



NUCLEAR ENERGY INSTITUTE

James H. Riley
PRINCIPAL ENGINEER
NUCLEAR GENERATION DIVISION

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Ms. Cindy K. Bladey
Chief, Rules, Announcements, and Directives Branch
Office of Administration
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

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US NRC

Subject: Industry Comments on "Draft Interim Staff Guidance (ISG) for Performing a Tsunami, Surge, or Seiche Hazard Assessment" (JLD-ISG-2012-06, Docket ID NRC-2012-0261)

Project Number: 689

Dear Ms. Bladey:

On October 26, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued a Federal Register Notice (77FR65417) soliciting public comments on draft "Guidance for Performing a Tsunami, Surge, or Seiche Hazard Assessment" (JLD-ISG-2012-06). The Nuclear Energy Institute (NEI)¹ submits the attached comments on behalf of the nuclear energy industry. Our main concerns with the document are summarized below.

- We understand that the intent of the ISG is to provide a summary of the methods that are available to evaluate the subject hazards, without excluding the ability to use any established method. However, the language in the document implies a prejudice against the use of NWS 23 and methods that have been applied to the subject evaluations in current licensing bases. The introduction to the ISG should clearly state the NRC's intention in this regard and the remainder of the document worded in a consistent manner.
- The ISG's discussion of software and examples of its use can be interpreted as a preference for certain software and expectations for uncertainty that should be applied to the results. There is other software that can be used for these evaluations. We understand that

¹ NEI is the organization responsible for establishing unified nuclear industry policy on matters affecting the nuclear energy industry, including the regulatory aspects of generic operational and technical issues. NEI's members include all utilities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect/engineering firms, fuel fabrication facilities, materials licensees, and other organizations and individuals involved in the nuclear energy industry.

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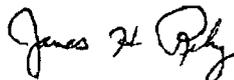
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indication of preference was not intended nor was there intent to establish expectations for application of specific uncertainty values. We request that the ISG be revised accordingly.

- In regard to the two comments above and in other areas, the approach in the ISG sometimes deviates from being informational to become directional (i.e., implying a specific manner in which some part of the evaluation is to be done). We understand that this is not the Staff's intent and request that the document be modified to correct this implication.
- Sections 4.2 through 4.6 of the tsunami portion of the ISG seem to have been copied from the storm surge portion and are not totally applicable in the new context. We request that these sections be revised to improve the applicability of this information to tsunami evaluations.
- The section on paleo-tsunami evaluations can be interpreted to request site specific studies as opposed to a review of existing information. We understand that this is not the Staff's intent and request that the language be modified accordingly.

If there are any questions on this material, please contact me at 202-739-8137; jhr@nei.org.

Sincerely,



James H. Riley

Enclosure

c: Mr. Christopher B. Cook, NRO/DSEA/RGS2, NRC
Mr. Edward G. Miller, NRR/JLD/JPMB, NRC

Fukushima Flooding Task Force

**Comments on JLD-ISG-2012-06,
"Guidance for Performing a Tsunami, Surge, or Seiche Hazard Assessment"**

Comments on Enclosure 1, Storm Surge Evaluations

1. Deterministic vs. Probabilistic Methodology – No firm position is presented in the ISG on acceptability of choice of analysis approach

The ISG describes both deterministic methods (PMH based on NWS-23 for Atlantic hurricanes; ANSI/ANS-2.8-1992 for extra-tropical and Great Lakes) and probabilistic methods (JPM for hurricanes; EST) as being appropriate for the analyses.

- a) Is it the intent of the ISG to accept of both methods? As written, there is ambiguity as to the acceptability of deterministic methods.
- b) The ISG indicates that NWS-23 contains inconsistencies with the current state of the science. Can the ISG provide a more definitive outline of the parameters that are considered to be out-of-date and methods and references that address the revision of the parameters.

2. Time and expense to complete Probabilistic Studies

The Draft Interim Staff Guidance offers an alternative approach for determining the storm surge elevation using a probabilistic or probabilistic-deterministic analysis of synthetic storms that result in an acceptably low probability storm surge. While these analyses can be performed, in most cases the estimated man-hours and level of effort required to complete the probabilistic or probabilistic-deterministic analysis of very low-probability floods (using JPM or JPM-OS) will significantly exceed the NRC estimates for storm surge analyses. As correctly noted in the ISG, FEMA and the USACE are currently utilizing JPM-OS methods for characterizing high-probability floods (i.e., 100-year and 500-year floods). They have performed these studies on a regional basis (with an economy of scale). The studies have been at significant cost and required several years to complete. The JPM and EST methods are time-intensive, computation-intensive, and require specialty software. Additional schedule and expense cannot be easily accommodated.

The costs and time required to complete JPM or JPM-OS analyses (as well as utilize high resolution numerical models like ADCIRC) for the flood re-evaluations can be significantly reduced by formally making available data recently developed by FEMA and the USACE. FEMA Region II and III flood re-mapping is on-going and not yet complete or published; however, development of the detailed coastal bathymetry and topography, Digital Elevation Models (DEMs) and storm statistics (with established storm parameter probability functions) is complete. Similarly, the USACE appears to have developed that information for the Gulf and lower latitudes. Given the time constraints to complete the flood re-evaluations, we request that the NRC work with FEMA and the USACE in a timely manner to formally make

that specific information available to the utilities for use as qualified design input to the flood re-evaluations.

