ISFSI Dry Storage System Protection During Short Term Operations (Tornado Hazards): NEI/Industry Perspectives

NRC Public Meeting: Approaches to Addressing Tornado Hazards During ISFSI Short Term Operations

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Nuclear Energy Institute

NUCLEAR ENERGY INSTITUTE

The Issue: Background and Overview

Jennifer Uhle-NEI

Industry Perspectives

- Certificates of Compliance (CoCs) for dry storage systems (DSS) have been issued by NRC under Part 72 since the 1990s
- 72.122 requires DSS to withstand natural phenomena including tornado missiles
- 72.122 is broadly worded and does not specify how the analyses must be conducted
- CoCs include deterministic tornado analysis for fully loaded casks, but many short-term or transient operations (STO) were not required to be covered by those deterministic analyses
- NRC has reviewed and approved these DSS designs as complying with 72.122 as part of the certification process

Industry Perspectives

- 72.212 requires general licensees to confirm the site parameters are enveloped by the cask design basis of the CoC
- NRC has reviewed and approved these CoCs and inspected cask loading campaigns for over 30 years
- For STOs where deterministic analysis was not required, safety is ensured through admin controls - no loading takes place in inclement weather
  - In 2006, NRC raised this very issue at a site and dropped it
- This issue is of very low safety significance
- NRC has raised this issue again recently and has changed its position, questioning acceptability of administrative controls and associated 72.48 evaluations
- This raises questions about the licensing basis of DSSs with respect to this issue and backfitting concerns for general licensees

VLSSIR and Principles of Good Regulation

- Very Low Safety Significance Issue Resolution (VLSSIR) Process has been used by the NRC 10 times in the reactor area
- It is designed to efficiently manage issues of very low safety significance when there is uncertainty in the licensing basis
- NRC's Principles of Good Regulation indicate:

  "Regulatory activities should be consistent with the degree of risk reduction they achieve. Where several effective alternatives are available, the option which minimizes the use of resources should be adopted."

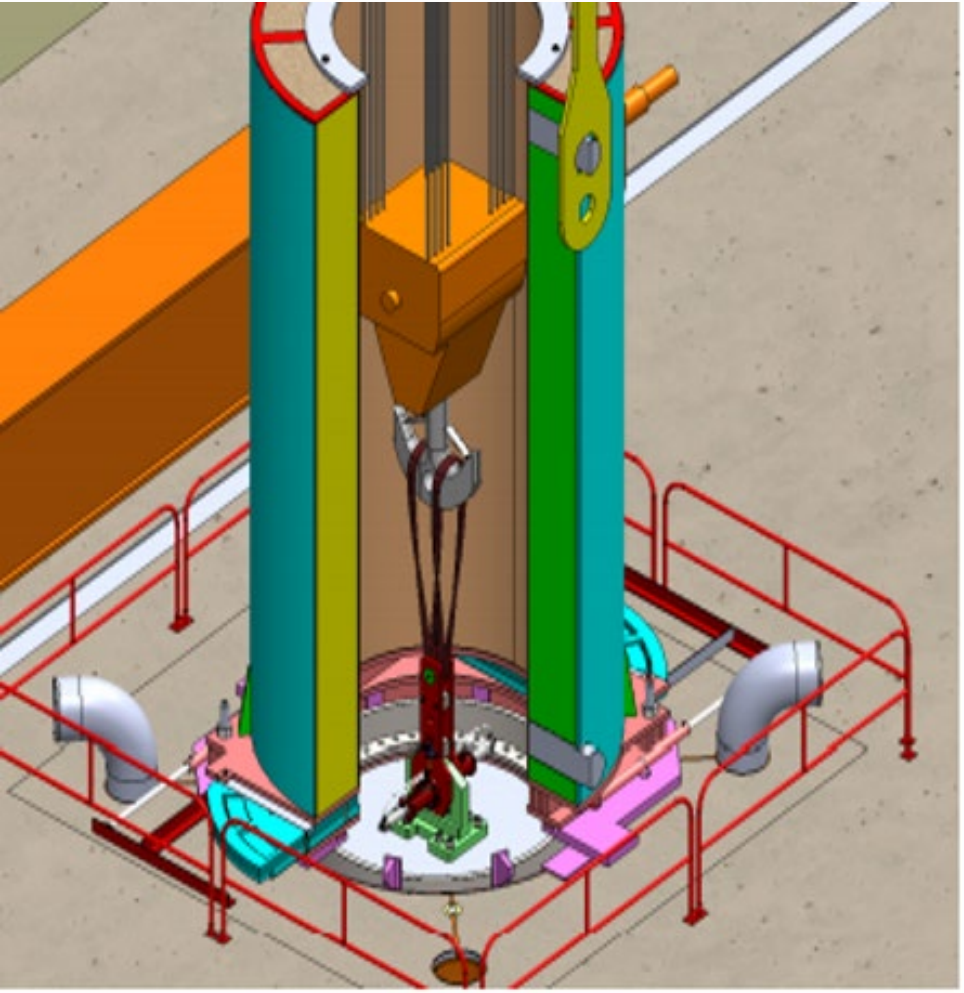
- VLSSIR should be used to address this issue of very low safety significance

