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10 CFR 50.90

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

Subject: Duke Energy Carolinas, LLC (Duke Energy)
McGuire Nuclear Station, Units 1 and 2
Docket Nos. 50-369 and 50-370
License Amendment Request
Permanent Extension of Type A and Type C Leak Rate Test Frequencies
Response to Request For Additional Information

By letter dated December 19, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16363A349), Duke Energy submitted the subject license amendment request to the U. S. Nuclear Regulatory Commission (NRC) for approval. By electronic mail dated April 28, 2016 (ADAMS No. ML17121A005), the NRC requested additional information. The enclosed document provides the requested information.

This submittal contains no regulatory commitments.

If you have any questions or require additional information, please contact P.T. Vu of Regulatory Affairs at (980) 875-4302.

I declare under penalty of perjury that the foregoing is true and correct. Executed on May 25, 2017.

Sincerely,

SDCapps

Steven D. Capps

Enclosure

ADD1
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xc:

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License Amendment Request

Request for Additional Information

ENCLOSURE

By letter dated December 19, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16363A349), Duke Energy, (the licensee), requested changes to the Technical Specifications (TSs) for McGuire Nuclear Station (MNS), Units 1 and 2. The proposed change (LAR) would permit the existing Containment 10 CFR 50 Appendix J Type A Integrated Leakage Rate Test (ILRT) intervals to be extended from 10 years to 15 years and the Type C test (LLRT) intervals for qualifying containment isolation valves (CIVs) to be extended from 60 months up to 75 months on a permanent basis.

In order to complete its review, the U.S. Nuclear Regulatory Commission (NRC) staff requests the following additional information. Please provide your response to the following request for additional information within 30 days of the date of this correspondence.

RAI-1

The NRC staff notes that the licensee adopted Option B of 10 CFR 50, Appendix J following the September 4, 2002 issuance of Amendment No. 207 to Facility Operating License No. NPF-9 and Amendment No. 188 to Facility Operating License NPF-17 for MNS, Units 1 and 2.

Per the guidance of Nuclear Energy Institute (NEI) 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J," Revision 0 (Reference 2), Section 10.2.3.2 and subject to the four provisions identified in Regulatory Position "C" of Regulatory Guide (RG) 1.163, "Performance-Based Containment Leak-Test Program," both MNS, Unit 1 and Unit 2 are currently allowed to extend the test intervals for Type C CIVs up to 60 months.

RG 1.63 Regulatory Position C.2 reads, in part:

> ..... Further, the interval for Type C tests for main steam and feedwater isolation valves in BWRs, and containment purge and vent valves in PWRs and BWRs, should be limited to 30 months as specified in Section 3.3.4 of ANSI/ANS-56.8-1994, with consideration given to operating experience and safety significance.

Section 10.2.3.2 of NEI 94-01 of both Revision 0 and Revision 3-A (Reference 3) reads, in part:

> Test intervals for Type C valves may be increased based upon completion of two consecutive periodic As-found Type C tests where the result of each test is within a licensee's allowable administrative limits.....

As conveyed in LAR Section 3.3 "Containment Leakage Rate Testing Program, Type B and Type C Testing," the NRC staff notes that currently less than half of the population of both Unit's CIVs are on extended frequencies of 60 months. The NRC staff's review of LAR Table 3.3-3 "MNS Type Band C LLRT Program Implementation Review As-Found Failures of Components on Extended Intervals *(emphasis added)*" fails to adequately explain "Why a greater percentage of the CIVs are not qualifying for extended frequencies"?

The NRC staff requests that the licensee provide additional information about LAR Section 3.3 and Table 3.3-3. In particular, about:

A. All (i.e. not just those on extended frequencies) CIVs that failed "Administrative Limits" during the last two MNS, Unit 1 and Unit 2 refueling outages.

