



Evaluating Applications for New Nuclear Power Plant Sites: A Geologist's Role

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Role of the NRC - Office of New Reactors

- Review applications by prospective licensees for:
 - **Standard Design Certifications**
 - **Combined Licenses**
 - **Early Site Permits**
 - **Limited Work Authorizations**
 - Construction Permits
 - Operating Licenses

Role of the NRC - Office of New Reactors

- NRC Staff is currently reviewing multiple applications by potential licensees wishing to construct and operate new commercial nuclear power facilities throughout the central and eastern United States.
- NRC Staff is also reviewing multiple applications for standard design certifications and applications for early site permits

Siting of New Nuclear Power Plants

- Understanding the geology, seismology and geotechnical engineering characteristics of a proposed site and its surrounding region is a requisite for:
 - Selecting a suitable site for a nuclear power facility.
 - Designing and constructing the facility to ensure safe operation in light of any potential geologic and seismic hazards that may affect the proposed site.
- NRC geoscientists follow regulatory requirements and guidelines to ensure that any utility applying for a license to construct and operate a new facility has assessed all potential geologic and seismic hazards for the proposed site.

NRC Regulatory Requirements

- NRC's regulatory requirements are found in Title 10 of the Code of Federal Regulations (10 CFR).
 - 10 CFR Part 52 – “Licenses, Certifications, and Approvals for Nuclear Power Plants”
 - Defines geologic and seismic characteristics of a proposed site that **must** be described by the applicant in a Safety Analysis Report (SAR) as part of the application process.
 - 10 CFR Part 100.23 – “Geologic and Seismic Siting Criteria”
 - Further defines principle geologic and seismic factors that **must** be considered for evaluating site suitability and adequacy of design bases in light of geologic and seismic characteristics.

NRC Regulatory Guidance

Regulatory Guides (RGs) were prepared by NRC technical experts to provide **guidance** to applicants on acceptable methods for satisfying the requirements in 10 CFR Part 52 and Part 100.

- **RG 1.206** – “Combined License Applications for Nuclear Power Plants – LWR Edition” (June 2007)
- **RG 1.208** – “A Performance-Based Approach to Define Site-Specific Earthquake Ground Motion” (March 2007).
- **RG 1.132** – “Site Investigations for Foundations of Nuclear Power Plants” (October 2003).

NRC Regulatory Guidance, Cont.

- **RG 1.208**

- Provides a method acceptable to the NRC for satisfying the requirements in 10 CFR Part 100.23
- Guidance for characterizing geology and seismicity of the site region (320-km [200-mi] radius), vicinity (40-km [25-mi]), area (8-km [5-mi]), and location (1-km [0.6-mi] radius).
- Defines information needed on earthquake source zone parameters (e.g., recurrence rate and maximum magnitude) for Probabilistic Seismic Hazard Analysis (PSHA).

NRC Regulatory Guidance, cont.

- **NUREG-0800** "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants"
 - Chapter 2 – Site Characteristics and Site Parameters
 - Provides guidance to the NRC staff in performing safety reviews of applications under 10 CFR Part 52 (including requests for amendments).
 - Provides for a rigorous assessment of geologic data presented in the Safety Analysis Report (SAR)
 - Assures the quality and uniformity of staff safety reviews.

The Applicant's Role

- The applicant submits a site Safety Analysis Report (SAR) as part of the required application materials.
 - The SAR presents technical information on geologic, seismic, and geotechnical engineering characteristics for a proposed site
 - Information presented in the SAR results from a review of pertinent literature as well as investigations performed by the applicant in progressively greater detail closer to the site.

Safety Analysis Report (SAR)

- The SAR includes two primary sections dealing specifically with geologic information:
 - Basic Geologic and Seismic Information
 - Surface Faulting

Basic Geologic and Seismic Information

- Physiography
- Geologic History
- Geomorphology
- Stratigraphy
- Lithology
- Structural Geology
- Tectonic History
- Paleoseismology
- Seismology
- Engineering Significance

Surface Faulting Information

- Geologic, seismic and geophysical Investigations
- Geologic evidence, or absence of evidence, for surface deformation
- Correlation of earthquakes with capable tectonic sources
- Ages of most recent deformations
- Relationship of tectonic structures in the area to regional tectonic structures
- Characterization of capable tectonic sources
- Designation of zones of Quaternary deformation
- Potential for surface tectonic deformation at the site

NRC Geologist's Role in the Technical Review Process

- Acceptance Review
 - Check for application completeness
- Technical Review
 - Perform a detailed review and evaluation
 - Verify information and perform confirmatory analyses
 - Document staff evaluations in a publically available Safety Evaluation Report (SER)
 - Participate in the public hearing process

Role of the NRC Geologist:

- Interface with seismologists, geotechnical engineers, hydrologists and environmental scientists.
- NRC geologists focus their technical reviews on the following five topics related to regional and site-specific geology:
 - Tectonic information
 - Seismic source characterization
 - Potential for surface faulting
 - Non-tectonic deformation
 - Conditions caused by human activities
- Emphasis is placed on Quaternary geologic features and processes

Role of the NRC Geologist:

- To perform a detailed technical review of data and conclusions presented in the applicants SAR, conduct independent literature reviews, examine borehole data, and assess the field evidence for lack of tectonic or non-tectonic deformation at or near the proposed site.
- Determine if the interpretations and conclusions accurately capture the geologic field evidence and the current understanding of the informed scientific community

Role of the NRC Geologist:

- Determine if the applicant investigated geologic and seismic site characteristics in sufficient detail to:
 - Allow adequate evaluation of the site in regard to potential for surface or near-surface faulting.
 - Support analysis of site vibratory ground motion.
 - Permit adequate engineering solutions for potential and actual geologic and seismic hazards at the site.

Role of NRC Geologists in the Public Hearing Process

- Testify before a panel of judges in legal public hearings conducted for a site, which includes working closely with NRC legal staff to prepare for and participate in the hearings.
 - Present all significant conclusions regarding the potential geologic and seismic hazards for the site, based on information presented in the SAR and evaluated by NRC staff.

Role of NRC Geologists in Examining Foundation Excavations

- Geologists are available to examine the foundation excavations along with geologic maps and cross sections of excavation walls and floors prepared for a site.
 - Assures that no features indicative of capable tectonic structures (i.e., Quaternary faults or earthquake-induced liquefaction) occur in the excavations.
 - Assures that no dissolution features are present in the foundation unit that may pose a geologic hazard for the site.

Where to go to find out more:

<http://www.nrc.gov/reactors/new-reactors.html>