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DRAFT REGULATORY GUIDE

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(Proposed Revision 4 of Regulatory Guide 1.29, dated September 1978)

SEISMIC DESIGN CLASSIFICATION

A. INTRODUCTION

General Design Criterion (GDC) 2, "Design Bases for Protection Against Natural Phenomena," of Appendix A, "General Design Criteria for Nuclear Power Plants," to Title 10, Part 50, "Domestic Licensing of Production and Utilization Facilities," of the *Code of Federal Regulations* (10 CFR Part 50) requires that nuclear power plant structures, systems, and components (SSCs) important to safety must be designed to withstand the effects of earthquakes without loss of capability to perform their safety functions.

Toward that end, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50 establishes quality assurance requirements for the design, construction, and operation of nuclear power plant SSCs that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. The pertinent requirements of Appendix B apply to all activities affecting the safety-related functions of those SSCs.

In addition, Appendix A, "Seismic and Geologic Siting Criteria for Nuclear Power Plants," to 10 CFR Part 100, "Reactor Site Criteria," requires that all nuclear power plants must be designed so that certain SSCs remain functional if the safe-shutdown earthquake (SSE) occurs. These plant features are those necessary to ensure (1) the integrity of the reactor coolant pressure boundary, (2) the capability to shut down the reactor and maintain it in a safe shutdown condition, or (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guideline exposures of 10 CFR Part 100.

This regulatory guide is being issued in draft form to involve the public in the early stages of the development of a regulatory position in this area. It has not received staff review or approval and does not represent an official NRC staff position.

Public comments are being solicited on this draft guide (including any implementation schedule) and its associated regulatory analysis or value/impact statement. Comments should be accompanied by appropriate supporting data. Written comments may be submitted to the Rules and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. Comments may be submitted electronically through the NRC's interactive rulemaking Web page at <http://www.nrc.gov/what-we-do/regulatory/rulemaking.html>. Copies of comments received may be examined at the NRC's Public Document Room, 11555 Rockville Pike, Rockville, MD. Comments will be most helpful if received by **December 4, 2006**.

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This guide describes a method that the staff of the U.S. Nuclear Regulatory Commission (NRC) considers acceptable for use in identifying and classifying those features of light-water reactor (LWR) nuclear power plants that must be designed to withstand the effects of the SSE. The Advisory Committee on Reactor Safeguards has been consulted regarding this guide and has concurred in the regulatory position.

The NRC issues regulatory guides to describe to the public methods that the staff considers acceptable for use in implementing specific parts of the agency's regulations, to explain techniques that the staff uses in evaluating specific problems or postulated accidents, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations, and compliance with regulatory guides is not required. The NRC issues regulatory guides in draft form to solicit public comment and involve the public in developing the agency's regulatory positions. Draft regulatory guides have not received complete staff review and, therefore, they do not represent official NRC staff positions.

This regulatory guide contains information collections that are covered by the requirements of 10 CFR Part 50, which the Office of Management and Budget (OMB) approved under OMB control number 3150-0011. The NRC may neither conduct nor sponsor, and a person is not required to respond to, an information collection request or requirement unless the requesting document displays a currently valid OMB control number.

B. DISCUSSION

After reviewing a number of applications for construction permits and operating licenses for boiling- and pressurized-water nuclear power plants, the NRC staff developed a seismic design classification system for identifying those plant features that must be designed to withstand the effects of the SSE. In so doing, the staff designated as Seismic Category I those SSCs that must be designed to remain functional if the SSE occurs.

