



U.S. ATOMIC ENERGY COMMISSION

# REGULATORY GUIDE

DIRECTORATE OF REGULATORY STANDARDS

Revision 1  
August 1973

## REGULATORY GUIDE 1.29

### SEISMIC DESIGN CLASSIFICATION\*

#### A. INTRODUCTION

General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena," of Appendix A to 10 CFR Part 50, "General Design Criteria for Nuclear Power Plants," requires that nuclear power plant structures, systems, and components important to safety be designed to withstand the effects of earthquakes without loss of capability to perform their safety functions.

Appendix B to 10 CFR Part 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," establishes quality assurance requirements for the design, construction, and operation of nuclear power plant structures, systems, and components 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 structures, systems, and components.

Proposed Appendix A to 10 CFR Part 100, "Seismic and Geologic Siting Criteria for Nuclear Power Plants," would require that nuclear power plant structures, systems, and components important to safety be designed to withstand the effects of earthquakes. Specifically, proposed Appendix A to 10 CFR Part 100 would require that all nuclear power plants be designed so that, if the Safe Shutdown Earthquake (SSE) occurs, all structures, systems, and components important to safety remain functional. These plant features are those necessary to assure (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 which could result in potential offsite exposures comparable to the guideline exposures of 10 CFR Part 100.

This guide describes an acceptable method of identifying and classifying those plant features that should be designed to withstand the effects of the SSE. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

#### B. DISCUSSION

After reviewing a number of applications for construction permits and operating licenses for boiling and pressurized water nuclear power plants, the AEC Regulatory staff has developed a seismic design classification system for identifying those plant features that should be designed to withstand the effects of the SSE. Those structures, systems, and components that should be designed to remain functional if the SSE occurs have been designated as Seismic Category 1.

#### C. REGULATORY POSITION

1. The following structures, systems, and components of a nuclear power plant, including their foundations and supports, are designated as Seismic Category 1 and should be designed to withstand the effects of the SSE and remain functional. 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 these structures, systems, and components.
  - a. The reactor coolant pressure boundary.
  - b. The reactor core and reactor vessel internals.
  - c. Systems<sup>1</sup> or portions of systems that are

<sup>1</sup>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.

\*This guide is a revision of former Safety Guide 29. As such, it applies to light-water-cooled reactors.

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required for (1) emergency core cooling, (2) postaccident containment heat removal, or (3) postaccident containment atmosphere cleanup (e.g., hydrogen removal system).

d. Systems<sup>1</sup> or portions of systems 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 2-1/2 inches or larger nominal pipe size 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 2-1/2 inches or larger nominal pipe size 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 systems<sup>1</sup> or portions of these systems, including the intake structures, that are required for (1) emergency core cooling, (2) postaccident containment heat removal, (3) postaccident containment atmosphere cleanup, (4) residual heat removal from the reactor, or (5) cooling the spent fuel storage pool.

h. Cooling water and seal water systems<sup>1</sup> or portions of these systems that are required for functioning of reactor coolant system components important to safety, such as reactor coolant pumps.

i. Systems<sup>1</sup> or portions of systems that are required to supply fuel for emergency equipment.

j. All electric and mechanical devices and interties between the process and the input terminals of the actuator systems involved in generating signals that initiate protective action.

k. Systems<sup>1</sup> or portions of systems that are required for (1) monitoring of systems important to safety and (2) actuation of systems 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 vital equipment, cooling systems for vital equipment, and life support systems, and any structures or equipment inside or outside of the control room whose failure could result in incapacitating injury to the occupants of the control room.<sup>2</sup>

o. Primary and secondary reactor containment.

p. Radioactive waste treatment, handling, and disposal systems,<sup>1</sup> except those portions of these systems whose postulated failure would not result in conservatively calculated potential offsite doses (using meteorology as prescribed by Regulatory Guides 1.3 and 1.4) which are more than 0.5 rem to the whole body or its equivalent to any part of the body.

q. Other systems<sup>1</sup> not covered by items l.a. through l.p. above which contain or may contain radioactive material and whose postulated failure would result in conservatively calculated potential offsite doses (using meteorology as prescribed by Regulatory Guides 1.3 and 1.4) which are more than 0.5 rem to the whole body or its equivalent to any part of the body.

r. The Class II electric 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 l.a. through l.q. above.

