



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-18-038

March 9, 2018

10 CFR 50.4

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

Browns Ferry Nuclear Plant, Units 1, 2, and 3  
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68  
NRC Docket Nos. 50-259, 50-260, and 50-296

Subject: Request to Extend Enforcement Discretion Provided in Enforcement Guidance Memorandum 15-002 for Tornado-Generated Missile Protection Non-Conformances Identified in Response to Regulatory Issue Summary 2015-06, "Tornado Missile Protection"

- References:
1. NRC Regulatory Issue Summary 2015-06, Tornado Missile Protection, dated June 10, 2015 (ML15020A419)
  2. NRC memorandum, Enforcement Guidance Memorandum 15-002, Enforcement Discretion for Tornado-Generated Missile Protection Noncompliance, dated June 10, 2015 (ML15111A269)
  3. NRC memorandum, Enforcement Guidance Memorandum 15-002, Revision 1: Enforcement Discretion for Tornado-Generated Missile Protection Non-Compliance, dated February 7, 2017 (ML16355A286)
  4. NRC Interim Staff Guidance DSS-ISG-2016-01, Clarification of Licensee Actions in Receipt of Enforcement Discretion Per Enforcement Guidance Memorandum EGM 15-002, Enforcement Discretion for Tornado-Generated Missile Protection Noncompliance, Revision 1, dated November 2017 (ML17128A344)

In Reference 1, the NRC issued Regulatory Issue Summary (RIS) 2015-06, Tornado Missile Protection, in part to remind licensees of the need to conform with a plant's current, site-specific licensing basis for tornado-generated missile protection.

In Reference 2, the NRC provided Enforcement Guidance Memorandum (EGM) 15-002, which contained guidance to exercise enforcement discretion when an operating power reactor licensee does not comply with a plant's current site-specific licensing basis for tornado-generated missile protection. The NRC would exercise this enforcement discretion only when a licensee implements initial compensatory measures to provide additional protection, followed by more comprehensive, long-term compensatory measures implemented within 60 days of issue discovery. The enforcement discretion would expire three years after issuance of RIS 2015-06, dated June 10, 2015, for plants of a higher tornado missile risk (Group A Plants) and five years after RIS issuance for plants of a lower tornado missile risk (Group B Plants). The EGM categorized Browns Ferry Nuclear Plant (BFN) as a Group A plant (Reference 2).

In Reference 3, the NRC issued Revision 1 of EGM 15-002 to state that licensees may request an extension to their enforcement discretion expiration date if proper justification is provided. This extension would be granted on a case-by-case basis and should remain in place until compliance is achieved.

In accordance with the revised EGM 15-002, Revision 1, Tennessee Valley Authority (TVA) hereby requests that the NRC extend the expiration date for the period of enforcement discretion for BFN from June 10, 2018, to June 10, 2020.

TVA has completed a comprehensive assessment for BFN and has identified non-conforming conditions (NCCs) regarding tornado missile protection requirements that affect the operability of structures, systems, or components addressed in the BFN Technical Specifications. A summary of the assessment methodology, scope, and results is provided in the enclosure.

The NCCs have been documented in the TVA corrective action program in accordance with TVA procedures, and all required notifications have been completed, as discussed in the enclosure.

Consistent with the guidance provided in NRC Interim Staff Guidance DSS-ISG-2016-01 (Reference 4), initial and comprehensive compensatory measures have been implemented for the BFN NCCs, as described in the enclosure.

The compensatory measures currently in place consist of installed tornado missile deterrent structures that do not rely on operator actions. The compensatory measures will remain in-place until the NCCs are resolved. Since no compensatory responsive actions will be required, a collective review of the feasibility of comprehensive compensatory measures is not warranted. An assessment of FLEX strategies in the area of tornado missile deterrent structures concluded the FLEX strategies are not affected by the installation of those structures.

The requested enforcement discretion due date extension would provide TVA sufficient time to address the NCCs and achieve compliance. TVA has concluded that there is no undue risk associated with the requested extension.

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TVA requests NRC approval of this enforcement discretion date extension by June 9, 2018.