C. REGULATORY POSITION

1. The following SSCs of a nuclear power plant, including their foundations and supports, are designated as Seismic Category I and must be designed to withstand the effects of the SSE and remain functional. The titles and functions of these Seismic Category I SSCs for LWR designs are based on existing technology from prior applications. Certain SSCs previously considered Seismic Category I may no longer have a safety-related function requiring Seismic Category I classification, and certain passive SSCs in new LWR designs may be titled differently. The pertinent quality assurance requirements of Appendix B to 10 CFR Part 50 shall apply to all activities affecting the safety-related functions of these SSCs:
 - a. the reactor coolant pressure boundary
 - b. the reactor core and reactor vessel internals
 - c. systems¹ or portions thereof that are required for (1) emergency core cooling, (2) post-accident containment heat removal, or (3) post-accident containment atmosphere cleanup (e.g., hydrogen removal system)
 - d. systems¹ or portions thereof that are required for (1) reactor shutdown, (2) residual heat removal, or (3) cooling the spent fuel storage pool
 - e. those portions of the steam systems of boiling-water reactors extending from the outermost containment isolation valve up to **but not** including the turbine stop valve, and connected piping of a nominal size of 6.35 cm (2.5 inches) or larger, up to and including the first valve that is either normally closed or capable of automatic closure during all modes of normal reactor operation (the turbine stop valve should be designed to withstand the SSE and maintain its integrity)
 - f. those portions of the steam and feedwater systems of pressurized-water reactors extending from and including the secondary side of steam generators up to and including the outermost containment isolation valves, and connected piping of a nominal size of 6.35 cm (2.5 inches) or larger, up to and including the first valve (including a safety or relief valve) that is either normally closed or capable of automatic closure during all modes of normal reactor operation
 - g. cooling water, component cooling, and auxiliary feedwater systems¹ or portions thereof, including the intake structures, that are required for (1) emergency core cooling, (2) post-accident containment heat removal, (3) post-accident containment atmosphere cleanup, (4) residual heat removal from the reactor, or (5) spent fuel storage pool cooling
 - h. cooling water and sealed water systems¹ or portions thereof that are required for functioning of reactor coolant system components important to safety, such as reactor coolant pumps
 - i. systems¹ or portions thereof that are required to supply fuel for emergency equipment
 - j. all electrical and mechanical devices and circuitry between the process and the input terminals of the actuator systems involved in generating signals that initiate protective action

¹ The system boundary includes those portions of the system required to accomplish the specified safety function and connected piping up to and including the first valve (including a safety or relief valve) that is either normally closed or capable of automatic closure when the safety function is required.

- k. systems¹ or portions thereof that are required for (1) monitoring and (2) actuating systems² important to safety
- l. the spent fuel storage pool structure, including the fuel racks
- m. the reactivity control systems (e.g., control rods, control rod drives, and boron injection system)
- n. the control room, including its associated equipment and all equipment needed to maintain the control room within safe habitability limits for personnel and safe environmental limits for vital equipment
- o. primary and secondary reactor containment
- p. systems,¹ other than radioactive waste management systems,³ not covered by items 1.a through 1.o above that contain or may contain radioactive material and of which postulated failure would result in conservatively calculated potential offsite doses (using meteorology as recommended in Revision 2 of Regulatory Guide 1.3, “Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss-of-Coolant Accident for Boiling-Water Reactors,” and Regulatory Guide 1.4, “Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss-of-Coolant Accident for Pressurized Water Reactors”) that are more than 0.005 Sievert (0.5 rem) to the whole body or its equivalent to any part of the body⁴
- q. the Class 1E electrical systems, including the auxiliary systems for the onsite electric power supplies, that provide the emergency electric power needed for functioning of plant features included in items 1.a through 1.p above

² See Regulatory Guide 1.151, “Instrument Sensing Lines,” July 1983.

³ See Regulatory Guide 1.143, “Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants,” Revision 2, November 2001.

⁴ All regulatory guides listed herein were published by the U.S. Nuclear Regulatory Commission. Most are available electronically through the NRC’s Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>, using an ADAMS accession number specified in the index to the Regulatory Guides Document Collection of the Electronic Reading Room on the NRC’s public Web site, at <http://www.nrc.gov/reading-rm/doc-collections/reg-guides/>. Some guides are also available in Adobe Portable Document Format (PDF) directly from the index to the Regulatory Guides Document Collection. Single copies of regulatory guides may also be obtained free of charge by writing the Reproduction and Distribution Services Section, ADM, USNRC, Washington, DC 20555-0001, or by fax to (301)415-2289, or by email to DISTRIBUTION@nrc.gov. Active guides may also be purchased from the National Technical Information Service (NTIS) on a standing order basis. Details on this service may be obtained by contacting NTIS at 5285 Port Royal Road, Springfield, Virginia 22161, online at <http://www.ntis.gov>, or by telephone at (703) 487-4650. Copies are also available for inspection or copying for a fee from the NRC’s Public Document Room (PDR), which is located at 11555 Rockville Pike, Rockville, Maryland; the PDR’s mailing address is USNRC PDR, Washington, DC 20555-0001. The PDR can also be reached by telephone at (301) 415-4737 or (800) 397-4205, by fax at (301) 415-3548, and by email to PDR@nrc.gov.