Short Term Operations Administrative Controls: Tornado Impact Not Explicitly Analyzed

Mark Richter-NEI

Cask Lid Not Placed in Transient Condition

- Placement of the lid on the overpack outside due to facility limitations or stack up location



Cask Lid Placement

- Canister transfer takes place outdoors, either at a cask transfer facility (CTF) or using equipment associated with the Part 50 facility
- This graphic shows a canister inside a storage cask just after being transferred
- Also shown here are the transfer cask and the mating device that allows removal of the transfer cask bottom lid to facilitate canister transfer

Cask Lid Placement

- The cask with mating device in place. The canister is lowered into the cask and the transfer cask and mating device are removed, leaving the cask with the canister inside and no lid installed.
- The cask lid is installed without unnecessary delay.

Short-term Evolutions Not Analyzed

- Short-term evolutions that are not analyzed: 1) lid off during alignment / fit-up, 2) partial insertion, and 3) between insertion and door placement

High Lift Gantry Crane

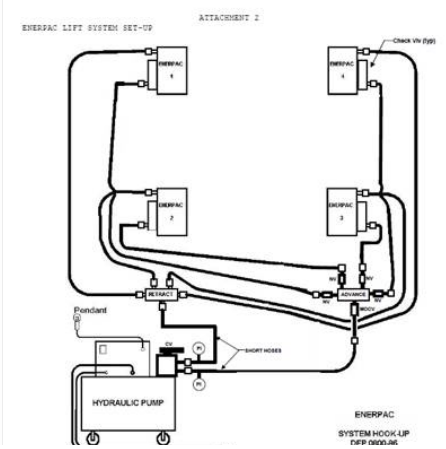
- Lifting equipment that meets the applicable FSAR/CoC criteria for single failure proof, redundant drop protection, or drop height limits

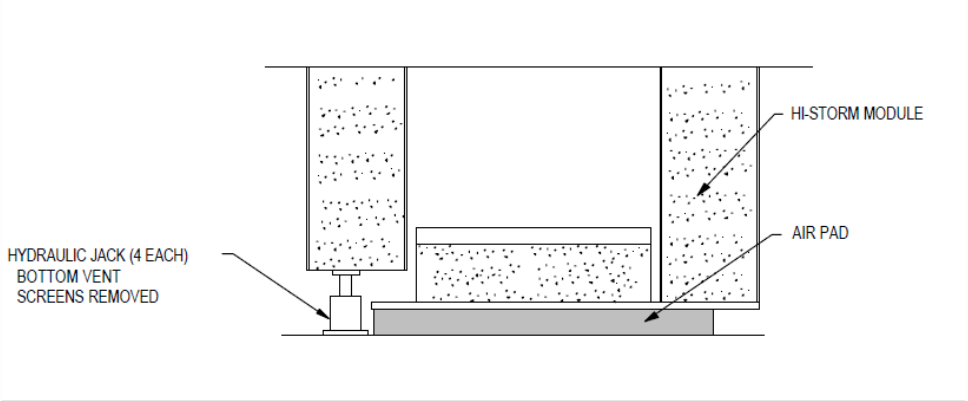
Cask Transporters

- Lifting equipment that meets the applicable FSAR/CoC criteria for single failure proof, redundant drop protection, or drop height limits