3. NUREG/CR-7134

NUREG CR-7134 is referenced in the ISG (Resio, et. al, 2012), but it does not appear that technical methods and guidance in NUREG CR-7134 are incorporated into the DRAFT ISG. NUREG CR-7134 outlines probabilistic methods that are not presently standard practice in the performance of recent surge analyses for COLAs and ESPs. It would not be possible to meet the present submittal schedule to NRC (March 12, 2013) given the expanded level of effort required to perform the analyses under the methods presented in NUREG CR-7134. For example, The ISG continues to allow use of NWS Technical Report 23 for development of the Probable Maximum Hurricane parameters and ANSI/ANS-2.8-1992 for development of the extra-tropical Probable Maximum Wind Storm parameters. NUREG/CR-7134 states that NWS Report 23 needs updating and identifies the need for refining the PMH parameters presented in NWS23 based on current meteorology and climatology data and understanding of hurricane physics. Detailed, specialized meteorological studies (i.e., based on atmospheric science and not the historical hurricane data) will be required to do this.

Will the methods outlined in the DRAFT ISG, which do not prescribe the use of NUREG CR-7134, be acceptable for the analyses?

4. Terminology

The ISG attempts to clarify various terms: DBF, SH, SWS, SSS, SSS, and DBSS. This causes confusion with the existing terms such as PMH, PMSS, etc. from other NRC guidance and various standards and manuals from USACE, FEMA, USGS, NOAA, NWS, etc. As a clear step forward, what terms would NRC prefer in the 50.54f flooding hazard reevaluation response reports? It may be useful to clarify what terms should be used, what old terms are analogous to the new terms, and what terms are obsolete.

5. Acceptability of Software Applications

The ISG includes only ADCIRC and SLOSH computer software applications. However, there are more software programs (such as DELFT3D, MIKE21, and others) that are currently used to model coastal/atmospheric/planetary boundary layer processes. As the DRAFT is written, it seems to imply that NRC is only endorsing particular software programs. Please clarify.

6. Applicability to Pacific Basins and Great Lakes

In general, much of the NRC's guidance on windstorms is oriented toward the East and Gulf Coasts, and not the Pacific Ocean. For example, the draft ISG references the ANSI/ANS-2.8-1992 guidance as a source of surge data. While ANSI/ANS-2.8-1992 mentions the Pacific region, it does not really provide sufficient Pacific Coast references with it. The ISG also

references the NWS 23 technical report for storm data, which again is only applicable for East and Gulf Coasts. Section 3.2 notes that one should consider what is appropriate for the region.

Better guidance is needed on west coast storm surge phenomena that incorporates the regional differences of hurricane or cyclone events and discusses actual large wave events as driven by Pacific storms. Perhaps it could be indicated that this area need rely on the historical data for hurricane storms and observed data for storm surge.

7. Safety Margins

The ISG is unclear concerning the types and magnitudes of safety margins that will be acceptable. For example:

- a) A 20% margin of error is cited for SLOSH, and this has been typically applied to new plant designs in COLAs and ESPs. If detailed numerical modeling is performed will it be necessary to apply, for example, a 20% margin of error like SLOSH analyses, where SLOSH is less detailed model?
- b) NUREG/CR-7134 presents examples where various margins related to parameter uncertainty, modeling uncertainty, freeboard, climate change, and sea level rise; however, these add up to considerable margins that existing plants are unlikely to meet. These conservatisms may be prudent for new construction, but applying them to existing plants may be overly burdensome.

Clarification would be helpful.

8. Other items for clarification.

- a) Previous versions of the ISG identified a target surge probability for the DBSS of 1×10^{-6} annual exceedance. Please confirm that this target is still valid when performing probability-based analyses in establishing the DBSS?
- b) Discussion/guidance about including the required antecedent water level probability with the surge probability to achieve the combined (1×10^{-6}) target probability would be useful.
- c) Please clarify the requirement to increase the PMH radius of maximum winds beyond the upper bound specified in NWS 23. Is this required to apply to conditions that are not supported by the meteorological record for the latitude being evaluated?
- d) The ISG refers to ANSI/ANS-2.8-1992 (not NUREG/CR-7046) for guidance as to how to apply hurricane parameters developed using NWS 23. Please confirm.
- e) Section 4.5.1 should be clearer on what to include for coincident waves. For example, is ANSI/ANS-2.8-1992 Section 9.1.4 2-year wind still appropriate? Besides

SLOSH, do coincident waves need to be added to ADCIRC, SWAN and STWAVE results? We assume USACE, 2012 is 2012b; should this be used as a guidance?

