June 10, 2015

EGM 15-002

MEMORANDUM TO: Daniel H. Dorman, Regional Administrator, Region I
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FROM: Patricia K. Holahan, Director ***/RA/***
Office of Enforcement

SUBJECT: ENFORCEMENT GUIDANCE MEMORANDUM 15-002, ENFORCEMENT DISCRETION FOR TORNADO-GENERATED MISSILE PROTECTION NONCOMPLIANCE

PURPOSE:

This enforcement guidance memorandum (EGM) provides guidance to exercise enforcement discretion when an operating power reactor licensee (licensee) does not comply with a plant's current site-specific licensing basis for tornado-generated missile[1] protection. Specifically, discretion would apply to the applicable technical specification (TS) limiting condition(s) for operation (LCO) which would require a reactor shutdown or mode change, if a licensee could not meet TS LCO required action(s) within the TS completion time.

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[1] Per Regulatory Guide 1.76, tornado-generated missiles are objects moving under the action of the aerodynamic forces induced by the tornado wind. Wind velocities in excess of 75 mph are capable of generating missiles from objects lying within the path of the tornado wind and from the debris of nearby damaged structures.

BACKGROUND:

Nuclear power plants are designed to ensure that structures, systems, and components (SSCs) needed to maintain the facility in a safe condition will be available to mitigate the effects of natural phenomena, including tornadoes and tornado-generated missiles. The U.S. Nuclear Regulatory Commission (NRC) regulations requiring protection from tornado missiles are Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, Criterion 2, "Design Bases for Protection Against Natural Phenomena," and Criterion 4, "Environmental and Dynamic Effects Design Bases." Methods acceptable to the NRC to comply with the aforementioned regulations are described in Regulatory Guides 1.76[2] and 1.117[3], and NUREG-0800[4] Section 3.5.1.4, "Missiles Generated by Natural Phenomena," Revision 2, July 1981.

Typically, licensees include a description in their facility's Final Safety Analysis Report or Updated Final Safety Analysis Report of how compliance with regulatory requirements is achieved. Most facilities use deterministic methods when evaluating protection from tornado-generated missiles and as a basis for complying with these regulations. However, NUREG-0800 Section 3.5.1.4 includes acceptance criteria permitting the use of an alternative approach if it can be demonstrated that the probability of damage to unprotected essential safety-related features is sufficiently small. Some licensees utilized this alternative approach by incorporating the NRC-approved, Electric Power Research Institute-developed TORMIS methodology,[5] or other NRC-approved probabilistic risk assessment methodology via the license amendment process.

Over the past several years, licensees and the NRC have identified facilities that have not conformed to their licensing basis for tornado-generated missile protection and are therefore not in compliance with applicable regulations. These non-compliances have been documented in NRC inspection reports and have resulted in license amendment requests (LARs). Some of the non-complying SSCs included TS-required equipment (e.g., emergency diesel generator exhaust header/ductwork, pipe risers, fan motors, etc.), which required an operability determination. In cases where the licensee concluded that the TS-required SSC was inoperable, the licensee was required to complete any actions specified by the TS until the LCO was met.

Depending on the details of the site-specific issue, licensees may or may not be able to restore the affected equipment to an operable status within the completion time allowed by TS. Restoring compliance depends on the number of non-complying SSCs and the extent to which their function is affected. Failure to meet the required TS LCO(s) or restore compliance with the tornado-generated missile protection licensing basis may require a reactor shutdown or mode change. Resumption of reactor operation would not be permitted until the TS LCO is met.

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[2] U.S. Atomic Energy Commission Regulatory Guide 1.76, "Design Basis Tornado for Nuclear Power Plants," Revision 1, March 2007, ADAMS Accession No. ML070360253.
[3] U.S. Nuclear Regulatory Commission Regulatory Guide 1.117, "Tornado Design Classification," Revision 1, April 1978, ADAMS Accession No. ML003739346.
[4] NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" Revision 3, March 2007, ADAMS Accession No. ML070380174.
[5] NRC Memorandum. L.S. Rubenstein to F.L. Miraglia, "Safety Evaluation Report – Electric Power Research Institute (EPRI) Topical Reports Concerning Tornado Missile Probabilistic Risk Assessment Methodology," October 26, 1983, ADAMS Accession No. ML080870291.