There are no new regulatory commitments contained in this letter. If you have any question regarding this submittal, please contact Mike Oliver at (256) 729-7874.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 9th day of March 2018.

Respectfully,

A handwritten signature in blue ink, appearing to read "J. W. Shea", followed by a horizontal line and the word "for".

J. W. Shea  
Vice President, Nuclear Regulatory Affairs & Support Services

Enclosure: Justification for Request to Extend the Expiration Date for Enforcement  
Discretion Regarding Tornado Missile Protection Requirements for the Browns  
Ferry Nuclear Plant

cc (Enclosure):

NRC Regional Administrator - Region II  
NRC Project Manager - Browns Ferry Nuclear Plant  
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant

## **ENCLOSURE**

# **JUSTIFICATION FOR REQUEST TO EXTEND THE EXPIRATION DATE FOR ENFORCEMENT DISCRETION REGARDING TORNADO MISSILE PROTECTION REQUIREMENTS FOR THE BROWNS FERRY NUCLEAR PLANT**

## **1. Introduction**

This enclosure provides the justification for the Tennessee Valley Authority (TVA) request to extend the expiration date for enforcement discretion regarding tornado missile protection requirements for the Browns Ferry Nuclear Plant (BFN).

In Reference 1, the NRC issued Regulatory Issue Summary (RIS) 2015-06, Tornado Missile Protection, in part to remind licensees of the need to conform with a plant's current, site-specific licensing basis for tornado-generated missile protection.

In Reference 2, the NRC provided in Enforcement Guidance Memorandum (EGM) 15-002 guidance to exercise enforcement discretion when a licensee does not comply with a plant's current site-specific licensing basis for tornado-generated missile protection. EGM 15-002 identified BFN as a higher tornado missile risk site (Group A), resulting in an enforcement discretion expiration date of June 10, 2018.

TVA completed a comprehensive tornado missile protection (TMP) assessment for BFN and has identified non-conforming conditions (NCCs) regarding tornado missile protection requirements. Compensatory measures were implemented to address the NCCs, in accordance with regulatory guidance.

TVA is requesting an extension to the enforcement discretion expiration date to allow sufficient time to address the NCCs.

TVA plans to submit a license amendment request (LAR) to request approval for the use of the Tornado Missile Risk Evaluator (TMRE) methodology for evaluating the identified NCCs. The TMRE is under development by the industry and currently under review by the NRC for application at three nuclear plants. It is expected that the TMRE will conclude that the present NCCs are acceptable configurations and that the compensatory measures currently in place can be eliminated.

This request to extend enforcement discretion was prepared in accordance with guidance in Appendix B of Revision 1 of Interim Staff Guidance DSS-ISG-2016-01 (Reference 3).

## **2. RIS 2015-06 Assessment Methodology**

The methodology followed by TVA for the BFN assessment in response to RIS 2015-06 includes the following three objectives:

- (1) document the BFN current licensing basis (CLB) for tornados and tornado missile protection,
- (2) evaluate the site's conformance with the tornado missile protection CLB through a design review and plant walkdowns, and document any NCCs, and
- (3) resolve the NCCs within the TVA corrective action program.

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#### 3. Summary of CLB for Tornado and Tornado Missile Protection Design

The BFN CLB is documented in the BFN Updated Final Safety Analysis Report (UFSAR) and was established prior to the finalization of the General Design Criteria (GDC) and formal regulatory endorsed guidance such as Regulatory Guide 1.117, Tornado Design Classification. The licensing basis was established and documented through meetings and correspondence with the Atomic Energy Commission (AEC).

During the construction permit licensing process, each of the three units of this plant was evaluated against the then-current draft of the AEC Proposed GDC. Units 1 and 2 were evaluated against the 27 Criteria, while Unit 3 was evaluated against the 70 Criteria. Although neither version of these proposed criteria had been adopted as regulatory requirements, the design, material procurement, and fabrication of each reactor unit was responsive to the respective applicable criteria for a construction permit. Although the later criteria (AEC-70) did not wholly complement the earlier (AEC-27), the design bases of each unit of this plant were reevaluated (at the time of initial FSAR preparation) against the draft of the 70 criteria current at the time of operating license application.

