

**Duke Energy Corporation
McGuire Nuclear Station
Special Report 99-03
Revision 1**

Abstract

License Conditions C.(4) {Unit 1} and C.(7) {Unit 2} require that McGuire Nuclear Station implement and maintain in effect all provisions of the plant Fire Protection Program. Contrary to these requirements, the station failed to fully implement Selected Licensee Commitment 16.9-5, Fire Rated Assemblies. There were a total of seven deficient penetrations discovered during the inspections of committed fire barriers.

On November 15, 1999, McGuire Nuclear Station staff discovered fire barriers that were not properly implemented. There were six penetrations in walls between safety and non-safety areas identified as deficient. Specifically, two penetrations were discovered with no seal material installed, and four penetrations were found with an improper seal installation. Subsequently, on December 1, 1999, McGuire Nuclear Station staff discovered one additional penetration in a committed fire barrier, which had an improper seal installation. Repair of the affected fire barriers has been completed.

The cause of the penetration seal deficiencies is attributed to inadequate configuration control during original installation, and a fire barrier periodic inspection procedure that provided inadequate guidance. The causes have been addressed by corrective actions. Configuration inspection of all penetrations in committed fire barriers is complete. The defective penetrations were discovered as part of the configuration inspection. Also, the procedure for performing periodic fire barrier inspections will be revised prior to further use to correct inadequacies.

This condition did not impair the ability of the Standby Shutdown System to perform the function of mitigating a 10 CFR 50 Appendix R fire event; therefore, McGuire did not operate outside the design basis of the plant.

Background

McGuire Nuclear Station Facility Operating License (FOL) Conditions C.(4) {Unit 1} and C.(7) {Unit 2} require that the station implement and maintain in effect all provisions of the plant Fire Protection Program as described in the Final Safety Analysis Report. License Conditions G {Unit 1} and F {Unit 2} direct Duke Energy to report any violations of the requirements contained in License Conditions C.(4) {Unit 1} and C.(7) {Unit 2} within 24 hours by telephone and confirm by facsimile no later than the first working day following the violation. A follow up written report is required to be submitted within 14 days.

Updated Final Safety Analysis chapter 16 contains Selected Licensee Commitment (SLC) 16.9-5 regarding the plant Fire Protection Program. This SLC commitment states:

"All fire rated assemblies (walls, floors/ceilings, cable tray enclosures and other fire barriers) separating

- redundant analyzed post fire safe shutdown equipment or,
- control complex (i.e., Control Room, Cable Rooms, and Battery Rooms) from the remainder of the plant or,
- safety from non-safety related areas or,
- containment from non-containment areas,

and all sealing devices (fire doors, fire windows, fire dampers, cable, piping and ventilation duct penetration seals) in fire rated assembly penetrations shall be operable."

This commitment is applicable at all times. The remedial action associated with SLC 16.9-5 states:

"With one or more of the above required fire rated assemblies and/or sealing devices inoperable, within 1 hour either establish a continuous fire watch on at least one side of the affected assembly, or verify the operability of fire detectors on at least one side of the inoperable assembly and establish an hourly fire watch patrol."

Testing requirement (a) associated with SLC 16.9-5 states:

"At least once per 18 months the above required fire rated assemblies and penetrations sealing devices shall be verified operable, by performing a visual inspection of:

- i. The exposed surfaces of each fire rated assembly,
- ii. Each fire window/fire damper/and associated hardware, and
- iii. At least 10% of each type of sealed penetration. If a seal is found degraded to inoperable status, a visual inspection of an additional 10% of each type of sealed penetration shall be made. This inspection process shall continue until a 10% inspection sample with no inoperable seals is found. Samples shall be selected such that each penetration seal will be inspected every 15 years."

Additional commitments, in this area, were provided by Duke Energy Corporation by letter to L. A. Reyes from M. S. Tuckman, dated August 4, 1998. Duke Energy Corporation committed to a three-site plan to update penetration seal design-basis documentation and configuration information. The plan includes inspections to document as-built penetration seal-configuration and development of a comprehensive design-basis document that will include this information and describe the qualification criteria for the penetration (analysis/testing). As part of this three-site plan, McGuire Nuclear Station committed to overall completion by 12/31/2000.

"O.Z. Gedney" plugs are a type of penetration seal referenced in this report. The O.Z. Gedney plugs are used as a three-hour fire separation barrier. The plugs are used to seal empty penetration sleeves. The O.Z. Gedney plug consists of a thick rubber-like material that is compressed between two ceramic-like insulating discs, by two metal end plates. The plug is sealed by tightened long threaded bolts, which extend between the two end plates. The diameter of the inserted portion of the plug is in close tolerance with the inside diameter of the penetration sleeve. One of the two end plates is oversized in diameter, so that it will cover the penetration sleeve and lap onto the flush surface of the fire barrier (e.g., wall, floor).

Description of Occurrence

Unit Status: Unit 1 and Unit 2 were in Mode 1 (Power Operation) at 100% Rated Thermal Power at the time this condition was discovered.

