

Resolution of Tornado Missile Protection Non- conforming Conditions – Proposed Path Forward

September 10, 2019



Agenda

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Problem Statement

Problem Statement

Detailed walkdowns identified non-conforming conditions from intended design for tornado missile protection (TMP). These apparent deviations are:

- Very low safety significance
 - NRR bounding risk assessment determined initiating event frequency of $4E-4$ per year
 - Risk assessment assumed a tornado-generated missile would fail all emergency core cooling equipment with no ability to recover, and did not consider plant-specific characteristics
- Often costly to resolve
- Typically at the subcomponent level, making determination of the original design difficult

Background

Plants have submitted applications to NEI 17-02, Tornado Missile Risk Evaluator (TMRE), to “accept-as-is” these non-conforming conditions

- TMRE quantitatively determines risk impact from tornado missiles
- Acceptable to “accept-as-is” provided risk impact is in accordance with RG 1.177 requirements

Background (continued)

Submitting TMRE applications does not result in “timely and efficient resolution of longstanding issues related to tornado-missile protection with the goal of bringing closure to these issues in 2019” as encouraged by February 28, 2019 letter from NRR Director

- Requiring NRC approval unnecessarily diverts both staff and licensee resources from more safety-significant matters
- Per NRC Principles of Good Regulation, “Regulatory activities should be consistent with the degree of risk reduction they achieve.”

February 28, 2019 letter discusses bringing facility into compliance by licensing basis changes through 10 CFR 50.59



Proposed Resolution – 10 CFR 50.59

Proposed Resolution

NEI 96-07 provides guidance for utilizing 10 CFR 50.59 provisions to "accept-as-is" non-conforming conditions without prior NRC approval

- Allows changes that have minimal safety impact to be made
- Requires licensees to meet applicable regulatory requirements and other acceptance criteria to which they are committed to proceed
- Uses established regulation and criteria to accept deviations from current licensing basis

Today's Objective

Outline the application of 10 CFR 50.59 to this situation.

Identify:

- Critical aspects of 50.59 application that require complete understanding
- Usefulness and application of pre-existing guidance
- Areas where portions of the NEI 17-02 tornado missile risk evaluator (TMRE) are useful tools in preparing 50.59 evaluation responses



50.59 “Activity” Description

50.59 Activity Description

This activity uses portions of the TMRE evaluation technique described to evaluate and accept as-is non-conforming conditions with regard to tornado missile protection (TMP) for certain aspects of the affected components.

- Each specific non-conforming condition is identified and individually dispositioned

Activity does not adopt NEI 17-02 as a “new NRC-approved methodology” (NEI 96-07 Section 4.3.8) as discussed in later slides



Overview of Screening Questions

Screening Questions 1, 2, and 4



- Activity “screens-in” based on screening question 1
 - Accept as-is disposition is a potential change to the licensing basis for the affected structures, systems, or components (SSCs)
 - Per NEI 96-07, any “adverse effect” on the licensing basis to an SSC must be screened-in, no matter how miniscule the adverse effect
- Screening Question 2 Answered No, since there are no revised procedures (per NEI 96-07 definition) as a result of this change
- Screening Question 4 Answered No, since there is no “test or experiment” (per NEI 96-07 definition) as a result of this change

Screening Question 3

NEI 17-02 uses the term “methodology” to describe techniques used to evaluate TMP requirement

- This is not a “method of evaluation” as defined by NEI 96-07

Screening Question 3 (continued)

Methods of evaluation described in the UFSAR subject to criterion 10 CFR 50.59(c)(2)(viii) meet one of the following criterion:

- Used in analyses that demonstrate that design basis limits of fission product barriers are met;
- Used in UFSAR safety analyses, including containment, ECCS and accident analyses typically presented in UFSAR Chapters 6 and 15, to demonstrate that consequences of accidents do not exceed 10 CFR 100 or 10 CFR 50, Appendix A, dose limits
- Methods of evaluation used in supporting UFSAR analyses that demonstrate intended design functions will be accomplished under design basis conditions that the plant is required to withstand, including natural phenomena, environmental conditions, dynamic effects, station blackout and ATWS

