

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF FEDERAL AND STATE MATERIALS  
AND ENVIRONMENTAL MANAGEMENT PROGRAMS  
OFFICE OF NUCLEAR REACTOR REGULATION  
OFFICE OF NEW REACTORS  
WASHINGTON, DC 20555-0001

Month XX, 2014

**NRC REGULATORY ISSUE SUMMARY 2014-XX  
TORNADO MISSILE PROTECTION**

**ADDRESSEES**

All holders of an operating license or construction permit for a nuclear power reactor under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," including those who have permanently ceased operations and have spent fuel in storage in spent fuel pools.

All holders of and applicants for a power reactor early site permit, combined license, standard design approval, or manufacturing license under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Reactors." All applicants for a standard design certification, including such applicants after initial issuance of a design certification rule.

**INTENT**

The U.S. Nuclear Regulatory Commission (NRC) is issuing this regulatory issue summary (RIS) to restate regulatory requirements and staff positions on protection from tornado missiles. This RIS requires no actions or written response on the part of an addressee.

**BACKGROUND INFORMATION**

Protection against natural phenomena, including tornadoes, was considered when each operating reactor was originally licensed. Tornadoes and tornado missiles were considered during the original design and construction of nuclear power plants. As part of the application for an operating license a potential licensee must submit, pursuant to 10 CFR 50.34(b), a Final Safety Analysis Report (FSAR) "...that describes the facility, presents the design bases and the limits on its operation, and presents a safety analysis of the structures, systems, and components, and of the facility as a whole..."

In their FSARs, applicants described how they protect most systems and components required in the event of a tornado and tornado missiles by locating the systems and components in structures that are designed to withstand tornadoes and tornado missiles. The FSARs described how some systems and components which are required in the event of a tornado but are not located in structures designed to withstand tornadoes and tornado missiles are instead protected by specifically-designed tornado missile barriers. Alternatively, applicants described in their FSARs how they determined that the probability of required unprotected structures, systems, and components being struck by a tornado missile is sufficiently low that no tornado missile protection is required. The NRC (or Atomic Energy Commission (AEC) before the NRC)

based its decision to issue or deny an operating license for a reactor in part on the information in the FSAR, including the descriptions of protection against tornados and tornado-generated missiles.

In the late 1970's and early 1980's, several licensees identified components that did not conform to their licensing basis for tornado missile protection. To address the concern and modify their licensing basis, some licensees requested NRC approval to use the probability-based TORMIS methodology developed by the Electric Power Research Institute (EPRI). The NRC approved the TORMIS methodology for demonstrating sufficient tornado missile protection<sup>1</sup>. Licensees incorporated this methodology or other probability methodologies into a License Amendment Request (LAR) in order to modify their licensing basis to bring the plant into conformance for tornado missile protection.

## **SUMMARY OF ISSUE**

Over the past 10 to 15 years, licensees and the NRC have identified that some plants are not within their tornado missile protection licensing basis. The non-conformances have been documented in NRC inspection reports and the subject of licensee submitted license amendment requests. Some of the non-conformances include:

- Point Beach Nuclear Power Plant<sup>2</sup>: failure to ensure tornado missile protection for emergency diesel generators
- Surry Power Station<sup>3</sup>: design change for emergency service water pumps was not adequate to protect the diesel-driven emergency service water pumps from damage resulting from tornado missile
- Fermi 2<sup>4</sup>: penetrations inadequate to protect components from tornado missiles

## **STAFF POSITIONS**

Staff reviews and inspections of tornado missile protection are based on applicable regulations and the requirements contained in the current licensing bases documents, typically the Updated Final Safety Analysis Report (UFSAR) or for a combined license referencing a standard design certification, the Final Safety Evaluation Report and referenced design control document. When evaluating for conformance with the licensing basis for tornado missile protection, in the absence of specific descriptions of protective features for tornado missile protection, including procedures and repairs, contained in the licensing basis documents, the staff relies on NRC regulations and guidance provided in regulatory guides and the standard review plans to interpret any generalities in a plant's licensing basis.