On November 15, 1999, the configuration inspection of penetration seals in the Auxiliary Building to Auxiliary Service Building wall discovered six penetrations with fire barrier deficiencies. Two (i.e., 767-134.1-8 and 767-134.1-9) of the six penetrations had no seal material installed. The remaining four (i.e., 767-135.1-1, 767-135.1-2, 767-135.1-3, and 767-135.1-4) had seals with an installation configuration that was not qualified for service as a three hour fire barrier. The six wall penetration seals were declared inoperable at 13:07 hours on November 15, 1999, and remedial actions per SLC 16.9-5 were implemented. The fire barriers for the six penetrations were corrected and declared operable at 15:33 hours on November 17, 1999.

On December 1, 1999, one additional penetration (i.e., 733-177.0-3) was discovered with a deficient seal configuration. The method of this discovery was also the configuration inspections. This penetration was located in the floor between the Unit 2 electrical penetration room on elevation 733 feet to the Auxiliary Feedwater pump room on elevation 716 feet. The fire barrier configuration was corrected to a three hour qualified configuration within one hour of discovery.

All seven deficient penetrations were discovered during the performance of the penetration configuration inspections per Duke Energy commitment.¹ This includes a commitment to perform configuration inspections of all penetration seals in committed fire barriers. This was completed on December 10, 1999.

The condition of the seven penetrations did not adversely affect the ability of the McGuire Nuclear Station Standby Shutdown Facility (SSF) to be available and capable of performing its intended safety function. In addition, based on mitigating factors discussed elsewhere in this report, equipment in the affected rooms would have also been available to perform their design functions.

¹ Letter, Tuckman to Reyes, dated August 4, 1998

Consequently, the plant was never outside of its design basis or in an unanalyzed condition. No technical specification requirements were violated during this occurrence. Based upon the above, it was determined that this occurrence does not meet the reportability requirements of 10CFR50.72 "Immediate Notification Requirements for Operating Nuclear Power Reactors" or 10CFR50.73 "Licensee Event Report System."

Safety Significance

The failure to implement the committed fire barriers per SLC 16.9-5 represented a degradation of the McGuire Fire Protection Program. However, the safety significance of this condition was mitigated by:

- The relatively small size of the openings in the two penetrations with no seal material and the presence of a seal in the other described penetrations,
- The location of the seven penetrations were in areas containing a low quantity of combustible materials,
- The presence of fire and smoke detection systems in the affected area of the Auxiliary Building,
- The presence of fire and smoke detection systems in both the Unit 2 electrical penetration and Auxiliary Feedwater pump rooms,
- The presence of a water suppression system in the Unit 2 Auxiliary Feedwater pump room,
- The availability of the Standby Shutdown Facility (SSF) with an independent diesel generator and control room for mitigating 10CFR50 Appendix R fire events, and
- Other features of the plant Fire Protection Program such as control of combustible materials, hot work control, and the presence of an on-site Fire Brigade

The two penetrations (i.e., 767-134.1-8 and 767-134.1-9) with no seal material installed were both six inch diameter sleeved openings containing three inch diameter piping. The penetrations were adjacent to each other in a two-foot thick reinforced concrete wall. The piping routed through the penetration is not combustible and therefore would not support fire propagation.

The five penetrations (i.e., 767-135.1-1, 767-135.1-2, 767-135.1-3, 767-135.1-4, and 733-177.0-3) with an improper installation configuration were spare penetrations through a reinforced concrete wall with a minimum two foot thickness. The five penetrations did not contain any components other than the seal. All five penetrations contained three hour rated O.Z. Gedney plugs, but were installed in an unqualified configuration. In all five cases, the installed configuration was deficient because the penetration sleeve extended beyond the flush face of the fire barrier wall or floor. While installation of the O.Z. Gedney

plugs in this configuration would be expected to provide a three-hour fire barrier, this was not a qualified configuration. Therefore, the five penetrations discovered in the above-described configuration are considered degraded.

The six deficient penetrations (i.e., 767-134.1-8 and 767-134.1-9, 767-135.1-1, 767-135.1-2, 767-135.1-3, and 767-135.1-4) discovered on November 15, 1999 were located on elevation 767 feet, within 30 feet of each other. The affected Auxiliary Building area is a single large common area. The area local to the penetrations has spent fuel pool area HVAC equipment and is considered to have a negligible combustibile loading. There were no safety related structures, systems or components located local to the deficient penetrations that would have been prone to damage when considering the spread and effects of a fire. Controlling hot work activities and the amount and location of combustibile materials in the plant provides control of combustibles. Therefore, there is a significantly reduced probability that a fire initiating on the Auxiliary Service Building side of the penetrations would propagate to and through the Auxiliary Building area to safety related structures, systems, and components (SSCs). In addition, the fire and smoke detection systems in the affected areas remained operable for most of the time that the wall seals were deficient. This would have ensured that plant personnel would have detected any fire in the affected areas before significant damage occurred. Once detected, the on-site Fire Brigade would have been available to control the extent of the fire and limit the severity of any damage. The Auxiliary Building common area contains equipment that is safety related and associated with the McGuire Nuclear Station SSF. However, the mitigating factors described above would have ensured that the safety related SSCs and SSF remained capable of performing their intended functions during the above occurrences and available to place the plant in a safe shutdown condition if required.