Response to RAI-1 A

The two most recent MNS Unit 1 refueling outages were 1EOC23 (September 2014) and 1EOC24 (March 2016). The two most recent MNS Unit 2 refueling outages were 2EOC23 (September 2015) and 2EOC24 (March 2017). Tables 1 - 4 contain Type C LLRT administrative failures for the requested outages. All leakage rates are reported in standard cubic centimeters per minute (sccm) and include instrument uncertainty. As-found penetration minimum pathway leakage rates (MNPLR) are provided in parentheses to demonstrate penetration integrity.

Table 1: 1EOC23 CIVs Exceeding LLRT Administrative Failure Limits

Penetration	CIV	Observed As-Found Leak Rate (MNPLR)	Observed As-Left Leak Rate	Valve Administrative Failure Limit
1M-309	1NM-423[1]	off scale (17)	1	≥ 110
1M-374	1WL-64A[2]	2,100 (2,100)	1	≥ 590
1M-221	1WL-385[3]	190 (1.44)	190	≥ 147.5

Table 1 Footnotes:

1. 1NM-423 disassembly noted excessive wear on valve disc and body seat. Internal valve parts were replaced and the seat mating surface was verified to have 100% contact.
2. 1WL-64A inspection revealed a limit switch setup issue that prevented full seating load on the diaphragm valve. Limit switches were adjusted to restore seating load.
3. 1WL-385 leakage was accepted by engineering. Repairs were completed the following outage, 1EOC24 as shown in Table 2.

Table 2: 1EOC24 CIVs Exceeding LLRT Administrative Failure Limits

Penetration	CIV	Observed As-Found Leak Rate (MNPLR)	Observed As-Left Leak Rate	Administrative Failure Limit
1M-317	1VI-124[1]	1,300 (7.2)	2.4	≥ 295
1M-221	1WL-385[2]	568 (3)	9.1	≥ 147.5
1M-342	1NV-1002[3]	off scale (3.41)	1	≥ 295
1M-309	1NM-22AC[4]	off scale (2.6)	4	≥ 147.5
1M-327	1KC-340[5]	off scale (2)	47	≥ 1,180
1M-320	1KC-424B[6]	off scale (19)	970	≥ 1,180

Table 2 Footnotes:

1. 1VI-124 disassembly noted an impression on the body seat that required lapping to restore proper sealing surfaces. Lapping was performed until 100% contact was achieved.
2. 1WL-385 disassembly noted a small particle of foreign material on the valve seat. Refer to RAI-1 B response for more details associated with 1WL-385.
3. 1NV-1002 disassembly noted the valve disc soft seat to be deteriorated and in need of replacement. Internal valve parts were replaced.
4. 1NM-22AC disassembly noted a bent valve stem at the disc to stem connection. The valve was repaired with new parts.
5. 1KC-340 disassembly noted residue present on the valve seat. The valve seat was repaired and disc verified to cycle freely. Refer to RAI-1 B response for more details associated with 1KC-340.

6. 1KC-424B torque setting was found out of tolerance. Torque setting adjustments were made to decrease leakage.

Table 3: 2EOC23 CIVs Exceeding LLRT Administrative Failure Limits

Penetration	CIV	Observed As-Found Leak Rate (MNPLR)	Observed As-Left Leak Rate	Administrative Failure Limit
2M-309	2NM-421[1]	588 (1.07)	588	≥ 110.6

Table 3 Footnotes:
1. 2NM-421 leakage was accepted by engineering. 2NM-421 leakage reduced to 85 sccm in 2EOC24.

Table 4: 2EOC24 CIVs Exceeding LLRT Administrative Failure Limits

Penetration	CIV	Observed As-Found Leak Rate (MNPLR)	Observed As-Left Leak Rate	Administrative Failure Limit
2M-221	2WL-385[1]	189 (53.6)	189	147.5

Table 4 Footnotes:
1. 2WL-385 leakage was accepted by engineering.

B. Whether there have been repetitive failures of "Administrative Limits" for any LLRTs associated with the MNS, Unit 1 or Unit 2 Type C tests (i.e. CIVs) since the last ILRTs of 2008. If so, please provide a minimum of three examples that details the corrective actions performed to prevent reoccurrence. The examples presented should be with respect to the worst performing CIVs.