Screening Question 3 (continued)

NEI 17-02 does not “demonstrate intended design functions will be accomplished”

- Quantifies risk of intended design functions NOT being accomplished



Evaluation Questions

Pertinent Evaluation Questions

- Questions 1 – 7 addressed in Evaluation
 - Question 8 not addressed, since Screening Question 3 answered No
- Question 2 (more than minimal increase in likelihood of malfunction of SSC) was the most relevant to this activity
 - Addressed in this presentation after remaining questions are addressed

1. Does the proposed activity result in more than a minimal increase in the frequency of occurrence of an accident previously evaluated in the Updated FSAR?

- “Accident previously evaluated in the final safety analysis report” is the tornado, not corresponding site-level event (e.g. loss of offsite power or loss of feedwater) that can be initiated as a result of a tornado or a tornado missile
- Per NEI 96-07 “changes in design requirements for earthquakes, tornadoes and other natural phenomena should be treated as potentially affecting the likelihood of a malfunction rather than the frequency of occurrence of an accident”

3. Does the proposed activity result in more than a minimal increase in the consequences of an accident previously evaluated in the Updated FSAR?

- No accidents evaluated in the Updated FSAR that will have their radiological consequences affected as a direct result of this proposed action
- Accident assumptions not changing as a result of the proposed activity
- No “clear trend toward increasing the consequences”

4. Does the proposed activity result in more than a minimal increase in the consequences of a malfunction of an SSC important to safety previously evaluated in the Updated FSAR?

- No malfunctions evaluated in the Updated FSAR that will have their radiological consequences affected as a direct result of this proposed action
- No failure modes changing as a result of proposed activity
- No “clear trend toward increasing the consequences”

5. Does the proposed activity create the possibility for an accident of a different type than any previously evaluated in the Updated FSAR?

- Any events initiated as a result of a tornado missile (e.g. loss of feedwater, station blackout) would be consistent with the accidents already evaluated in the UFSAR
- “Credible” tornado missile would not cause malfunction of multiple accident-initiating components

6. Does the proposed activity create the possibility for a malfunction of an SSC important to safety with a different result than any previously evaluated in the Updated FSAR?

- Malfunctions initiated by tornado missile are consistent with the malfunctions already analyzed in the Updated FSAR
- TMRE evaluation technique confirms that the probability of a different malfunction than that already analyzed in the Updated FSAR is either not credible or bounded by previously analyzed malfunctions

7. Does the proposed activity have any impact on the integrity of the fuel cladding, reactor coolant pressure boundary, or containment?

- No fission product barrier (cladding, RCS, or containment) design basis limits affected

2. Does the proposed activity result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety previously evaluated in the Updated FSAR?

Answering No requires the following:

- Compliance with UFSAR-described codes, standards, and Regulatory Guides
- Compliance with Applicable GDCs, specifically GDC 2
- Determination that there's not a “more than minimal” increase in the probability of a malfunction

2. Does the proposed activity result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety previously evaluated in the Updated FSAR? (continued)

Response broken up into three “segments” to address these items

These segments are described in the following slides

Segment 1, Compliance with UFSAR-described codes, standards, and Regulatory Guides

NEI 96-07 requires meeting applicable regulatory requirements and other acceptance criteria to which they are committed (such as contained in regulatory guides and nationally recognized industry consensus standards, e.g., the ASME B&PV Code and IEEE standards)

- Many plants committed to RG 1.76
 - Activity does not affect intensity of assumed tornados, nor spectrum of analyzed missiles
- Some plants committed to RG 1.117
 - Appendix A provides guidance on the “portions” and “extent” of various systems required to have TMP
 - Exposed target of nonconformances is very small in nature, and represents a small aspect of the larger, protected SSC
 - Acceptance of these nonconformances remains consistent with RG 1.117
- Other plant-specific commitments addressed on a specific basis

Segment #2- Consideration of a “departure” from GDC 2

GDC 2 states:

Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunamis, and seiches without loss of capability to perform their safety functions.