The one deficient penetration (i.e., 733-177.0-3) discovered on December 1, 1999 was located in the floor of the Unit 2 electrical penetration room. The O.Z. Gedney plug was installed on the topside of the floor penetration sleeve. The seal was not in a qualified configuration as a three-hour fire barrier, because the penetration sleeve extends beyond the flush face of the floor. However, the seal was capable of performing its committed separation function for the following reasons. Postulating a fire initiating in the Auxiliary Feedwater pump room below, the barrier would have an equivalent exposure as that of a seal mounted in the qualified configuration of a flush floor penetration sleeve. In addition, there is a water suppression system located in the Auxiliary Feedwater pump room, which would have minimized the spread of a fire initiating in this room. A postulated fire initiating in the Unit 2 electrical penetration room would not have challenged the ability of the penetration seal to minimize fire spread since there is a low loading of combustibles in the room and the location of the barrier is at the floor. Also, the fire and smoke detection systems in the affected areas remained

operable for most of the time that the floor seal was deficient. This would have ensured that plant personnel would have detected any fire in the affected area before significant damage occurred. Once detected, the on-site Fire Brigade would have been available to control the extent of the fire and limit the severity of any damage. The affected area does contain equipment that is safety related and associated with the McGuire Nuclear Station SSF. However, the mitigating factors described above would have ensured that the safety related SSCs and SSF remained unaffected during the above occurrence and available to place the plant in a safe shutdown condition if required.

Based on the above, there were no significant safety consequences associated with the deficient wall penetration fire barriers.

Causes

The seven deficient penetrations were apparently caused by inadequate configuration control during original installation. An inadequate periodic inspection procedure allowed the deficiencies to remain undetected. The causes have been addressed by corrective actions. Configuration inspection of all penetrations in committed fire barriers is complete. The defective penetrations were discovered as part of the configuration inspection. Also, the procedure for performing periodic fire barrier inspections will be revised prior to further use to correct inadequacies.

The two penetrations (i.e., 767-134.1-8 and 767-134.1-9) that contained no seal material were discovered on November 15, 1999. These discrepancies were discovered during the penetration configuration inspection while attempting to get dimensional readings on the seal with a measuring device. Both sides of these two penetrations were blocked from easy access. On the Auxiliary Building side, both penetrations had pipe restraints at the wall face and were obstructed by insulation. On the Auxiliary Service Building side, both penetrations had piping insulation continuing into the sleeve. A completed periodic inspection procedure from 1988 was discovered which concluded the two penetration seals were "OK from both sides." The fire barrier periodic inspection procedure directs a visual inspection of penetration seals for "apparent changes in appearance or abnormal degradation."² The procedure acceptance criteria provides a description that the "material shall remain in good repair without evidence of separation from the walls of the seal, from components passing through the seal..." Although the procedure directs visual inspection of the sealing surface, guidance was not specific for addressing difficult to access seal surfaces. Therefore, the fire barrier inspection procedure had inadequate written guidance.

The five deficient applications of O.Z. Gedney plugs appear to be a condition that has existed since original implementation of fire barriers. Four of the deficient penetration seals was discovered

² Fire Barrier Inspection Procedure, PT/0/A/4250/04

on November 15, 1999, and the fifth discovered on December 1, 1999. These discrepancies were discovered during the penetration configuration inspection. The dimensional offset between the O.Z. Gedney plug end plate and the flush face of the fire barrier wall and floor was found unacceptable.

On January 12, 1989, the acceptance criteria that "O.Z. Gedney plugs are flush mounted" was added to the fire barrier periodic inspection procedure.² However, this procedure revision apparently did not include adequate detail regarding the acceptance criteria. The outside plate of the seal is required to be flush mounted to the fire barrier (e.g., wall, floor). The procedure can be misinterpreted, as meaning that the outside plate of the seal is acceptable when flush mounted to the penetration sleeve. Therefore, the fire barrier inspection procedure had inadequate written guidance.

Corrective Actions

Immediate:

1. The six deficient penetration seals discovered on November 15, 1999 were declared inoperable and the remedial action of SLC 16.9-5 was implemented.
2. The one deficient penetration seal discovered on December 1, 1999 was corrected within one hour of discovery.

Subsequent:

1. The six deficient penetration seals discovered on November 15, 1999 were corrected on November 17, 1999.
2. Configuration inspections of all penetrations in committed fire barriers were completed on December 10, 1999.

Planned (The below planned actions represent NRC commitments):

1. Penetration seal design-basis documentation and configuration information will be updated per previous commitment.
2. The fire barrier periodic inspection procedure will be revised prior to further use.² Additional guidance will be added to (a) ensure adequate penetration seal visual inspections in difficult to access conditions, and (b) provide a detailed criteria for acceptable configuration(s) of O.Z. Gedney plugs.

² Fire Barrier Inspection Procedure, PT/0/A/4250/04