Response to RAI-1 B

A review of Type C leak rate test failures since the last ILRTs of 2008 for both units was conducted. For Unit 1, eight valves were noted as having more than one administrative failure. For Unit 2, one valve was noted as having more than one administrative failure.

Valve 1WL-385 (Penetration 1M-221)

During 1EOC21 (September 2011), Valve 1WL-385, Unit 1 Ventilation Unit Condensate Drain Tank (VUCDT) Inlet Penetration Check Valve, failed to meet its administrative test acceptance criterion of < 147.5 sccm when tested at 15 psig. The observed leakage was 474 sccm. The testing was being conducted in accordance with a normally scheduled Appendix J program surveillance under Option B. 1WL-385 is a one-inch soft seat "Y" pattern Kerotest check valve with spring assist to close. The valve functions as a CIV in the closed direction and to provide thermal overpressure relief of the associated penetration piping in the open direction. 1WL-385 is tested in parallel with Motor Operated Valve (MOV) 1WL-321A (Unit 1 VUCDT Containment Inside Isolation Valve). 1NM-321A has an administrative test acceptance criterion of < 885 sccm at 15 psig. Since the system configuration limits the ability to determine which valve is contributing the leakage or ratio of leakage, the penetration test was considered a failure to meet the individual valve administrative leak rate criterion, specifically that of 1WL-385. As a result of 1WL-385 administrative failure, penetration 1M-221 was removed from Option B

extended interval testing and placed on base interval. Prior to Unit 1 restart, 474 sccm was evaluated and determined to be acceptable when compared to the total allowable bypass leakage limit of 0.07La (9,820 sccm) and the total combined Type B and C allowable limit of 0.6La (84,200 sccm). No further work was required to address 1WL-385 leakage during 1EOC21. Work Order (WO) 02013330 was initiated for 1WL-385 disassembly and inspection during refueling outage 1EOC22.

During 1EOC22 (March 2013), 1WL-385 failed to meet its administrative test acceptance criterion of < 147.5 sccm when tested at 15 psig. The observed leakage was 1,782 sccm. The testing was being conducted prior to WO 02013330 valve disassembly and was considered an as-found failure. Given that 1WL-385 experienced elevated as-left leakage during 1EOC21, the 1EOC22 as-found failure was not unexpected, although test data confirmed an adverse change in performance. 1WL-385 was disassembled and the disc assembly rubber seat was discovered worn and required replacement. The valve seat was lapped to ensure proper contact between mating surfaces and the disc was verified to cycle freely. The valve internal spring and body gaskets were replaced with new parts. Inspection of 1WL-385 revealed the cause of leakage to be a deteriorated valve disc soft seat that prevented a proper seal between the disc and valve body seat. Following 1WL-385 repairs during 1EOC22, as-left testing was performed. 1WL-385 failed to meet its administrative test acceptance criterion of < 147.5 sccm when tested at 15 psig. The observed leakage was 485 sccm. Prior to Unit 1 restart, the leakage was evaluated and determined to be acceptable when compared to the total allowable bypass leakage limit of 0.07La (9,820 sccm) and the total combined Type B and C allowable limit of 0.6La (84,200 sccm). No additional work was pursued to address 1WL-385 leakage during 1EOC22, and penetration 1M-221 remained on base interval testing frequency. WO 02171306 was initiated for 1WL-385 disassembly and inspection during refueling outage 1EOC23.

During 1EOC23, 1WL-385 failed to meet its administrative test acceptance criterion of < 147.5 sccm when tested at 15 psig. The observed leakage was 190 sccm. Based on a reduction in leak rate from 1EOC22, 1WL-385 was not disassembled for inspection in 1EOC23 and WO 02171306 was rescheduled for 1EOC24.