Based on the understanding of the intent of the proposed criteria current at the time of operating license application, it was concluded that each unit of this plant conforms with the intent of the AEC GDC for Nuclear Power Plant Construction Permits.

The BFN CLB for tornados and tornado missiles pertinent to the RIS 2015-06 assessment are described in Amendment 27 of the BFN UFSAR, Sections 1.6, 1.7, 2.3, 5.2, 5.3, 9.3 10.9, 10.23, 11.6, 12.1, and 12.2, Appendix C, Appendix F, and Appendix I.

#### CLB for Tornado Protection Design

As discussed in UFSAR Section 12.2, the design basis tornado has a wind velocity of 300 miles per hour (mph) combined with a differential pressure of 3 pounds per square inch (psi) at a rate of 0.6 psi per second. BFN Class 1 structures were designed in accordance with the wind loading indicated in the FSAR for the given structure. The 600 foot gaseous radwaste system stack is designed for controlled failure if it should be damaged by a violent tornado. The upper portion is designed to fail first to limit the reach of the stack if it should be blown down. It would not strike the Diesel Generator or Reactor Building. The wind loads for the Onsite Storage Facility (also known as the Low Level Radioactive Waste Storage Facility) is 290 mph rotational at 150 feet and 70 mph translational.

#### CLB for Tornado Missile Protection Design

Per UFSAR Section 12.2, the walls of the Reactor Building and other Class 1 structures were designed for the following CLB tornado missiles travelling 300 mph at impact (except where otherwise noted in the UFSAR):

- 2 inch x 4 inch x 12 foot board weighing 40 pounds/cubic feet end on
- crosstie, 7 inches x 9 inches x 8-1/2 feet weighing 50 pounds/ cubic feet end on
- compact car weighing 1800 pounds with an impact area of 20 square feet
- pieces of concrete 6-1/2 inches x 12 inches x 2 inches thick end on, as a result of the spalling effect from the concrete chimney postulated failure
- aircraft warning beacon from chimney

Diesel Generator Building walls less than 18 inches thick above elevation 583.5' are noted as an exception in UFSAR section 12.2.8.1.

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The Diesel Generator Building doors were designed for the following CLB tornado missiles travelling 100 mph at impact:

- 100 pounds with circular impact area of 4-inch diameter
- 10 foot length of 2-inch standard pipe impacting endwise
- 10 foot length of 1/2-inch standard pipe impacting endwise

The spent fuel pool credits GE APED-5696 for tornado missile impact analysis which contains the following missile spectrum for the spent fuel pool:

- 14 inch diameter pine pole 5 feet long
- 14 inch diameter pine pole 10 feet long
- 14 inch diameter pine pole 15 feet long
- 3 inch diameter steel rod 5 feet long
- 3 inch diameter steel rod 8 feet long
- 9 inch x 9 inch x 4 foot concrete block
- 9 inch x 9 inch x 8 foot concrete block
- 3 foot diameter concrete sphere
- small car

The spent fuel pool missile spectrum, as discussed in GE APED-5696, contains the only vertical missiles discussed in the BFN CLB.

The Residual Heat Removal Service Water (RHRSW) pumps are deck-mounted on the intake structure in an accessible location so that maintenance may be performed under emergency conditions. The pumps are designed to operate in severe wind and weather such as during tornadoes. The RHRSW pumps are widely dispersed and physically separated into groups of three on the intake deck to prevent common damage from one or more missiles.

#### **4. RIS 2015-06 Assessment Scope and Results**

The assessment completed reviews and walk downs for BFN Class 1 structures, which were designed to withstand the tornado missiles specified in the CLB.

