no significance with respect to the health and safety of the public.

This LER is preliminary and will be supplemented upon completion of the cause analysis.

There are no regulatory commitments contained in this LER other than the commitment to submit a supplement. Duke Energy expects to supply that supplement within 60 days but does not consider that time frame to be a commitment.

If questions arise regarding this LER, please contact Sherry Andrews of Regulatory Affairs at 980-875-4837.

Sincerely,

Steven D. Capps

Attachment

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NRR

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cc: V. M. McCree
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LICENSEE EVENT REPORT (LER)

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

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 1	2. DOCKET NUMBER 05000- 369	3. PAGE 1 OF 5
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4. TITLE
Condition Prohibited by Technical Specifications (TS) due to Emergency Diesel Generator 1B Failure.

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
08	21	2014	2014	01	0	10	20	2014	None	None
									FACILITY NAME	DOCKET NUMBER
									None	None

9. OPERATING MODE
1

10. POWER LEVEL
100

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)
<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input 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 checked="" 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

LICENSEE CONTACT Sherry Andrews, Senior Engineer, Regulatory Affairs	TELEPHONE NUMBER (Include Area Code) 980-875-4837
---	--

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	EK	V	N152	Y					

14. SUPPLEMENTAL REPORT EXPECTED

<input checked="" type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)	<input type="checkbox"/> NO
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15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
12	19	2014

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

On August 18, 2014, approximately 14 hours into a 24 hour surveillance test of Emergency Diesel Generator (EDG) 1B, Operators noted cylinder 5L exhaust temperature decreased by 130 degrees Fahrenheit and power indication began oscillating. Operations began an orderly shutdown of EDG 1B. Subsequently, Operators in the diesel room reported an unusual noise, at which time Operations immediately unloaded and stopped EDG 1B. EDG 1B was subsequently repaired and tested satisfactorily. This event is being reported under 10 CFR 50.73(a)(2)(i)(B) as an operation or condition which was prohibited by the plant's Technical Specification due to EDG 1B repair and testing exceeding the 72 hour completion time as mandated by TS 3.8.1.

On August 21, 2014, McGuire Unit 1 requested a Notice of Enforcement Discretion (NOED) in anticipation of exceeding TS 3.8.1 "AC Sources - Operating" Required Action Completion Time. The NOED was granted by the NRC on the same day.

The preliminary cause of this event is EDG 1B cylinder 5L inlet valve failure due to high cycle fatigue accelerated by higher stresses resulting from engine parts that were outside manufacturer tolerances. Investigation of the fatigue failure that occurred is ongoing. The LER will be supplemented upon finalization of the cause analysis.



**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

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.

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17. NARRATIVE

BACKGROUND:

The following information is provided to assist readers in understanding the event described in this LER. Applicable Energy Industry Identification [EII] system and component codes are enclosed within brackets. McGuire's unique system and component identifiers are contained within parentheses.

For McGuire, the onsite standby power source for each 4160 volt Engineered Safety Feature (ESF) bus is a dedicated Emergency Diesel Generator [DG] (EDG). An EDG starts automatically on a safety injection (SI) signal (i.e., low pressurizer pressure or high containment pressure signals) or on an ESF bus degraded voltage or undervoltage signal. After the EDG has started, it will automatically tie to its respective bus after offsite power is tripped as a consequence of ESF bus undervoltage or degraded voltage, independent of or coincident with an SI signal. The EDGs will also start and operate in the standby mode without tying to the ESF bus on an SI signal alone. Following the trip of offsite power, a sequencer strips loads from the ESF bus. When the EDG is tied to the ESF bus, loads are then sequentially connected to its respective ESF bus by the automatic load sequencer. The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading the EDG by automatic load application.

The prime movers for the McGuire EDGs are 16 cylinder Nordberg diesel engines. Each cylinder has one inlet and one exhaust valve. Each EDG unit is rated for continuous operation at 4000 kilowatts (kW) with added capacity to operate between 4200 – 4400 kW for a period of two hours out of every twenty-four hours of operation without adversely affecting the life of the unit. The design basis accident load level for each of the redundant systems does not exceed the 4000 kW continuous rating of the EDG unit assigned to each system.

TS Limiting Condition of Operation (LCO) 3.8.1, Required Action B.4 governs AC Sources - Operating for Modes 1, 2, 3, and 4. LCO 3.8.1 requires in part that two EDGs be operable. Required Action B.4 states that with one EDG inoperable, the EDG must be restored to operable status within 72 hours. Condition G states that with the Required Actions and associated Completion Times of Condition B not met, the unit must be in Mode 3 within 6 hours and in Mode 5 within 36 hours.

SR 3.8.1.14 verifies that every 18 months each EDG, when connected to its bus in parallel with offsite power and operating with maximum Kilovolt-ampere (kVAR) loading that offsite power conditions permit, operates for >= 24 hours:

- a. For >= 2 hours loaded >= 4200 kW and <= 4400 kW; and
- b. For the remaining hours of the test loaded >= 3600 kW and <= 4000 kW.



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At the time of the event, repair and testing of the EDG 1B was anticipated to not be completed within the 72 hour completion time mandated by TS 3.8.1, Required Action B.4. Therefore, Duke Energy requested the Completion Time of the Required Action be extended from the current 72 hours by an additional 48 hours, for a total of 120 hours, to allow McGuire Unit 1 to remain in Mode 1 (Power Operation) until repairs could be completed and testing to demonstrate operability of EDG 1B was completed. The NOED was subsequently granted by the NRC on the same day for an additional 48 hours of unit operation. EDG 1B was restored to operable status approximately 34 hours into the 48 hour period allowed by the NOED.