- f) Section 3.0 states that the USACE models should be used to estimate storm surge. Later (Section 4.3.2.2) there is much discussion on the SLOSH model, which is a NOAA model. NUREG/7046 also discusses SLOSH in detail. The preamble to Section 3 should be revised.
- g) Section 4.2.2.1 states: "However, a detailed site/regional specific meteorological study consistent with NUREG 0800 Section 2.3 should be conducted. This applies to all coastal sites, including the Great Lakes, to verify that the ANSI/ANS-2.8 assumptions reflect the most severe meteorological parameters." It is implied that this may only be needed for the Great Lakes region. We recommend that a review of previous meteorological data should be sufficient for the analyses for Pacific Coast facilities.
- h) Section 4.3.1 refers to current NRC guidance for defining the antecedent water level. Please provide the reference. Also, the sentence beginning with "Due to..." implies that the current NRC guidance should be used (i.e., with the long-term sea level rise). Please consider rewording this sentence for clarity.
- i) Reference USACE, 2009, does not seem to be in public circulation. Considering its importance to the finding that NWS 23 is not consistent with the current state of knowledge, and the recommendation that that the PMH concept be updated with new theoretical concepts and data, it should be readily available. Alternately, if USACE, 2009 was a precursor to Resio, 2012 (NUREG CR-7134) and NUREG CR-7134 is the relevant document, USACE, 2009 should not be referenced.
- j) Section 3.3 (Datums) should reference "*NOAA Paper NOAA/CSC/20718-PUB Topographic and Bathymetric Data Considerations*" and "*NOAA NOS Technical Report: Technical Considerations for Use of Geospatial Data in Sea Level Change Mapping and Assessment*." Since NOAA is the Federal Agency tasked to deal with bathymetric data and responsible for them, NRC should make use of their guidance documents, specifically for vertical datums. These documents also go into detail on sea rise due to climate change, DEM data quality issues, coastline data, and other relevant issues.

Comments on Enclosure 2, Tsunami Evaluations

1. Lessons-Learned from Fukushima Dai-ichi nuclear tsunami –caused disaster

The DRAFT ISG is based primarily on the guidance provided by NUREG/CR-6966 (2009), promulgated after the 2004 Sumatra earthquake and tsunami event. There are no references, or revised guidance, based on studies or "lessons-learned" following the

Fukushima Dai-ichi nuclear tsunami –caused disaster. Will there potentially be revisions to the guidance based on emerging lessons-learned on Fukushima Tsunami disaster?

2. Incomplete/incorrect discussion of tsunami analyses

Draft Enclosure 2, Section 4.2, 4.3, 4.4, 4.5 and 4.6 appear to be copied from Enclosure 1, Section 5.3, 5.4, 5.5, 5.6 and 5.7. These sections should be customized for tsunami analyses.

For example, Section 4.2 presents wind wave runup equations, not tsunami equations. Is it the intent of the guidance to apply the statistical definition used to describe distributions of wind induced waves to tsunami waves? Considering that there is a “well-defined” maximum wave front (as opposed to storm waves, which are a distribution of frequencies and heights), and the number of waves are limited, we are not sure it would be useful to apply this here. Considering the traditional usage associated with wind driven waves, the language here, in combination with the reference to the CEM are confusing and seem to conflict with NUREG CR-7046, Appendix H.

As an additional example, in Section 4.3, the proper tsunami wave numerical programs are not cited. SLOSH is not an appropriate model for tsunami analyses. ADCIRC (and similar models that couple water body and planetary boundary layers) may be adequate with the proper boundary wave input; however, other programs such as FUNWAVE, COULWAVE, MOST, TSUNAMI (and others) are specifically created for analysis of tsunami.

3. Paleo-tsunami Investigations

Enclosure 2, Section 3.3 states, “Any relevant paleo-tsunami evidence should be addressed.” The ISG, and NUREG/CR-6966, do not clearly indicate if site-specific paleo-tsunami investigations are required, or if only a review of previous regional scientific studies is necessary.

4. Use of Probabilistic Approach

PRA, as discussed in detail in the *Marine Geology special issue*, ten Brink et al. (2008) and the NRC's *Workshop on Landslide Tsunami Probability*, Aug. 23-24, 2011, and the *NRC/USGS Workshop Report: Landslide Tsunami Probability, 2012* are important efforts on NRC's part. Considering the effort that has been put into the Probabilistic Tsunami Hazard Analysis (PTHA) development, and the large uncertainties associated with historical landslide sources, using the PTHA approach, combined with a Hierarchical Hazard Assessment (as described by P. Lynett) seems to have promise, especially in areas that lack resolution in undersea data. It is unclear however which approach the NRC prefers, or if it has a preference at all, based on Enclosure 2. Please be more specific as to the preferred current approach that NRC would like to see.

5. Other Items for Clarification

- a) Section 2.2 states: " *The Glossary (Appendix) provides the definitions of Design Basis Flood (DBF), Simulated Tsunami (ST) and Design Basis Tsunami (DBT).*" Neither the term *Simulated Tsunami* nor *Design Basis Tsunami* are defined in the Glossary. NRC should define these terms.

- b) For consistency to Enclosure 1, ANSI/ANS-2.8-1992 "Determining Design Basis Flooding at Power Reactor Sites" should be discussed in section 2.1 and not discussed for the first time in Section 2.2. Additionally, since RG 1.59 has very little of relevance to tsunamis, it should quickly be dismissed in this section as well.