During 1EOC24, 1WL-385 failed to meet its administrative test acceptance criterion of < 147.5 sccm when tested at 15 psig. The observed leakage was 568 sccm. 1WL-385 was disassembled and a small particle of debris was discovered on the seat. The foreign material prevented a proper seal between the disc and valve body seat. The valve was reassembled with all new parts. As-left leak rate testing was conducted with a final value of 9.1 sccm.

The 1WL-385 valve LLRT failures represent an adverse trend because this valve failed multiple times from 2011 to 2016. The two maintenance inspections during 1EOC22 and 1EOC24 yielded two separate failure modes. Prior to 2011, penetration 1M-221 had favorable LLRT results. The discussion below classifies each failure mode witnessed and actions taken (if any) to prevent recurrence.

<u>1WL-385 soft seat degradation 1EOC22:</u>

As a result of the potential for 1WL-385 soft seat degradation, a preventative maintenance (PM) task was created to rebuild the valve; replacing the soft seat, spring, gaskets and to perform lapping to ensure proper contact of mating sealing surfaces. For 1WL-385, maintenance history shows the elastomers were replaced during 1EOC8 (May 1993) and again in 1EOC22 (March

2013). Based on the expected service life, the PM interval was set at 15 refueling outages, or approximately 22.5 years. MNS will continue to monitor valve performance by testing in accordance with the 10 CFR 50 Appendix J program and make adjustments in PM frequency as necessary based on inspection results.

1WL-385 foreign material 1EOC24:

Penetration 1M-221 is used as a part of the Unit 1 upper and lower containment ventilation unit condensate drain system. Condensate for each air-handling unit is transported through six-inch MOV 1WL-321A (inside CIV) and 1WL-322B (outside CIV) to the VUCDT located outside of containment. The penetration piping and associated CIVs are protected from thermal over-pressurization by a one-inch spring check valve, 1WL-385. This portion of the liquid waste system operates under low pressure since the ventilation unit drains are open to containment atmosphere. Since the system inlet is open to the environmental effects of the ventilation units, the system is vulnerable to particulate and other small system generated foreign material, especially in sections of small bore piping with low flows. 1WL-385 is located outside the normal flow path, parallel to 1WL-321A and would not experience forward or reverse flow during normal operation.

Per MNS 4th interval In-service Testing (IST) submittal dated February 27, 2013 (ADAMS ML13078A009), 1WL-385 was re-categorized from ASME OM code category A to category A&C. Per 2004 ASME OM Code 2004 Edition through 2006 Addenda, Table ISTC-3500-1 requires category A&C check valves to undergo leakage testing and bi-directional exercise testing. As a part of MNS 4th IST interval update, LLRT procedure changes were implemented to include forward flow exercise testing of 1WL-385 as a part of performing LLRT on the valve. The procedure sequence directs forward flow testing of the valve before performing LLRT in the reverse (accident) direction. With respect to ISTC-5221 "Check Valves," paragraph (a.1) states that "check valves that have a safety function in both directions shall be exercised by initiating flow and observing that the obturator has traveled to either the full open position or to the position required to perform its intended function(s), and verify that on cessation or reversal of flow, the obturator has traveled to the seat." Per this section of the code, forward flow exercise testing is required before closure verification testing. MNS utilizes LLRT for 1WL-385 to ensure the valve obturator has returned to the seat following forward flow verification testing. Although 1WL-385 leakage values have exceeded the program administrative limit, pressurization to 15 psig with an adequate vent path ensures the valve is not experiencing gross leakage and that the valve obturator returned to the seated position. MNS is aware of the potential for introducing foreign material to the valve seat by performing forward flow verification testing before leak rate testing and concluded this testing sequence to be the most conservative with respect to the known as-left condition of the valve.

Penetration 1M-221 LLRT remains on base interval subject to the rules of 10 CFR 50 Option B. Associated valves will continue to be monitored each refueling outage until the conditions of NEI 94-01, Revision 0, Section 10.2.3 are met.