---

<sup>1</sup> NRC Memorandum, L.S. Rubenstein to F.J. Miraglia, "Safety Evaluation Report – Electric Power Research Institute (EPRI) Topical Reports Concerning Tornado Missile Probabilistic Risk Assessment (PRA) Methodology," October 23, 1983, Agencywide Documents Access and Management System (ADAMS) Accession No. ML080870291

<sup>2</sup> Point Beach Nuclear Power Plants, Unit 1 and 2, "NRC Integrated Inspection Report 05000266/2011004; 05000301/2011004," November 2, 2011, NCV 05000266/2011004-03 and 05000301/2011004-03, pages 13-15 of Enclosure, ADAMS Accession No. ML11306A264

<sup>3</sup> Surry Power Station, "NRC Resident Inspection Report 05000280/2009004 and 05000281/2009004," October 29, 2009, page 3 of Enclosure, ADAMS Accession No. ML093020726

<sup>4</sup> Fermi 2, "Proposed License Amendment to Revise the Fermi 2 Licensing Bases for Protection from Tornado-Generated Missiles," January 11, 2013, Enclosure 1, pages 3 and 4, ADAMS Accession No. ML13011A377

The primary NRC regulations and guidance for determining equipment to be protected from the effects of tornadoes and tornado missiles that have been used by operating nuclear power plants are:

- Appendix A to Part 50, "General Design Criteria for Nuclear Power Plants"<sup>5</sup>

Criterion 2 - *Design bases for protection against natural phenomena.* Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as ...tornadoes...without loss of capability to perform their safety functions.

NOTE: For pre-General Design Criteria (GDC) plants, GDC 2 does not apply as a regulation. In these cases the UFSARs typically contain "Safety Criterion" or other bases that the plant was designed to. In many cases, the safety criterion contains nearly the same words as GDC 2. In other cases, plants have amended their licensing basis to voluntarily comply with the GDCs, including GDC 2. As stated above, when the staff reviews a plant for conformance to the plant's tornado missile protection licensing basis, the staff reviews the plant against what is contained in the current licensing basis.

- Regulatory Guide 1.117, Revision 1<sup>6</sup>, "Tornado Design Classification"

#### B. Discussion

...Physical design parameters of tornado protection provisions are such that designated structures, systems, and components will be able to maintain their necessary capabilities in the event of a Design Basis Tornado...

Protection of designated structures, systems, and components may generally be accomplished by designing protective barriers to preclude tornado damage...

...If protective barriers are not installed, the structures and components themselves should be designed to withstand the effects of the tornado, including tornado missile strikes. The physical separation of redundant or alternative structures or components required for safe shutdown of the plant is generally not considered acceptable by itself for protecting against tornado effects, including tornado-generated missiles.

...equipment used to provide long-term core cooling following a LOCA should be protected.

#### C. Regulatory Position

Structures, systems, and components important to safety that should be protected from the effects of a Design Basis Tornado are:

---

<sup>5</sup> Title 10 of the Code of Federal Regulations, "Energy," Appendix A to Part 50, "General Design Criteria for Nuclear Power Plants"

<sup>6</sup> NRC Regulatory Guide 1.117, "Tornado Design Classification," Revision 1, April 1978

1. Those necessary to ensure the integrity of the reactor coolant pressure boundary;
2. Those necessary to ensure the capability to shut down the reactor and maintain it in a safe shutdown condition (this includes both hot standby and cold shutdown capability); and
3. Those whose failure could lead to radioactive releases resulting in calculated offsite exposures greater than 25% of the guideline exposures of 10 CFR Part 100 using appropriately conservative analytical methods and assumptions.”

Appendix - Structures, Systems, and Components of Light-Water-Cooled Reactors to be Protected Against Tornadoes

4. Systems or portions of systems that are required for... (6) supporting the above systems, e.g., cooling water, ultimate heat sink, air supply, auxiliary feedwater, and ventilation.
  7. The control room, including all equipment needed to maintain the control room within safe habitability limits for personnel and safe environmental limits for tornado-protected equipment.
  9. Systems or portions of systems that are required for monitoring, actuating, and operating tornado-protected positions of systems listed in items 4, 6, 7, and 13.
  11. Those portions of the long-term emergency core cooling system that would be required to maintain the plant in a safe condition for an extended time after a loss-of-coolant accident.
  13. The Class 1E electric systems, including the auxiliary systems for the onsite electric power supplies, that provide the emergency electric power needed for the functioning of plant features included in items 1 through 11 above.
  14. Those portions of structures, systems and components whose continued function is not required but whose failure could reduce to an unacceptable safety level the functional capability of any plant features included in items 1 through 13 above or could result in incapacitating injury to occupants of the control room.
- Standard Review Plan 3.5.2<sup>7</sup>, “Structures, Systems, and Components to be Protected from Externally-Generated Missiles”