Central question: Does “without loss of capability to perform their safety functions” mandate protection of individual components in a manner similar to those GDCs that require single failure protection?

Segment #2- Consideration of a “departure” from GDC 2 (continued)

Analogous words from draft GDC stated “without loss of capability to protect the public”

- Clearly does not mandate the protection of individual components in a manner similar to a single failure-proof design

Change attributed to September 6, 1967 comment letter from W. B. Behnke, Jr. of the Commonwealth Edison Company to Mr. W. B. McCool of the U.S. Atomic Energy Commission

- Concerned that the phrase “protect the public”, and other similar phrases, were much too broad and exceeded the intended scope of the AEC’s responsibility

Segment #2- Consideration of a “departure” from GDC 2 (continued)

No mention of expanding the level of protection to individual components

No foundation for a reading of the 1971 GDC 2 phrase “without loss of capability to perform their safety functions” that results in a direct requirement to protect individual components against a postulated tornado missile

It can be reasonably concluded that the intent of GDC 2 is not to require protection of individual components.

Segment #3- Use of a qualitative assessment to conclude that there is not a more than minimal increase in the likelihood of a malfunction

Per NEI 96-07 “A proposed activity is considered to have a negligible effect on the likelihood of a malfunction when a change in likelihood is so small that it cannot be reasonably concluded that the likelihood has actually changed (i.e., there is no clear trend toward increasing the likelihood).

Portions of the tornado missile risk evaluator (TMRE) evaluation technique described in Sections 4 and 5 and supporting Appendices to NEI 17-02 used to determine increase in likelihood of a malfunction

Segment #3- Use of a qualitative assessment to conclude that there is not a more than minimal increase in the likelihood of a malfunction (continued)

Example of tornado missile failure probabilities using portions of guidance from NEI 17-02

Tor intensity	Tor Frequency	EEFP	Tor Miss FP per year
F'2	8E-5	2E-4	1.6E-08/yr
F'3	2E-5	1E-3	2.0E-08/yr
F'4	4E-6	3E-3	1.2E-08/yr
F'5	1E-6	8E-3	8.0E-09/yr
F'6	6E-8	2E-2	1.2E-09/yr
Average of five Tor Miss FPs			1.14E-08/yr

Segment #3- Use of a qualitative assessment to conclude that there is not a more than minimal increase in the likelihood of a malfunction (continued)

Current failure probability of affected SSCs provided in NUREG/CR-6928, “Industry-Average Performance for Components and Initiating Events at U.S. Commercial Nuclear Power Plants”

Current failure probabilities between 2 – 5 orders of magnitude greater than failure probability from tornado missile

Segment #3- Use of a qualitative assessment to conclude that there is not a more than minimal increase in the likelihood of a malfunction (continued)

Failure probability from tornado missile is very small when compared to the uncertainties and/or variations inherent in current calculated failure probability

- Does not change current failure probability based on the number of significant digits reported in NUREG/CR-6928

It reasonable to conclude that the increase in failure probability can be considered “negligible”

Criterion 2 Summary

Segment #1

- Compliance with all UFSAR-described codes, standards and Regulatory Guide commitments is maintained.

Segment #2

- Compliance with GDC -2 is maintained.

Segment #3 Summary:

- All of the non-conforming conditions will result in an increased likelihood of occurrence of a malfunction that is negligible.



Conclusions

Conclusions

- Questions 1 – 7 of evaluation can be answered “No”
- Pursuant to § 50.59(c)(1), licensees can make changes in the facility as described in the final safety analysis report without obtaining a license amendment request if criteria in § 50.59(c)(2) are not met
 - The “change to the facility” is to accept as-is non-conforming conditions with regard to TMP