The NCCs, and affected systems, identified by TVA during the design reviews and walk downs were documented in the following two condition reports within the corrective action program:

- a. Condition Report (CR) 1288222: Emergency Diesel Generator (EDG) Fuel Oil Vent Lines - Tornado Missile Strike

During walk downs, portions of the Fuel Oil System located on the Diesel Generator Building roof were found to be susceptible to tornado-generated missile impacts. The fuel oil vent lines for the D, 3A, 3B, 3C, and 3D EDGs are exposed to the effects of a tornado generated missile. Damage to the exposed and unprotected portion of the D, 3A, 3B, 3C, and 3D EDG fuel oil vent lines by a tornado missile strike has the potential to crimp the vent line and render the vacuum prevention feature ineffective. The development of a vacuum in the fuel oil system would limit the ability of the fuel oil pumps to transfer fuel oil from the 7-day tanks to the day tank and could restrict or eliminate the flow of fuel oil to the affected EDG. The affected EDG would then not be able to function due to lack of fuel oil.

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b. CR 1306987: BFN-3-DOOR-260-0484 - Tornado Missile Vulnerability

During walk downs, design basis and licensing basis reviews it was determined that BFN-3-DOOR-260-0484 (Door 484) is a standard commercial grade double leaf door that is not rated to withstand the impact of a tornado generated missile. Door 484 is an exterior door located on the east end of the 1C hallway of the Unit 3 Control Bay. There are numerous safety related electrical conduits, safety related Control Bay Chiller piping and other safety related and non safety related mechanical and electrical features located in the 1C Hallway. Review of Door 484 documentation identified that the door had been accepted as part of the BFN IPEEE and found to have been satisfactorily considered for the GSI 156 Systematic Evaluation Program. However, this acceptance and justification were never documented in an NRC Safety Evaluation Report, a BFN License Amendment Request, or the BFN UFSAR. Therefore, the condition was determined to be non-conforming when Door 484 could not be shown to meet the licensing basis described within the CLB.

#### 5. Initial Actions

The following initial actions were taken in response to the identified NCCs, in accordance with EGM 15-002 and Interim Staff Guidance DSS-ISG-2016-01:

- a. The EDG Fuel Oil Vent Lines NCCs were reported by TVA as an eight-hour notification on April 25, 2017 (Event Number 52707) under 10 CFR 50.72(b)(3)(ii)(B), "The nuclear power plant being in an unanalyzed condition that significantly degrades plant safety." The NRC resident inspector was also notified.
- b. Operability determinations were completed and documented in the corrective action program. The non-conforming equipment associated with the EDG Fuel Oil Vent Lines was initially declared inoperable. Guidance in Revision 1 of EGM 15-002 (Reference 4) was used to declare the equipment operable but non-conforming and to implement enforcement discretion.
- c. Initial compensatory measures were completed per EGM 15-002 and Interim Staff Guidance DSS-ISG-2016-01 for the EDG Fuel Oil Vent Lines. An operator workaround was implemented to provide an alternate fuel tank vent path as soon as possible following a tornado event. Subsequently, a revision to procedure 0-AOI-100-7, Severe Weather Abnormal Operating Instruction, added steps to include removing a sampling plug on each of the EDG 7-day fuel oil tanks to provide an alternate ventilation path based on damage assessment following a severe weather event.
- d. The Door 484 NCC was entered into the corrective action program (CR 1306987), the NRC resident was notified, and a prompt determination of operability was completed. Temporary missile deterrent structures were installed as compensatory measures and will remain in place until the non-compliance is dispositioned in accordance with a method acceptable to the NRC such that discretion is no longer needed. In accordance with guidance contained in EGM 15-002 (Reference 4), notification in accordance with 10 CFR 50.72 was not required since the notification of Event Number 52707 had previously been made. Licensee Event Reports (LERs) in accordance with 10 CFR 50.73 were made as discussed below.

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- e. LER 2017-003-00 (Reference 5) was submitted in accordance with 10 CFR 50.73 to document an unanalyzed condition because Technical Specification-required equipment did not meet CLB requirements for protection against tornado missiles. Specifically, the EDG Fuel Oil Vent Lines were exposed to tornado missiles and could cause failure of the associated EDGs.
- f. LER 2017-003-01 (Reference 6) was submitted in accordance with 10 CFR 50.73 to address an additional unanalyzed condition where Technical Specification-required equipment did not meet CLB requirements for protection against tornado missiles. This LER revision documented that Door 484, an exterior door located on the east end of the 1C Hallway is a standard commercial grade double leaf door that is not rated to withstand the impact of a tornado generated missile. As a result, numerous safety related electrical conduits, safety related Control Bay Chiller piping, and other safety related and non safety related mechanical and electrical features located in the 1C Hallway could be exposed to the effects of tornado missiles.