1KC-340 (Penetration 1M-327)

During 1EOC19 (September 2008), 1KC-340 failed to meet its administrative test acceptance criterion of < 1180 sccm when tested at 15 psig. The observed leakage was 2,006 sccm. The test was being conducted in accordance with 10 CFR 50 Appendix J Option B. As a result of the as-found failure, penetration 1M-327 was removed from extended interval testing and

returned to based interval. 1KC-340 is an eight-inch wafer style check valve with soft seat. A torsion spring provides light seating pressure. To address 1KC-340 as-found leakage, WO 1833494 was generated to inspect the valve. Upon inspection a brownish residue was found on the valve seat and could be hand removed using a light abrasive pad. After re-assembly, a light check was performed and visible light could be seen past the disc O-ring. After additional cleaning, no light was visible past the disc O-ring. It is not clear why the additional cleaning of the valve would have any effect on the O-ring contact with the seating surface. The valve was noted to open easily with light finger pressure. The seat leakage is believed to be caused by the brown residue on the seating surface and secondarily, by insufficient closing force applied by the torsional spring to create continuous and sufficient pressure on the O-ring seal. The brown residue is likely caused by system corrosion inhibitor Sodium Molybdate used in the KC system since 2004. Following inspection, 1KC-340 passed as-left testing with a leak rate of 247 sccm at 15 psig test pressure.

1KC-340 passed as-found testing in both 1EOC20 and 1EOC21 at 1 sccm and 1.39 sccm, respectively. Based on two successful as-found tests, penetration 1M-327 was placed back on extended interval testing per NEI 94-01, Revision 0, Section 10.0. LLRT of penetration 1M-327 was next due 1EOC24.

During 1EOC24 (March 2016), 1KC-340 failed to meet its administrative test acceptance criterion of < 1180 sccm when tested at 15 psig. The observed leakage was off scale and the valve would not pressurize to 15 psig test pressure. WO 20068356 was generated for 1KC-340 inspection during 1EOC24. Minor residue on the valve seating surface was noted by field technicians; however, the valve appeared to be in good condition. Valve installation configuration matched design drawings and the hinge allowed proper movement of the disc assembly. 1KC-340 successfully passed as-left testing at 47 sccm. The likely cause was again determined to be a brownish residue acting as an obstruction preventing a proper seal between the disc O-ring and the valve seat. As a result of this as-found failure, Penetration 1M-327 was removed from extended interval testing and returned to base interval LLRT subject to the rules of 10 CFR 50 Option B. Valves associated with penetration 1M-327 will continue to be monitored each refueling outage until the conditions of NEI 94-01, Revision 0, Section 10.0 are met.

1NF-1464 (Penetration 1M-372)

During 1EOC20 (March 2010), ice condenser refrigeration system valve 1NF-1464 failed to meet its test acceptance criterion of < 73.8 sccm when tested at 15 psig using air. Actual observed leakage was 184.7 sccm. As a result of this failure, penetration 1M-372 was removed from Option B extended interval testing and returned to base interval. 184.7 sccm was evaluated and determined to be insignificant compared to the overall containment leakage summation; therefore, no additional work was performed during 1EOC20. WO 1926097 was generated to disassemble and inspect 1NF-1464 during 1EOC21.

During 1EOC21 (September 2011), 1NF-1464 failed as-found leak rate testing with an observed leakage rate of 157 sccm at 15 psig. The test was being conducted as an as-found test prior to valve disassembly per WO 1926097. The as-found testing was being conducted in a "wet" condition using the normal system glycol-water mixture. Per Technical Specification Surveillance Requirement (TSSR) 3.6.1.1 Note 3, Type C tests on penetrations M372 and M373 may be performed without draining the glycol-water mixture from the seats of their diaphragm valves if meeting a zero indicated leakage rate (not including instrument error). Since the

observed leakage of 157 sccm exceeded TSSR 3.6.1.1 requirement of zero indicated leakage, this was considered the second consecutive 1M-372 penetration failure.

