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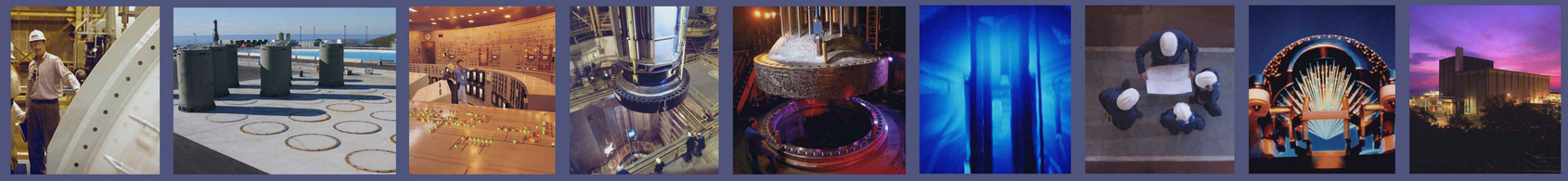


Tsunami Hazards: Overview of the NRC Safety Review Process, NRC-Supported Research, and NRC Plans for Updating Guidance

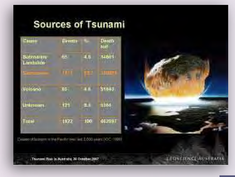
Office of New Reactors

Background

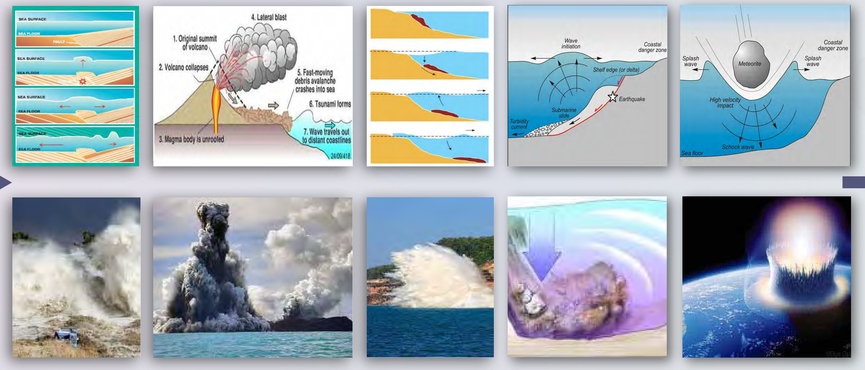
Last year's accident at Fukushima has, understandably, raised public awareness of tsunami hazards and generated many questions about the treatment of the tsunami hazard by the NRC, as well as by nuclear power plant licensees and applicants. NRC staff members from the Office of New Reactors (NRO) and the Office of Nuclear Regulatory Research (RES) provide an overview of tsunami phenomena and discuss how tsunami hazards are currently evaluated in the NRC's safety review process. This poster reviews the NRC's ongoing research activities surrounding tsunami sources, tsunami wave propagation modeling, and warning systems and outlines the NRC's plans to develop design-basis tsunami hazard estimation guidance.

Tsunami Science

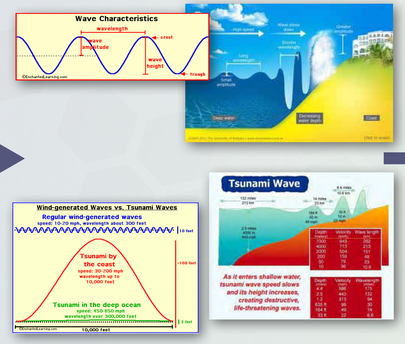
Sources of Tsunami



Tsunami Source Generators



Tsunami Wave Characteristics & Propagation



Tsunami Landfall

Site Safety Reviews

Regulatory Guidance

General Design Criterion 2

10 CFR PT. 100.23

Regulatory Guide 1.102, "Flood Protection for Nuclear Power Plants," Rev. 1 1976

Regulatory Guide 1.59, "Design Basis for Nuclear Power Plants," Rev. 2. 1977

Regulatory Guide 1.206 , "Combined License Applications for Nuclear Power Plants," 2007

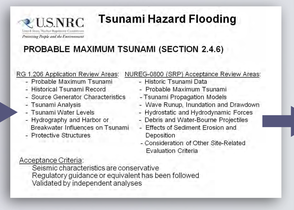
US NRC, Standard Review Plan (NUREG 0800), "Probable Maximum Tsunami Flooding," Section 2.4.6

Hydrology Safety Review Sections

Use the deterministic probable maximum concept

1	Descriptive Hydrology
2	Historic Flood
3	Local Precipitation / River & Streams Floods
4	Dam Failure
5	Surge & Seiche
6	Tsunami Hazards
7	Ice Effects
8	Cooling System
9	Flood Protection
10	Channel Division
11	Low Water
12	Ground Water
13	Effluent Transport

RG 1.206 & NUREG-0800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Tsunami Hazard Flooding

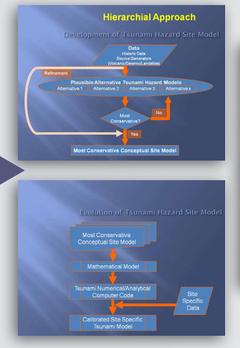
PROBABLE MAXIMUM TSUNAMI (SECTION 2.4.6)