#### **6. Long-Term Compensatory Measures and Actions Implemented and/or Planned**

Long-term compensatory measures for the identified NCCs have been implemented as indicated below.

##### **a. EDG Fuel Oil Storage Tank Vents**

Procedure 0-AOI-100-7 was revised further to add steps to remove sampling plugs from the fuel oil tanks and replace the removed plugs with FME covers to provide adequate venting for the D, 3A, 3B, 3C, and 3D EDG 7-day fuel oil tanks when a tornado warning is in effect for BFN.

Subsequently, these compensatory actions were replaced with passive compensatory actions to reduce the vulnerability of the fuel oil system and preserve operation resources during a tornado event. TVA performed empirical testing to determine the susceptibility of the vent pipes to deform in a manner that prevented venting due to a tornado generated missile. The test results demonstrated that the vent pipes would deform in a manner that still provides the venting function. The areas of the vent piping that could not be demonstrated to function based on testing limitations were addressed by the installation of the tornado missile deterrent barriers. Tornado missile deterrent structures constructed of concrete anchor bolts, Tubelock scaffold members and/or steel plates were placed around the vulnerable portions of the vent pipes for the D, 3A, 3B, 3C, and 3D EDG fuel oil 7-day tanks. The 0-AOI-100-7 procedural steps were removed based on the empirical testing performed on the 3-inch diameter schedule 40 pipe specimens and the installation of the tornado missile deterrent structures.

##### **b. Door 484**

TVA installed temporary missile deterrent structures at the east access point of 1C Hallway in the Unit 3 Control Bay as compensatory measures for the Door 484 vulnerability. The tornado missile deterrent structures were constructed to form multiple lines of defense, together with the existing 1C Hallway Security Barrier and the Unit 3 Reactor Protection System Motor-Generator (MG) Set room door, to deter a tornado generated missile from damaging any safety-related equipment located along 1C Hallway, in the MG Set Room, and in the adjacent Mechanical Equipment Room.



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These structures form a redundant labyrinth barrier to preclude the impact of a tornado generated missile into the 1C Hallway and damage adjacent safety related electrical cables.

#### **7. Assessment of Long-Term Compensatory Measures Coincident with Other Operator Actions**

The long term compensatory measures currently in place consist of tornado missile deterrent structures and do not rely on operator actions. The installed temporary missile deterrent structures do not block equipment access, impede ingress/egress, or adversely affect the station's response to abnormal, emergency, or FLEX events. Therefore, the long-term compensatory measures will not impede, distract, or interfere with operator actions required during a tornado event. The compensatory measures will remain in place until the NCCs are resolved.

#### **8. Plans for Permanent Resolution**

TVA plans to submit a risk-informed LAR for the use of the TMRE methodology, currently in development by the industry. The TMRE methodology would be used to evaluate the identified NCCs.

In the event that an approved TMRE methodology is not available for use, TVA would consider an alternative methodology to evaluate and accept the identified NCCs, or the implementation of plant modifications to eliminate the non-conformances, or a combination of the two.

#### **9. Basis and Reason for Extension Request**

In EGM 15-002 (Reference 2), the NRC provided guidance to exercise enforcement discretion when an operating power reactor licensee does not comply with a plant's current site-specific licensing basis for tornado-generated missile protection. The NRC would exercise this enforcement discretion only when a licensee implements initial compensatory measures to provide additional protection, followed by more comprehensive, long-term compensatory measures implemented within 60 days of issue discovery. The enforcement discretion would expire three years after issuance of RIS 2015-06, dated June 10, 2015, for plants of a higher tornado missile risk (Group A Plants), and five years after RIS issuance for plants of a lower tornado missile risk (Group B Plants). EGM 15-002 identified BFN as a plant of a higher tornado missile risk; therefore, its enforcement discretion would expire on June 10, 2018.

