

August 15, 2016

MEMORANDUM TO: Brian E. Thomas, Director  
Division of Engineering  
Office of Nuclear Regulatory Research

FROM: Scott C. Flanders, Director */RA/*  
Division of Site Safety & Environmental Analysis  
Office of New Reactors

SUBJECT: RESULTS OF PERIODIC REVIEW OF REGULATORY GUIDE  
1.76

This memorandum documents the US Nuclear Regulatory Commission's (NRC) periodic review of regulatory guide (RG) 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants." Revision 1 to RG 1.76, published in March 2007, provides licensees and applicants with guidance that the staff of the NRC considers acceptable for use in selecting the design-basis tornado and design-basis tornado-generated missiles that a nuclear power plant should be designed to withstand to prevent undue risk to the health and safety of the public. As discussed in Management Directive 6.6, "Regulatory Guides," the NRC staff reviews RGs approximately every 5 years to ensure that the RGs continue to provide useful guidance. Documentation of the NRC staff review of RG 1.76, Revision 1, is enclosed.

Based on the results of the periodic review, the staff concludes that no changes to RG 1.76, Revision 1, are warranted at this time. However, the staff is aware of some ongoing activities that could result in identification of technical and regulatory issues that could warrant addressing in a future revision. Specifically, the National Institute of Standards and Technology (NIST) is presently in the middle of a four-year effort to develop tornado hazard maps, including tornado frequency and damage indicators. Once NIST completes its efforts and publishes its results, the staff will review the results to determine if an updated version of RG 1.76 is warranted.

Enclosure:  
As stated

CONTACT: Brad Harvey, NRO/DSEA  
301-415-4118

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## Regulatory Guide Periodic Review

**Regulatory Guide Number:** 1.76, Revision 1

**Title:** Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants

**Office/Division/Branch:** NRO/DSEA/RHM1/RMOT  
**Technical Lead:** Brad Harvey

**Staff Action Decided:** Reviewed, issues identified for future consideration

**1. What are the known technical or regulatory issues with the current version of the Regulatory Guide (RG)?**

Revision 1 to RG 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants," was published in March 2007. The RG provides guidance that the NRC staff considers acceptable for use in selecting the design-basis tornado and design-basis tornado-generated missiles that a nuclear power plant should be designed to withstand to prevent undue risk to the health and safety of the public. Nuclear power plants must be designed so that they remain in a safe condition under extreme meteorological events, including those that could result in a severe tornado that could reasonably be predicted to occur at the site. The design-basis tornado wind speeds presented in this regulatory guide are based on Revision 2 of NUREG/CR-4461 (ML070810400). The tornado database used in Revision 2 of NUREG/CR-4461 includes information recorded for more than 46,800 tornado segments occurring from January 1, 1950, through August 31, 2003.

Currently various reviews are in progress that are assessing the methodology for defining tornado risk. For example, the National Institute of Standards and Technology (NIST) is in the middle of a four-year effort to develop new tornado hazards maps for the U.S. and the American Society of Civil Engineers (ASCE) has recently convened a standards committee working group to establish methodologies for estimating tornado wind speeds as well. Preliminary results for these activities indicate that the existing tornado hazard map in RG 1.76, Revision 1, may need to be updated to account for tornado database errors, biases, limitations, and uncertainties. The results of these activities, which will not be available for several years, may provide a basis for updating RG 1.76 once they are published. Any new information will be reviewed upon publication and RG 1.76 assessed for the need of a revision at that time.

**2. What is the impact on internal and external stakeholders of not updating the RG for the known issues, in terms of anticipated numbers of licensing and inspection activities over the next several years?**

The design basis tornado for most operating reactors is based on the more conservative Revision 0 to RG 1.76. Consequently, no technical or regulatory issues are anticipated for most operating reactors.

For new reactor designs, the staff anticipates to be reviewing only 1-2 applications in the next several years. If necessary, the NRC staff will deal with these applications on a case-by-case basis.

**3. What is an estimate of the level of effort needed to address identified issues in terms of full-time equivalent (FTE) and contractor resources?**

As no technical or regulatory issues were identified for immediate resolution, no resources are required at this time.

**4. Based on the answers to the questions above, what is the staff action for this guide (Reviewed with no issues identified, Reviewed with issues identified for future consideration, Revise, or Withdraw)?**

Reviewed with potential issues identified for future consideration.

**5. Provide a conceptual plan and timeframe to address the issues identified during the review.**

No issues were identified during this review that warrants updating the R. G. However, NIST is presently in the middle of a four-year effort to develop revised tornado hazard maps. Once NIST completes its efforts and publishes its results, the staff will review the results to determine if an updated version of RG 1.76 is warranted.

**NOTE: This review was conducted in July 2016 and reflects the staff's plans as of that date. These plans are tentative and are subject to change.**