To ensure the widest dissemination of this issue, the staff issued regulatory issue summary (RIS) 2015-06, “Tornado Missile Protection,” (ADAMS Accession No. ML15020A419) to (1) remind licensees of the need to conform their facility to the current, site-specific licensing basis for tornado-generated missile protection, (2) provide examples of failures to conform with a plant’s tornado-generated missile licensing basis, and (3) remind licensees that their systematic evaluation program and individual plant examination of external events results do not constitute regulatory requirements, and are not part of the plant-specific tornado-generated missile licensing basis, unless the NRC or licensee took action to specifically amend the licensing basis.

Upon reviewing the above-noted RIS, some licensees may discover that a TS-controlled SSC at their facility does not comply with the plant’s current licensing basis (CLB) and that an operability determination (or functional assessment) will be necessary. If the licensee’s operability determination concludes that the TS SSC is non-complying but operable, or the necessary and related support function is non-complying but functional, it is appropriate for the licensee to address the non-complying condition through their corrective action program.

If the licensee concludes that the TS-required SSC is inoperable, the licensee must follow any required action(s) of the applicable TS LCO(s). Licensees may use compensatory measures to restore an inoperable SSC to an operable but degraded or non-complying status. If the licensee successfully implements compensatory measures to restore the inoperable SSC to an operable but non-complying status, then the licensee can use their corrective action program to restore the SSC’s compliance with the CLB. However, if the licensee cannot perform the LCO required action(s) or restore compliance within the completion time allowed by the LCO, the licensee would be required to shut down the reactor or place the reactor in a mode or other specified condition that is not applicable to the LCO.

Basis for Granting Enforcement Discretion

In general, tornado missile scenarios that may lead to core damage are very low probability events, because safety-related SSCs are typically designed to withstand the effects of tornados. For a tornado missile induced scenario to occur, a tornado would have to hit the site and result in the generation of missiles that would hit and fail vulnerable, unprotected safety related equipment and/or unprotected safety related subcomponents in a manner that is non-repairable and non-recoverable. For example, the emergency diesel generator exhaust stack would have to be crimped in a manner that would prevent the exhaust of combustion products; if it were sheared off completely, the EDG would likely remain operable. In addition, because plants are designed with redundancy and diversity, the tornado missiles would have to affect multiple trains of safety systems and/or means of achieving safe shutdown.

The Office of Nuclear Reactor Regulation (NRR), Division of Risk Assessment (DRA) has completed a generic risk analysis of potential tornado missile protection non-compliances to examine the risk significance of these scenarios. This assessment (ADAMS Accession No. ML14114A556) documents a conservative, bounding-type analysis of the risk significance for plant facilities that may not be in compliance with their tornado missile protection licensing basis. It used tornado hazard curves provided in NUREG/CR-4461, “Tornado Climatology of the Contiguous United States,” (ADAMS Accession No. ML 070810400) and Regulatory Guide 1.76, “Design-Basis Tornado and Tornado Missile for Nuclear Power Plants,” (ADAMS Accession No. ML100541776). The generic nature of this analysis did not afford the staff the capability to

assess plant-specific tornado missile protections which likely exist at many reactors in accordance with their CLB, and that would result in lower risk determinations. It also did not consider the plant-specific nature of the non-compliances or the redundancies of SSCs. The generic analysis assumed that core damage would occur if a tornado hit a plant located in the most active tornado region in the country and that it caused a tornado-generated missile to fail all emergency core cooling equipment at the plant with no ability to recover. Given this conservative assumption, the core-damage frequency (CDF) was calculated to be 4E-5 per year, which is more than an order of magnitude below the 1E-3 per year threshold provided in the NRR Office Instruction LIC-504, "Integrated Risk-Informed Decision-Making Process for Emergent Issues." Per LIC-504, 1E-03 per year provides a guideline that can be used to determine whether additional regulatory actions should be considered to place a plant in a safe condition. Consequently, the staff's study established that the CDF associated with tornado missile related non-compliances are well below CDFs requiring immediate regulatory action.