2. Those portions of SSCs of which continued function is not required but of which failure could reduce the functioning of any plant feature included in items 1.a through 1.q above to an unacceptable safety level or could result in incapacitating injury to occupants of the control room should be designed and constructed so that the SSE would not cause such failure.⁵
3. At the interface between Seismic Category I and non-Seismic Category I SSCs, the Seismic Category I dynamic analysis requirements should be extended to either the first anchor point in the non-seismic system or a sufficient distance into the non-Seismic Category I system so that the Seismic Category I analysis remains valid.
4. The pertinent quality assurance requirements of Appendix B to 10 CFR Part 50 should be applied to all activities affecting the safety-related functions of those portions of SSCs covered under Regulatory Positions 2 and 3 above.
5. Regulatory Guide 1.189, “Fire Protection for Operating Nuclear Power Plants,” provides guidance used to establish the design requirements for portions of fire protection SSCs to meet the requirements of GDC 2, as they relate to designing those SSCs to withstand the effects of the SSE.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff’s plans for using this draft regulatory guide. No backfitting is intended or approved in connection with its issuance.

The NRC has issued this draft guide to encourage public participation in its development. Except in those cases in which an applicant or licensee proposes or has previously established an acceptable alternative method for complying with specified portions of the NRC’s regulations, the methods to be described in the active guide will reflect public comments and will be used in evaluating (1) submittals in connection with applications for construction permits, standard plant design certifications, operating licenses, early site permits, and combined licenses, and (2) submittals from operating reactor licensees who voluntarily propose to initiate system modifications if there is a clear nexus between the proposed modifications and the subject for which guidance is provided herein.

⁵ Wherever practical, structures and equipment of which failure could possibly cause such injuries should be relocated or separated to the extent required to eliminate that possibility.

REGULATORY ANALYSIS

1. Statement of the Problem

The NRC issued Revision 3 of Regulatory Guide 1.29, “Seismic Design Classification,” in September 1978 for use in identifying SSCs, including their foundations and supports, of light-water-cooled nuclear plants that must be designed to remain functional if the SSE occurs. Those SSCs are classified as Seismic Category I. This revision updates Regulatory Guide 1.29 to reflect current methodologies and knowledge.

2. Objective

The objective of this regulatory action is to review the current version of Regulatory Guide 1.29, and, if required, revise the NRC’s guidance in the area of seismic design classification of SSCs of light-water-cooled nuclear plants.

3. Alternatives and Consequences of Proposed Action

The NRC staff considered the following alternative approaches to guidance regarding seismic design classification:

- (1) Do not revise Regulatory Guide 1.29.
- (2) Update Regulatory Guide 1.29.

3.1 Alternative 1: Do Not Revise Regulatory Guide 1.29

Under this alternative, the NRC would not revise Regulatory Guide 1.29, and licensees would continue to use the current version (Revision 3). This alternative is considered the baseline or “no action” alternative and, as such, involves no value/impact considerations.

3.2 Alternative 2: Update Regulatory Guide 1.29

Under this alternative, the NRC would update Regulatory Guide 1.29 to identify Seismic Category I SSCs of light-water-cooled nuclear plants, which must be designed to remain functional if the SSE earthquake occurs. The staff has endeavored to implement the risk-informed safety classification methodology in accordance with 10 CFR 50.69, “Risk-Informed Categorization and Treatment of SSCs for Nuclear Power Reactors.” However, because of time constraints and limited applications of this voluntary regulatory rule by licensees and applicants, the staff has postponed this effort. The changes in Revision 4 of Regulatory Guide 1.29 include a statement in Regulatory Position 1 acknowledging seismic classification and title changes for SSCs that relate to new LWR designs, clarification of Regulatory Position 3, addition of a new Regulatory Position 5 to refer to Regulatory Guide 1.189 for consideration of portions of fire protection SSCs as Seismic Category I, references to additional regulatory guides (1.143 and 1.151), and some abbreviations and grammatical corrections throughout the body of the guide. This proposed revision includes Seismic Category I SSCs listed in the previously applicable staff position; this revision did not add or delete any SSCs from that list.

4. Conclusion

Based on this regulatory analysis, the staff recommends that the NRC should revise Regulatory Guide 1.29, as discussed above.

BACKFIT ANALYSIS

Regulatory Guide 1.29 provides a list of Seismic Category I SSCs, including their foundations and supports, for use by applicants and licensees of light-water-cooled nuclear plants. This proposed Revision 4 does not require a backfit analysis, as described in 10 CFR 50.109, "Backfitting," because it does not impose a new or alternative provision in the Commission's rules or a regulatory staff position interpreting the Commission's rule that is either new or different from a previously applicable staff position. In addition, this proposed revision does not require modification of or addition to SSCs; design of a facility; or the procedures or organization required to design, construct, or operate a facility.