Following as-found testing, 1NF-1464 was removed from the system and as-found bench testing was conducted using air in the accident direction (checked direction). Bench testing included supplying pressurized air in the accident direction and submerging the opposite side of the valve in water. Bubbles were present at 1 psig and continued to worsen as air pressure was increased. For troubleshooting purposes, bench test pressure was increased to 40 psig when the bubbles began to decrease. This additional data suggested that small debris was likely on the valve soft seats and that the additional test pressure aided the valve's ability to seal. Upon valve disassembly, foreign material was found on the valve body seat. Per engineering inspection, the foreign material was described as resembling grinding dust and normal system corrosion flakes from carbon steel piping. The valve was cleaned and soft seats replaced. After valve assembly, another bench test was conducted in the same manner as the as-found bench test. No bubbles were observed while slowly increasing pressure from 1 psig to 20 psig. The valve was also bench tested in the forward flow direction with satisfactory results. 1NF-1464 was reinstalled into the system and post maintenance leak rate testing was performed. The observed as-left leakage for 1NF-1464 was 1 sccm.

Since 1EOC21, Penetration 1M-372 has successfully passed its LLRT three times. 1EOC22, 1EOC23 and 1EOC24 observed as-found leakages were 1, 1.3 and 1 sccm, respectively. The penetration is currently on Option B extended interval testing with the next Type C LLRT due in 1EOC27.

C. Of the total number of 86 Unit 1 Type C penetration tests, how many are not eligible for an extended frequency of 60 months per the requirements of RG 1.163 Regulatory Position C.2 and NEI 94-01, Revision 0?

Response to RAI-1 C

Of 86 Unit 1 Type C penetration tests, 18 are associated with the containment purge (VP) system and kept on 30 month interval per requirements of RG 1.163 Regulatory Position C.2. Seven penetrations are considered service penetrations and are utilized during refueling outages to support maintenance activities. Since these penetrations are manipulated each outage, testing is conducted in accordance with NEI 94-01, Revision 0, Section 10.2.3.3 "Repairs or Adjustments". McGuire also has five Unit 1 penetrations that contain Rotork motor operated diaphragm valves. Vulnerability has been identified with this valve type associated with inadvertently re-setting the closed limit switch by manually operating these valves. Therefore, these five penetrations are programmatically restricted from Option B extended interval testing.

The 30 penetration tests listed above are coded "SR" in MNS work management system, meaning a work order is automatically generated for conducting LLRT each outage. These 30 penetration tests are not eligible for an extended frequency of 60 months per the requirements of RG 1.163 Regulatory Position C.2 and NEI 94-01, Revision 0.

Based on the restrictions above, 56 Type C penetration tests are eligible for Option B testing. Of those 56, there are currently 39 Type C penetration tests on Option B extended interval testing representing 69.6% of the eligible population.

D. Of the total number of 88 Unit 2 Type C penetration tests, how many are not eligible for an extended frequency of 60 months per the requirements of RG 1.163 Regulatory Position C.2 and NEI 94-01, Revision 0?

Response to RAI-1 D

Of 88 Unit 2 Type C penetration tests, 18 are associated with the VP system and kept on 30 month interval per requirements of RG 1.163 Regulatory Position C.2. Eight penetrations are considered service penetrations and are utilized during refueling outages to support maintenance activities. Since these penetrations are manipulated each outage, testing is conducted in accordance with NEI 94-01, Revision 0, Section 10.2.3.3 "Repairs or Adjustments". McGuire also has six Unit 2 penetrations that contain Rotork motor operated diaphragm valves. Vulnerability has been identified with this valve type associated with inadvertently re-setting the closed limit switch by manually operating these valves. Therefore, these six penetrations are programmatically restricted from Option B extended interval testing.

The 32 penetration tests listed above are coded "SR" in MNS work management system, meaning a work order is automatically generated for conducting LLRT each outage. These 32 penetration tests are not eligible for an extended frequency of 60 months per the requirements of RG 1.163 Regulatory Position C.2 and NEI 94-01, Revision 0.

Based on restrictions above, 56 Type C penetration tests are eligible for Option B testing. Of those 56, there are currently 40 Type C penetration tests on Option B extended interval testing representing 71.4% of the eligible population.