The estimated bounding CDF does not account for a number of conservatisms since the staff could not factor in plant-specific characteristics that could lower the CDF estimate, potentially by as much as one or more orders of magnitude. For example, whereas the study assumed the failure of redundant systems due to tornado generated missiles, actual spatial configurations of redundant systems at a plant could lower the probability of complete system failures as a result of tornado generated missiles. Additionally, some tornado generated missiles may not cause system failures at all or may cause failures that are repairable or recoverable within a reasonable time frame.

It should also be noted that some licensees have sought and received approval of license amendments to accept tornado missile non-conformances based on computer simulations that showed very small annual probability of a tornado missile strike on any non-conforming SSCs (i.e., less than 1E-06 per year). While one must be careful extrapolating from such cases to the entire population of nuclear power plants with non-conforming SSCs, these studies at least demonstrate the conservatisms used in the staff's generic analysis.

While the results of the analysis indicate that the CDF associated with tornado missile related non-compliances are well below CDFs requiring immediate regulatory action, the staff concluded that a graded approach to addressing this issue was appropriate. For plants with a higher tornado missile risk (Group A Plants, see attachment), the staff determined that an enforcement discretion period of 3 years was appropriate. Plants with a lower tornado missile risk (Group B Plants, see attachment) were allowed up to five years.

In summary, the generic bounding risk analysis performed by NRR DRA has concluded that this issue is of low risk significance. Therefore, enforcement discretion of up to 5 years, accounting for differences in initiating event frequency based on geographical location of the plants, will not impose significant additional risk to public health and safety.

Actions:

This EGM applies specifically to an SSC that is determined to be inoperable for tornado-generated missile protection. It allows the staff to exercise enforcement discretion and permits a licensee to continue reactor operation even if the licensee cannot meet the TS LCO required action(s) or restore compliance within the completion time allowed by the LCO.

The staff will exercise this enforcement discretion only when a licensee implements initial compensatory measures prior to the expiration of the time allowed by the LCO that provide additional protection such that the likelihood of tornado missile effects are lessened. These compensatory measures would be followed by more comprehensive compensatory measures that must be implemented within approximately 60 days of issue discovery and remain in place until permanent repairs are completed, or until the NRC dispositions the non-compliance in accordance with a method acceptable to the NRC such that discretion is no longer needed. In addition, the issue would be entered into the licensee's corrective action program. Examples of potential compensatory measures the licensee may consider are the following:

a) Development and implementation of procedures and conduct of training for plant staff in performing compensatory and mitigating actions related to tornado missile impact effects on identified safety-related SSCs,

b) Actions to be taken if a tornado watch is predicted or issued for the area to secure potential missiles, protect equipment that could affect safety-related SSC operation, cease maintenance activities in progress on equipment that could affect availability of SSCs, repair/restore SSCs if undergoing maintenance, stage equipment necessary for mitigative actions in protected but promptly accessible locations, and

c) Actions to be taken if a tornado warning is issued for the area (e.g., pre-staging of plant staff at safe, strategic locations to promptly implement mitigative actions, and alerting plant staff necessary for prompt mitigative actions of preparation for response following severe weather conditions).

This enforcement discretion will expire 3 years after the issuance date of RIS 2015-06 for plants of a higher tornado missile risk (Group A Plants) and 5 years after RIS issuance for plants of a lower tornado missile risk (Group B Plants). Analyses performed by NRR DRA demonstrate that the enforcement periods stated above will not impose undue additional risk. The differences in the periods of enforcement discretion recognizes the higher tornado initiating event frequencies for plants listed under "Group A Plants" in comparison to those listed under "Group B Plants." The attachment to this EGM includes all operating reactors grouped according to the DRA analysis. A licensee could establish compliance by either engineering and installing a plant modification, or by employing a methodology for addressing tornado missile non-compliances acceptable to the NRC. If a licensee chooses to submit an LAR, the LAR must be submitted and found to be acceptable for review in accordance with LIC-109, "Acceptance Review Procedures," (ADAMS Accession No. ML091810088), within the applicable timeframe established in the attachment. Enforcement discretion will continue to be in place until the NRC dispositions the licensee's LAR.