Cask Support From Underneath

- Cask is moved on and off an air pallet system using jacks or other equipment which supports the cask from underneath





Tornado Missile Analysis: Holtec Perspective

Kim Manzione-Holtec

CoC Licensing Bases

- HI-STORM 100
  - FSAR Analyses
    - Storage overpack resting on the ground during long-term storage condition
    - Transfer cask resting on the ground in loaded configuration
    - Structural analysis in Chapter 3 and summarized in accident section in Chapter 11
    - If sites have tornado winds or missiles that exceed those in the FSAR, those are analyzed and documented in 72.212 report, for the same configurations
  - CoC Requirements
    - Specific to CTF (Appendix B/D, Section 3.5)
    - Site-Specific Parameters and Analyses (Appendix B/D, Section 3.4) identify specific environmental phenomena to be evaluated during short term operations
  - No requirement for any analysis of tornadoes during transient operations

CoC Licensing Bases

- HI-STORM FW
  - FSAR Analyses
    - Storage overpack resting on the ground during long-term storage condition
    - Transfer cask resting on the ground in loaded configuration
    - Structural analysis in Chapter 3 and summarized in accident section in Chapter 12
    - If sites have tornado winds or missiles that exceed those in the FSAR, those are analyzed and documented in 72.212 report, for the same configurations
  - CoC Requirements
    - No CoC level requirements for any tornado event
    - Site-Specific Parameters and Analyses (Appendix B, Section 3.4) identify specific environmental phenomena to be evaluated during short term operations
  - No requirement for any analysis of tornadoes during transient operations

NUREG Language

- Both NUREG-1536 and NUREG-2215 state:
  - "The NRC does not accept the presumption that there will be sufficient warning of tornadoes that operations such as transfer between the fuel pool facility and storage site may never be exposed to tornado effects"
  - "NUREG-2215 [1536] is a consolidation of existing guidance for staff's use when reviewing applications for licenses and certificates for spent fuel dry storage systems and facilities"
- These NUREGs apply to the application process for CoC submittal and the Holtec CoCs were found to be acceptable without analysis of tornadoes during short term operation or requirement for the licensee to perform these evaluations

Safety Evaluation Reports

- HI-STORM FW SER (quoted from Amd 0 – ML111950325)
  - "The applicant has met the requirements of 10 CFR 72.122(b) and (c) and 10 CFR 72.24(c)(3). The structures, systems, and components important to safety are designed to accommodate the combined loads of normal, off-normal, accident, and natural phenomena events with an adequate margin of safety"
- HI-STORM 100 SER (quoted from Amd 0 – ML00371865)
  - "The applicant has met the requirements of 10 CFR 72.122(b) and (c) and 10 CFR 72.24(c)(3). The structures, systems, and components important to safety are designed to accommodate the combined loads of normal, off-normal, accident, and natural phenomena events with an adequate margin of safety"
- Licensees continue to meet 72.122(c) because they implement a system that has been certified to meet the requirements, and ensure that their site specific environmental phenomena are bounded or evaluated appropriately

Short Term Operations

- In general, Administrative Controls are in place at all times prior to the cask exiting the Part 50 facility until the cask is placed in storage on the ISFSI Pad
- Specific examples of admin controls, where a cask is moved and a tornado impact is not explicitly analyzed
  - During the placement of the HI-STORM Lid on the overpack outside due to facility limitations or stackup location
  - Cask is moved on and off an air pallet system using jacks or use of other equipment which supports the cask from underneath
  - Using lifting equipment that meets the applicable FSAR/CoC criteria for single failure proof, redundant drop protection, or drop height limits