This event is being reported under 10 CFR 50.73(a)(2)(i)(B), any operation or condition which was prohibited by the plant's Technical Specifications. Throughout the duration of this event, Unit 1 operated in Mode 1 at 100% power. 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 August 18, 2014, at 1718, approximately 14 hours into a 24 hour surveillance test of EDG 1B, cylinder 5L exhaust temperature dropped from a steady 741 degrees Fahrenheit (F) down to 611 degrees F. Control room and local power indications were observed to be fluctuating. Operations directed a procedural shutdown (stepping down load) of EDG 1B. An operator in the field reported an unusual sound from the engine when load was reduced. Operations immediately unloaded and stopped EDG 1B and subsequently declared EDG 1B inoperable on August 18, 2014, at 1729 hours. Maintenance activities commenced to inspect and repair EDG 1B.

During the initial disassembly of EDG 1B cylinder 5L for repair, the inlet valve spring was discovered in a relaxed state (not compressed) indicating that the inlet valve and/or stem was broken and was no longer captured by the valve stem keeper. Further examination concluded the inlet valve failed at the bottom of the keeper groove on the valve stem. This caused the valve to repeatedly contact the valve seat insert which broke the insert into small pieces. The insert pieces fell into the cylinder damaging the piston, head, exhaust valve, and cylinder liner. The damage was confined to EDG 1B cylinder 5L with the exception of some broken pieces of valve seat that entered the engine exhaust header. The pieces were swept down the exhaust header and stopped by the turbocharger inlet protection screen.

On August 21, 2014, at 1300, McGuire requested a NOED for an additional 48 hours to TS LCO 3.8.1, Required Action B.4 to allow for repair of EDG 1B. The NOED was subsequently granted by the NRC for an additional 48 hours of unit operation. The enforcement discretion period began on August 21 at 1529.

On August 23, 2014, at 0335, the operability test was completed satisfactorily for EDG 1B.

On August 24, 2014, at 1041, the 24 hour Surveillance test was completed satisfactorily for EDG 1B.



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CAUSAL FACTORS:

The preliminary cause of this event is EDG 1B cylinder 5L inlet valve failure due to high cycle fatigue accelerated by higher stresses resulting from engine parts that were outside manufacturer tolerances.

Metallurgical analysis indicated the failure mechanism of EDG 1B cylinder 5L inlet valve stem was high cycle fatigue. The hardness (tensile strength) of the inlet valve stem was lower than that specified by the Original Equipment Manufacturer (OEM). In addition, the inlet valve hydraulic lash adjuster was out of tolerance per manufacturer specifications.

McGuire's cause evaluation for this event was not complete as of the date of submission of this LER; therefore, Duke Energy will provide a supplement.

CORRECTIVE ACTIONS:

Immediate:

1. Replaced the affected parts for EDG 1B Cylinder 5L.
2. Performed series of EDG 1B break-in runs following replacement of parts.
3. Performed EDG 1B Operability test.
4. Performed EDG 1B 24 hour Surveillance test.

Subsequent:

1. Duke Energy's Metallurgy Laboratory analyzed the affected cylinder components.
2. Determined by Engine Signature Analysis (ESA) historical review that the EDG 1B cylinder 5L signature was atypical with respect to some of the other cylinder signatures. Further review determined the EDG 1B cylinders 4L, 6L, and 3R also had similar ESA responses.
3. Confirmed no other unit 1 or unit 2 EDG cylinders have atypical ESA responses.
4. Determined EDG 1B cylinder 5L hydraulic lash adjuster was outside manufacturer's tolerance. Similar hydraulic lash adjusters were discovered on cylinders 4L, 6L, 3R, and in warehouse stock (removed).
5. The hardness (tensile strength) of EDG 1B 5L, 4L, 6L, and 3R inlet valves was analyzed.
6. Replaced EDG 1B cylinder heads 4L, 6L, and 3R. Replaced hydraulic lash adjusters for 4L, 6L and 3R with new parts pre-tested to function properly.
7. Disassembled turbocharger and inspected for further damage.
8. Performed ESA on EDG 1B after maintenance. Results were satisfactory.

Investigation of the fatigue failure that occurred on the inlet valve stem is ongoing.



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SAFETY ANALYSIS:

The nuclear safety significance of this event was that the site operated for a period of time outside the technical specification limits with the EDG 1B inoperable. The associated risk, including the Probabilistic Risk Assessment analysis, of this condition was evaluated as part of the NOED and was found to be acceptable. The redundant EDG 1A was operable and available and could have performed its intended safety function at all times while the EDG 1B was tagged out to support maintenance and testing.

The extent of condition review determined that the EDGs 1A, 2A, and 2B were not susceptible to the same failure mode as EDG 1B based on the ESA of the engines. EDGs 1A, 2A, and 2B cylinders do not exhibit ESA atypical responses similar to that of EDG 1B cylinders 5L, 4L, 6L, and 3R. The scope of this issue was confirmed to be limited to the four cylinders with the lash adjusters from the same lot only installed on EDG 1B. The lash adjusters of the identified lot have been confirmed to not be installed in the 1A, 2A, and 2B EDGs.

ADDITIONAL INFORMATION:

Investigation of the fatigue failure that occurred on the inlet valve stem is ongoing. A recurring event review will be conducted at the conclusion of the root cause analysis.

10 CFR Part 21 Applicability

This event is currently being evaluated for 10 CFR Part 21 applicability in accordance with Duke Energy administrative procedures. The results of this evaluation will be documented in the LER supplement report upon finalization.