A licensee may receive this enforcement discretion for identified non-compliances on more than one affected SSC. These may include previous NRC-identified unresolved items, as well as any new NRC- or licensee-identified non-compliance. If any affected SSC is not returned to an operable status within the applicable timeframe, or if a licensee fails to submit an acceptable LAR for review within the applicable timeframe, the affected SSC will no longer be eligible for this enforcement discretion, and the licensee will be required to follow the applicable TS action statement.

If a licensee's reactor is, or will be, in a shutdown condition at a point during the applicable timeframe, and is, or will be, in a TS shutdown action statement or required mode change that resulted from tornado missile non-compliance, this enforcement discretion will allow a licensee to restart the reactor.

Through its generic analysis, NRR has concluded that issues associated with the inoperability of an SSC due to a tornado-generated missile, within the applicability of this EGM at nuclear power plants, are likely to be of minimal risk significance. Additionally violations of other requirements (e.g., 10 CFR Part 50, Appendix A, Criterion 2, 10 CFR Part 50, Appendix A, Criterion 4, etc.) that may have contributed to the TS violation will be evaluated on a case-by-case basis. The regional offices should consult with both NRR and the Office of Enforcement in those cases.

Further as a part of implementing this enforcement discretion, an enforcement action (EA) tracking number will be assigned and be documented in an inspection report. An enforcement panel is not required unless a site specific issue warrants further evaluation; in this case another EA number would be required. The cover letter to the inspection report that discusses the violation should include the following or similar language:

> "A violation of the licensee's current site-specific licensing basis for tornado-generated missile protection was identified. Because this violation was identified during the discretion period covered by Enforcement Guidance Memorandum 15-002, "Enforcement Discretion for Tornado Missile Protection Noncompliance" and because the licensee was implementing compensatory measures, the NRC is exercising enforcement discretion by not issuing an enforcement action for the violation and allowing continued reactor operation."

This EGM will only apply to operating power reactor licensees.

cc: M. Satorius, EDO
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SECY

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Nuclear Power Plants Grouped by Tornado Initiating Event Frequencies

Group A Plants – Higher Tornado Missile Risk

Arkansas Nuclear One 1 & 2
Beaver Valley 1 & 2
Braidwood 1 & 2
Browns Ferry 1, 2 & 3
Brunswick 1 & 2
Byron 1 & 2
Callaway
Catawba 1 & 2
Clinton
Comanche Peak 1 & 2
Cooper
D.C. Cook 1 & 2
Davis-Besse
Dresden 2 & 3
Duane Arnold
Farley 1 & 2
Fermi 2
FitzPatrick
Fort Calhoun
Ginna
Grand Gulf 1
Harris 1
Hatch 1 & 2
LaSalle 1 & 2
McGuire 1 & 2
Monticello
Nine Mile Point 1 & 2
Oconee 1, 2 & 3
Palisades
Perry 1
Point Beach 1 & 2
Prairie Island 1 & 2
Quad Cities 1 & 2
River Bend 1
Robinson 2
Sequoyah 1 & 2
Summer
Susquehanna 1 & 2
Vogtle 1 & 2
Waterford 3
Watts Bar 1 & 2[6]
Wolf Creek 1

Group B Plants – Lower Tornado Missile Risk

Calvert Cliffs 1 & 2
Columbia
Diablo Canyon 1 & 2
Hope Creek 1
Indian Point 2 & 3
Limerick 1 & 2
Millstone 2 & 3
North Anna 1 & 2
Oyster Creek
Palo Verde 1, 2 & 3
Peach Bottom 2 & 3
Pilgrim 1
Salem 1 & 2
Seabrook 1
South Texas Project 1 & 2
St. Lucie 1 & 2
Surry 1 & 2
Three Mile Island 1
Turkey Point 3 & 4

Reference:
NUREG/CR-4461, "Tornado Climatology of the Contiguous United States," Revision 2

[6] This EGM will be applicable to Watts Bar Unit 2 once they receive their operating license.