RG 1.206 Application Review Areas:
- Probable Maximum Tsunami
- Historical Tsunami Record
- Source Generator Characteristics
- Tsunami Analysis
- Tsunami Water Levels
- Hydrography and Harbor or Breakwater Influences on Tsunami
- Protective Structures

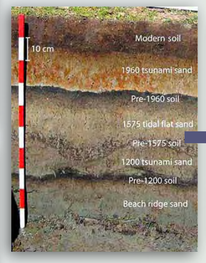
NUREG-0800 (SRP) Acceptance Review Areas:
- Historic Tsunami Data
- Probable Maximum Tsunami
- Tsunami Propagation Models
- Wave Runup, Inundation and Drawdown
- Hydrostatic and Hydrodynamic Forces
- Debris and Water-Bourne Projectiles
- Effects of Sediment Erosion and Deposition
- Consideration of Other Site-Related Evaluation Criteria

Acceptance Criteria:
Seismic characteristics are conservative
Regulatory guidance or equivalent has been followed
Validated by independent analyses

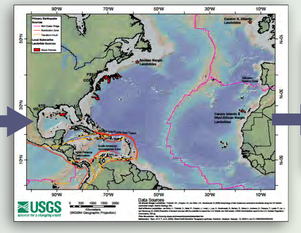
Hierarchical Approach to Tsunami Flood Hazard Safety Reviews



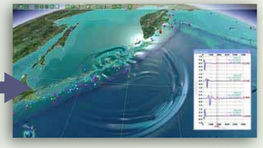
Example of Site Specific Historical Data



Tsunami Source Generators (Gulf of Mexico & Atlantic)



Tsunami Model Simulation



Tsunami Hazard Research

NRC Tsunami Research

Currently the US NRC has a tsunami research program that is focused on developing modern hazard assessment techniques and additional guidance through cooperation with the National Oceanic and Atmospheric Administration (NOAA) and the United States Geological Survey (USGS).

This has already led to several technical reports and an update to NUREG 0-800. The NOAA and USGS contractors are also assisting with NRO reviews of tsunami hazard. A new regulatory guide on tsunami hazard assessment is currently planned in the Office of Nuclear Regulatory Research, although it is not expected to be available in draft form until 2012.

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2004–Formed science review working group (NOAA, NCTR, USGS, USC, Kent State, Universite Laval/Canada and Middle East Technical University/Turkey

2007–Physical study of tsunami sources (USGS)

2007–Tsunami generation and propagation modeling (NOAA)

2008–Tsunami deposit identification and characteristics (USGS)

2008–Funded IAEA Extra-Budgetary Program for knowledge transfer between member states developing tsunami methodologies

2011–Tsunami Landslide Source Probability and Potential Impact on NPPs (USGS/University of Southern California)

2011–Probabilistic Tsunami Hazard Assessment (PTHA) workshop with USGS at MIT/Woods Hole

2011–Tsunami Hazard Modeling for U. S. Coastlines (University of Washington, Seattle)

USGS
science for a changing world

2007–Completed technical report on tsunami sources. Revised August 2008.

2009–Completed technical report on tsunami deposit identification and characteristics

2011–Received NRC funding for tsunami modeling NUREG.

2011–Hosted PTHA workshop at MIT/ Woods Hole

2007 to Present–Completed tsunami hazard safety reviews for the following new reactor applications:

- Calvert Cliffs
- Levy County
- Victoria County
- South Texas
- Turkey Point
- PSEG

NOAA

2004–Community Model Interface for Tsunami (ComMIT): ComMIT will enable government agencies and others in the region to run tsunami models, using data from local or remote databases. This approach has several advantages: (1) it allows nations without a significant cadre of trained modelers to built tsunami modeling capability for forecast and hazard assessment; (2) it allows nations with restrictions on sharing geo-spatial data to input that data locally and not share it with other web-based model users, but at the same time share the model results regionally or globally; and , (3) most significantly, the internet-based approach creates a virtual regional and global community of modelers using the same tools and approaches to understand tsunami threats, and to share information and insights among themselves.

2007–Completed two technical reports; "Standards, Criteria, and Procedures for NOAA Evaluation of Tsunami Numerical Models" and "Scientific and Technical Issues in Tsunami Hazard Assessment of Nuclear Power Plant Sites".

2011–NOAA/Pacific Northwest National Laboratory: NUREG/CR-6966 – "Tsunami Hazard Assessment at Nuclear Power Plant Sites in the United States of America".

IAEA

2011–July 2011 (Vienna, Austria) kickoff meeting of IAEA International Seismic Safety Center (ISSC) working group on tsunami hazards. First official meeting November 2011 (Sendai, Japan). Working group includes Germany, Turkey, India, Pakistan, Italy, Russia, Japan and the United States. Product will be an IAEA tsunami hazard safety report.

Japan–Provided several reports on lessons learned from Fukushima and a probabilistic tsunami hazard assessment technical report (seismic sources). In addition, Japan is providing tsunami modeling (TSUNAMI model code) and tsunami warning software training to third-world member states.

United States, co-chair with Japan for IAEA ISSC working group–Lead for landslide probabilistic tsunami hazard assessment and ComMIT training for member states.

Italy/Turkey–Lead for volcanic tsunami hazard assessment.

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