III. Review Procedures

2. ...Depending on the nature and source of the externally-generated missiles, protection may be by missile barriers for individual components, by location of independent redundant subsystems in compartments in missile-protected structure, or by subgrade location at sufficient depth. Physical separation alone

---

<sup>7</sup> NUREG-0800, “Standard Review Plan,” Section 3.5.2, “Structures, Systems, and Components to be Protected from Externally-Generated Missiles,” Revision 2, July 1981

is not normally an acceptable method of missile protection for redundant safety-related systems and components.”

The above staff regulatory positions and standard review plan have remained essentially constant over the past 20 to 30 years.

#### SYSTEMATIC EVALUATION PROGRAM AND INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS APPLICABILITY

Some licensees have attempted to use the Systematic Evaluation Program (SEP) and/or the Individual Plant Examination of External Events (IPEEE) to justify conformance with their tornado missile protection licensing basis. The SEP and IPEEE do not supersede any part of a plant's licensing bases, absent further action on the part of the NRC or the licensee (i.e., a license amendment application). The objectives of the SEP and IPEEE are summarized below:

- Attachment to SECY-92-223<sup>8</sup>, “Resolution of Deviations Identified during the Systematic Evaluation Program,” on pages 1 and 2 states:

The objectives of the SEP were that the NRC should

1. assess the safety adequacy of the design and operation of currently licensed nuclear power plants,
  2. establish documentation which shows how each operating plant reviewed compares with current criteria on significant safety issues and provide a rationale for acceptable departures from these criteria,
  3. provide the capability to make integrated and balanced decisions about any required backfitting,
  4. structure the program to identify early and resolve any significant deficiencies, and
  5. use available resources efficiently and minimize requirements for additional resources by the NRC or the industry.
- NUREG-1407<sup>9</sup>, “Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities,” p. 1, states:

#### 1.2 IPEEE Objectives

The objectives of the IPEEE, which are similar to the objectives of the internal IPE [Individual Plant Examination], are for each licensee:

1. to develop an appreciation of severe accident behavior,

---

<sup>8</sup> SECY-92-223, “Resolution of Deviations Identified During the Systematic Evaluation Program,” September 18, 1992, ADAMS Accession No. ML12256B290

<sup>9</sup> NUREG-1407, “Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities,” June 1991, ADAMS Accession No. ML063550238

2. to understand the most likely severe accident sequences that could occur at the licensee's plant under full power operating conditions,
3. to gain a qualitative understanding of the overall likelihood of core damage and fission product releases, and
4. if necessary, to reduce the overall likelihood of core damage and radioactive material releases by modifying, where appropriate, hardware and procedures that would help prevent or mitigate severe accidents.

These objectives do not address conformance with a plant's licensing basis. However, in certain plant-specific cases the staff has accepted the SEP and IPEEE as a basis for conformance with a plant's tornado missile protection licensing basis after the licensee submitted the SEP/IPEEE for review and approval as part of a LAR. Absent additional action by either the NRC or the licensee, the SEP and IPEEE do not become part of the plant's licensing basis.

#### OTHER DOCUMENTS

The staff has issued the following generic communications related to the issue of protection of components from tornado missiles:

- NRC Information Notice 96-06, "Design and Testing Deficiencies of Tornado Dampers at Nuclear Power Plants," ADAMS Accession No. ML031060290, discussed how "Equipment such as tornado dampers may have been overlooked in development of surveillance testing programs..." (p. 2).
- NRC RIS 2006-23, "Post-Tornado Operability of Ventilating and Air-Conditioning Systems Housed In Emergency Diesel Generator Rooms," ADAMS Accession No. ML061720371, addressed "...loading effects caused by natural phenomena to safety related systems and components housed inside a structure partially exposed to the outside environment..." (p. 1).
- NRC RIS 2008-14, "Use of TORMIS Computer Code for Assessment of Tornado Missile Protection," ADAMS Accession No. ML080230578, addressed issues associated with the use of the TORMIS computer code for demonstrating compliance with tornado missile protection requirements.
- NRC RIS 2013-05, "NRC Position on the Relationship Between General Design Criteria and Technical Specification Operability," ADAMS Accession No. ML13056A077.