Other Admin Controls

- Restriction of combustible materials on haul path
- Restriction on moving casks during flood conditions or moving transfer casks
- Restriction on duration of time a cask can be in proximity to a Part 50 non-seismic structure that could impact the cask

Conclusion

- Evaluation of tornado missiles during transient operations is not in the HI-STORM 100 or HI-STORM FW licensing bases
- Sites implement administrative controls to confirm no adverse weather, which further ensures that a tornado missile impact during transient operations is not credible
- Sites have utilized this same approach since the initial dry cask loadings and some inspection reports even document no concerns with the approach
- Suggestion to include via amendment
  - Will cause many sites to stop loading
  - Would require sites to either upgrade to the newer amendment for all existing casks or submit exemption requests
  - Indicates that this situation is not currently in the licensing basis

Tornado Missile Analysis: Orano Perspective

Raheel Haroon-Orano

TN Americas LLC

Tornado Analyses in NUHOMS® Licensing Bases

TN Americas LLC
November 9, 2021

CoC 1042 NUHOMS® EOS
Amendment 0

- The UFSAR for Amendment 0 analyzes the horizontal storage module (HSM) and the transfer cask (TC) body and lid for tornado loads.
- The UFSAR for Amendment 0 accident analysis chapter includes tornado impacts on the HSM and the TC.
- The Amendment 0 NRC SER discussed those HSM and TC analyses and associated accident analyses.
- The Amendment 0 UFSAR operating procedures chapter includes steps performed outdoors.
- When at the HSM, the TC lid is removed, the canister is inserted, and then the HSM door is installed. Those short term operations, which take an hour or two, are not analyzed for tornado wind and missiles.

CoC 1042 NUHOMS® EOS
Amendment 1

- Amendment 1 introduced a new HSM model, the HSM-Matrix (HSM-MX).
- The HSM-MX is a two-tiered HSM, with an associated loading crane, the MX-LC, for loading the two tiers.
- The UFSAR for Amendment 1 analyzed the (HSM-MX) for tornado loads in UFSAR Appendix A. The UFSAR Appendix A accident analysis chapter included tornado impacts on the HSM-MX.
- The Amendment 1 NRC SER discussed those HSM-MX analyses and associated accident analyses.
- The Amendment 1 UFSAR Appendix A operating procedures chapter includes very similar steps performed outdoors as are performed under Amendment 0, but now for loading the HSM-MX, including operating the MX-LC.
- Again, none of those short-term-operational steps were analyzed for tornado impacts.

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Other NUHOMS® CoCs and Amendments

- CoC 1004 Standardized NUHOMS® Amendment 0 was effective 1/23/1995.
- CoC 1004 Amendment 17 became effective 6/7/2021.
  - Hundreds of dry fuel storage systems have been loaded under the various CoC 1004 amendments.
  - All of those CoC 1004 amendments have the same scheme for tornado analysis as described in the CoC 1042 Amendment 0 and Amendment 1 slides and involve very similar short-term-operational steps.
- CoC 1029 (Advanced Standardized NUHOMS®) and CoC 1030 (NUHOMS® HD) also have the same scheme in all amendments.

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Closing Remarks
Jennifer Uhle-NEI

Closing Remarks

- Issue is of very low safety significance
- From a regulatory standpoint . . .
  - Expectation that tornado analyses address all short-term ISFSI operations is outside of the licensing basis for general ISFSI licensees
  - Deals with DSS certifications and site-specific 72.212 evaluations that have been subject to NRC inspection and relied on by general licensees for decades
  - Raises questions regarding whether this is a new interpretation of the regulations that would require general licensees to change SSCs, procedures or organization required to operate the ISFSI (backfitting)
  - VLSSIR process is a good fit for determining whether NRC and industry resources are best spent to resolve the licensing basis question or backfit

Discussion