2. Those portions of structures, systems, or components whose continued function is not required but whose failure could reduce the functioning of any plant feature included in items l.a. through l.r. above to an unacceptable safety level should be designed and constructed so that the SSE would not cause such failure.

3. Seismic Category I design requirements should extend to the first seismic constraint beyond the defined boundaries. Those portions of structures, systems, or components which form interfaces between Seismic Category I and non-Seismic Category I features should be designed to Seismic Category I requirements.

4. The pertinent quality assurance requirements of Appendix B to 10 CFR Part 50 should be applied to the safety requirements of those portions of structures, systems, and components covered under Positions 2 and 3 above.

<sup>1</sup>See footnote 1, p. 1.29-1

<sup>2</sup>Wherever practical, structures and equipment whose failure could possibly cause such injuries should be relocated or separated to the extent required to eliminate this possibility.

required for (1) emergency core cooling, (2) postaccident containment heat removal, or (3) postaccident containment atmosphere cleanup (e.g., hydrogen removal system).

d. Systems<sup>1</sup> or portions of systems 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 2-1/2 inches or larger nominal pipe size 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 2-1/2 inches or larger nominal pipe size 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 systems<sup>1</sup> or portions of these systems, including the intake structures, that are required for (1) emergency core cooling, (2) postaccident containment heat removal, (3) postaccident containment atmosphere cleanup, (4) residual heat removal from the reactor, or (5) cooling the spent fuel storage pool.

h. Cooling water and seal water systems<sup>1</sup> or portions of these systems that are required for functioning of reactor coolant system components important to safety, such as reactor coolant pumps.

i. Systems<sup>2</sup> or portions of systems that are required to supply fuel for emergency equipment.

j. All electric and mechanical devices and circuitry between the process and the input terminals of the actuator systems involved in generating signals that initiate protective action.

k. Systems<sup>1</sup> or portions of systems that are required for (1) monitoring of systems important to safety and (2) actuation of systems 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 vital equipment, cooling systems for vital equipment, and life support systems, and any structures or equipment inside or outside of the control room whose failure could result in incapacitating injury to the occupants of the control room.<sup>2</sup>

o. Primary and secondary reactor containment.

p. Radioactive waste treatment, handling, and disposal systems,<sup>1</sup> except those portions of these systems whose postulated failure would not result in conservatively calculated potential offsite doses (using meteorology as prescribed by Regulatory Guides 1.3 and 1.4) which are more than 0.5 rem to the whole body or its equivalent to any part of the body.

q. Other systems<sup>1</sup> not covered by items 1.a. through 1.p. above which contain or may contain radioactive material and whose postulated failure would result in conservatively calculated potential offsite doses (using meteorology as prescribed by Regulatory Guides 1.3 and 1.4) which are more than 0.5 rem to the whole body or its equivalent to any part of the body.

r. The Class 1B electric 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.q. above.

2. Those portions of structures, systems, or components whose continued function is not required but whose failure could reduce the functioning of any plant feature included in items 1.a. through 1.r. above to an unacceptable safety level should be designed and constructed so that the SSE would not cause such failure.

3. Seismic Category 1 design requirements should extend to the first seismic restraint beyond the defined boundaries. Those portions of structures, systems, or components which form interfaces between Seismic Category 1 and non-Seismic Category 1 features should be designed to Seismic Category 1 requirements.

4. The pertinent quality assurance requirements of Appendix B to 10 CFR Part 50 should be applied to the safety requirements of those portions of structures, systems, and components covered under Positions 2 and 3 above.

<sup>1</sup>See to note 1, p. 1.29-1

<sup>2</sup>Wherever practical, structures and equipment whose failure could possibly cause such injuries should be relocated or separated to the extent required to eliminate this possibility.