#### **BACKFITTING AND ISSUE FINALITY DISCUSSION**

Draft RIS 2014-XX sets forth the NRC staff's positions on the applicable NRC regulatory requirements and guidance with respect to tornado missile protection, and the staff's position that a licensee's SEP and IPEEE do not constitute, absent additional NRC or licensee action, regulatory requirements or part of the licensing basis for the licensee's plant.

These positions do not represent new or changed staff positions. In addition, this RIS does not require any action or written response on the part of any licensee or design certification

applicant. Accordingly, issuance of this RIS in final form would not represent backfitting as defined in 10 CFR § 50.109(a)(1), or be inconsistent with any applicable issue finality provision in 10 CFR Part 52. Therefore, the NRC did not prepare a backfit analysis for this RIS or further address the issue finality criteria in Part 52.

**FEDERAL REGISTER NOTIFICATION**

[Discussion to be provided in final RIS.]

**CONGRESSIONAL REVIEW ACT**

[Discussion to be provided in final RIS.]

**PAPERWORK REDUCTION ACT STATEMENT**

This RIS does not contain new or amended information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). Existing requirements were approved by the Office of Management and Budget (OMB), approval numbers 3150-0011 and 3150-0151.

**PUBLIC PROTECTION NOTIFICATION**

The NRC may not conduct or sponsor, and a person is not required to respond to a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

## CONTACT

Please direct any questions about this matter to the technical contact listed.

Michael C. Cheok, Director  
Director of Construction Inspection  
and Operational Programs  
Office of New Reactors

Lawrence E. Kokajko, Director  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Larry W. Camper, Director  
Division of Waste Management  
and Environmental Protection  
Office of Federal and State Materials  
and Environmental Management Programs

Technical Contact: Edward T. Smith, NRR  
301-415-1548  
e-mail: [edward.smith@nrc.gov](mailto:edward.smith@nrc.gov)

Note: NRC generic communications may be found on the NRC public Web site,  
<http://www/nrc.gov>, under NRC Library/Document Collections.



**CONTACT**

Please direct any questions about this matter to the technical contact listed.

Michael C. Cheok, Director  
Director of Construction Inspection  
and Operational Programs  
Office of New Reactors

Lawrence E. Kokajko, Director  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Larry W. Camper, Director  
Division of Waste Management  
and Environmental Protection  
Office of Federal and State Materials  
and Environmental Management Programs

Technical Contact: Edward T. Smith, NRR  
301-415-1548  
e-mail: [edward.smith@nrc.gov](mailto:edward.smith@nrc.gov)

Note: NRC generic communications may be found on the NRC public Web site,  
<http://www.nrc.gov>, under NRC Library/Document Collections.

ADAMS ACCESSION NO.: **ML13094A421**

\* via e-mail

TAC No. MF0541

|        |                     |              |                 |                 |                 |
|--------|---------------------|--------------|-----------------|-----------------|-----------------|
| OFFICE | NRR/DSS/SBPB        | Tech Editor* | NRR/DSS/SBPB/BC | NRR/DSS/D       | OE*             |
| NAME   | ESmith (GCasto for) | CHsu         | GCasto          | TMcGinty        | GGulla          |
| DATE   | 05/24/2013          | 04/30/2013   | 05/24/2013      | 08/08/2013      | 09/16/2013      |
| OFFICE | PMDA*               | OIS*         | RI/DRS/D*       | RII/DRS/D*      | RIII/DRS/D*     |
| NAME   | LHill               | TDonnell     | RLorson         | TReis           | GShear          |
| DATE   | 08/15/2013          | 08/27/2013   | 10/17/2013      | 10/09/2013      | 10/17/2013      |
| OFFICE | RIV/DRS/D*          | NRR/DORL/D*  | OGC             | NRR/DPR/PGCB/PM | NRR/DPR/PGCB/LA |
| NAME   | TBlount             | MEvans       | DRoth           | TAlexion        | CHawes          |
| DATE   | 10/08/2013          | 10/07/2013   | 02/07/2014      | 02/18/2014      | 02/20/2014      |
| OFFICE | NRR/DPR/PGCB/BC     |              |                 |                 |                 |
| NAME   | SStuchell (Acting)  |              |                 |                 |                 |
| DATE   | 02/20/2014          |              |                 |                 |                 |

OFFICIAL RECORD COPY