In Reference 4, the NRC issued Revision 1 of EGM 15-002, which stated that licensees may request an extension to their enforcement discretion expiration date if proper justification is provided. This extension would be granted on a case-by-case basis.

In accordance with the revised EGM 15-002, TVA is requesting an extension of the expiration date for enforcement discretion at BFN from June 10, 2018, to June 10, 2020.

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There is no undue risk associated with this requested extension of the enforcement discretion due date. The identified NCCs involve limited exposure of equipment to tornado missiles, and the equipment is protected by temporary missile deterrent structures. In addition, tornado missile scenarios generally do not represent a significant safety concern because their risk is bounded by the initiating event frequency.

A comprehensive assessment of the site regarding TMP against the CLB has been completed, revealing the NCCs discussed above. The compensatory actions implemented for the NCCs are consistent with the guidance in EGM 15-002 and Interim Staff Guidance DSS-ISG-2016-01, and provide assurance that the consequences of the identified NCCs are minimized until permanently resolved. These compensatory measures would remain in place throughout the period of extended enforcement discretion and until the NCCs are resolved.

The TMRE methodology is being developed by the industry to evaluate tornado missile protection NCCs. LARs for implementation of the TMRE methodology at three pilot sites have been submitted, with NRC approval of the pilot site LARs not expected until summer or fall of 2018. Once the pilot site LARs and the industry TMRE methodology have been approved, other licensees with identified tornado missile protection NCCs may submit LARs, based on the approved pilot LARs, for implementation of the TMRE methodology to address the NCCs at their sites.

To address the TMP NCCs identified at BFN, TVA plans to perform a TMRE analysis for the NCCs, and prepare and submit a LAR for use of the approved TMRE methodology to evaluate the NCCs. The BFN LAR would be submitted after the LARs for the pilot sites and the industry guidance for the TMRE methodology have been approved. If the TMRE methodology did not resolve all of the NCCs at BFN, then the use of an alternative methodology and/or the installation of plant modifications would be pursued. This cannot be completed by the current enforcement discretion expiration date of June 10, 2018. Since NRC approvals of the pilot site LARs are not expected until sometime after June 10, 2018, TVA actions to resolve the NCCs at BFN cannot be reasonably implemented in an orderly and cost-effective manner in the time remaining under the existing enforcement discretion.

The requested enforcement discretion expiration date of June 10, 2020, would allow TVA sufficient time to resolve the TMP NCCs and restore the site to compliance. TVA expects that the TMRE analysis will resolve all of the identified NCCs at BFN. The requested enforcement discretion expiration date of June 10, 2020, would provide sufficient time for TVA to perform a TMRE analysis for the NCCs, and to submit a LAR for implementation of the TMRE methodology at BFN. TVA has begun performing walkdowns in support of the TMRE analysis, and plans to submit the TMRE LAR in 2019, pending approval of the pilot plant TMRE LARs and the industry TMRE methodology guidance. If, while performing the TMRE analysis, TVA unexpectedly determines that not all of the NCCs will be resolved by the TMRE analysis, TVA would have sufficient time before the requested enforcement discretion expiration date of June 10, 2020, to pursue the use of an alternate methodology and/or install plant modifications, as previously discussed, to resolve the NCCs.

If conditions arise such that achieving TMP compliance at BFN within the requested extended period of enforcement discretion is not possible, the NRC would be promptly notified.

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#### **References**

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2. NRC memorandum, Enforcement Guidance Memorandum 15-002, Enforcement Discretion for Tornado Generated Missile Protection Non-Compliance, dated June 10, 2015 (ML15111A269)
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4. NRC memorandum, Enforcement Guidance Memorandum 15-002, Revision 1: Enforcement Discretion for Tornado-Generated Missile Protection Noncompliance, dated February 7, 2017 (ADAMS Accession Number ML16355A286)
5. License Event Report 50-259/2017-003-00, Unanalyzed Condition for Tornado Missiles Striking the Emergency Diesel Generator Fuel Oil Vent Lines, dated June 26, 2017 (ML17177A576)
6. License Event Report 50-259/2017-003-01, Unanalyzed Conditions Regarding Tornado Missile Protection, dated August 11, 2017 (ML17223A726)