

TORNADOES AND HURRICANES

Computer Based Training Module Available on NANTeL



ABSTRACT

This CBT is a self-paced, detailed, comprehensive, nuclear industry generic overview of the tornado and hurricane forces on nuclear plants and structures. It includes the key terms and calculations relating to tornadoes and hurricanes, (e.g., pressure differentials, missile protection, the use of TORMIS, etc). The module has undergone one round of revision to address ownership issues and feedback via NANTeL and other sources to make it more effective and seamless for the learners. The final exam was revised to add the open book resource documents link and reformat selected questions to improve clarity based on exam analysis and feedback.



INTENDED AUDIENCE

1. Experienced nuclear plant structural and mechanical engineers who are developing expertise in Tornado and Hurricane wind loads and missile analyses
2. Site engineering Managers or Supervisors.



DURATION

- 1.5 hours
- An additional 8-12 hours for reading materials provided within the CBT

TERMINAL LEARNING OBJECTIVES

1. Identify design basis/licensing basis requirements for a given plant.
2. State applicable Nuclear Regulatory Committee (NRC) regulations and requirements.
3. Identify all loads associated with tornadoes.
4. Differentiate between tornadoes and hurricanes.
5. List available/applicable options for tornado designs.
6. Explain probabilistic evaluations using TORMIS program.
7. Explain the specific limitations for use of TORMIS program.
8. Identify the basis for selection of tornado missile spectrum for deterministic approach.
9. Identify and explain all required local and overall evaluations.

KEY INDUSTRY DOCUMENTS

1. Regulatory Issue Summary (RIS) 2008-14
2. RG 1.76, Rev.1 - "Design Basis Tornado and Tornado Missiles for Nuclear Power Plants" (March 2007)
3. Standard Review Plan, NUREG 0800
4. ACI 349 - (American Concrete Institute) "Code Requirements for Nuclear Safety Related Concrete Structures"
5. ANSI/AISC N690-1994, "Specification for Safety-Related Steel Structures for Nuclear Facilities"
6. ASCE Committee Report on Impactive and Impulsive Loads in Proceedings of ASCE Conference of September 15-17 of 1980
7. ASCE Paper 3269 - "Wind Forces on Structures," Transactions of the American Society of Civil Engineers, Volume 126, Part II (1961)
8. ASCE/SEI 7-05 - "Minimum Design Loads for Buildings and Other Structures" (2006)
9. Bechtel Topical Report BC-TOP-9A - "Design of Structures for Missile Impact"
10. John M. Biggs - "Introduction to Structural Dynamics" McGraw-Hill Book Company (1964)
11. K.W. Johansen - "Yield Line Formulae for Slabs" (British Cement and Concrete Association)
12. RG 1.221 Rev 0 - "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants"
13. Bechtel Topic Report BC-TOP-3A, Tornado Wind Building Design
14. US Army Technical Manual TM 5-858-3, "Designing Facilities to Resist Nuclear Weapon Effects - Structures"
15. NRC AP-600 Design Control Document Chapter 3, Section 3.3. "Wind Loading"
16. US Army Technical Manual TM 5-1300, "Structures to Resist Accidental Explosions"
17. NRC NUREG/CR-7005, "Technical Basis for Regulatory Guidance on Design-Basis Hurricane Wind Speeds for Nuclear Power Plants"
18. RG 1.76 Rev 0, "Design Basis Tornado for Nuclear Power Plants" (April 1974)
19. C. Wayne Young, "Depth Prediction for Earth-Penetrating Projectiles", ASCE Journal of Soil Mechanics and Foundation Engineering, May 1969, pages 803-817
20. NRC RG 1.221 Rev 1 "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants"
21. SRP 3.3.2 "Tornado Loadings" Section II 3.a (i), Rev 2
22. SRP 3.3.2 "Tornado Loadings" Section II B i, Rev 3
23. SRP 3.5.3, Rev 3 "Barrier Design Procedures" (March 2007)
24. SRP 3.5.1.4, Rev 1, "Missiles Generated by Natural Phenomena" (July 1978)
25. SRP 3.5.1.4, Rev 2, "Missiles Generated by Natural Phenomena" (July 1981)
26. SRP 3.5.1.4, Rev 3, "Missiles Generated by Tornadoes and Extreme Winds" (March 2007)
27. SRP 3.8.4, "Other Seismic Category 1 Structures" Rev 4 (September 2013)