U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Regulations and Regulatory Guidance

Public Meeting With AREVA on Fuel Seismic Evaluation

U.S NRC

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1. Up-coming NRC Information Notice

Addressees:

Operating Reactor Licensees, COL Applicants

Purpose:

Inform addressees about possible fuel spacer grid strength degradation due to exposure

Status: In concurrence addressing staff comments

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2. Regulations and Regulatory Guidance

a. Control Rod Insertability During A Seismic Event

Regulatory Basis

Regulation:

Part 50, App. A: General Design Criterion 2

Part 50, App. S: Earthquake Engineering Criteria For Nuclear Power Plants

"…., to design nuclear power plant structures, systems, and components important to safety to withstand the effects of natural phenomena, such as earth quakes, without loss of capability to perform their safety functions."

Regulatory Basis

Part 50, Appendix S. Paragraph IV(a)(3)

"The required safety functions of structures, systems, and components must be assured during and after the vibratory ground motion associated with the Safe Shutdown Earthquake Ground Motion through design, testing or qualification methods."

Regulatory Basis

Part 50. Appendix A
GDC 27

Combined reactivity control systems capability. The reactivity control systems shall be designed to have a combined capability, in conjunction with poison addition by the ECCS, of reliably controlling reactivity changes to assure that under postulated accident conditions and with appropriate margin for stuck rods the capability to cool the core is maintained.

Regulatory Guidance

Standard Review Plan

4.2 Control Rod Insertability Requirements

Page 4.2-5

“SRP Acceptance Criteria

viii. Control rod reactivity and insertability must be maintained.”

Regulatory Guidance

Standard Review Plan

4.2 Control Rod Insertability Requirements

Page 4.2-31

"2. Safe-Shutdown Earthquake

Two criteria apply to the SSE—(1) fuel rod fragmentation must not occur as a result of the seismic loads and (2) control rod insertability must be assured."

Regulatory Guidance

Standard Review Plan

4.2 Control Rod Insertability Requirements

Page 4.2-6

"If interference is determined to be possible, tests are needed to demonstrate control blade/rod insertability consistent with assumptions in safety analyses."

Regulatory Basis

NRC Staff SER on BAW-10133 PA, Rev.1,

Page 7 of SER

Staff Position: For the postulated seismic event (SSE), control rod insertability must be assured.

US EPR D.C Review

2. Regulations and Regulatory Guidance

b. Shut-down Requirements During A Seismic Event

Regulatory Basis

Regulation:

Part 50, App. S: Earthquake Engineering Criteria For Nuclear Power Plants

“ Also, as specified in 50.54(ff), nuclear power plants that have implemented the earthquake engineering criteria described herein must shut down if the criteria in paragraph IV(a)(3) of this appendix are exceeded.”

Regulatory Basis

Regulation:

Part 50, App. S: Paragraph IV(a)(3)

Required Plant Shut-down

"If vibratory ground motion exceeding that of the Operating Basis Earthquake Ground Motion or if significant plant damage occurs, the licensee must shut down the nuclear power plant."

Regulatory Basis

Regulation:

Part 100, Appendix A, V, 2.0 Determination of Operating Basis Earthquake

"…If vibratory ground motion exceeding that of the Operating Basis Earthquake occurs, shutdown of the nuclear power plant will be required…."

AREVA Approach

U.S EPR FSAR 3.7.4

Page 3.7-315

"…The decision for a controlled shutdown will be based primarily on an assessment of the actual damage potential of the event (available within four hours) and on the results of plant inspections (available within eight hours)……"

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AREVA's proposed approach:

Implies that the reactor could remain at power during and following a seismic event.

Without an automatic trip, the reactor with deformed fuel could remain in operation.

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2. Regulations and Regulatory Guidance

d. Coolability Requirements

Regulatory Basis

Criterion 2—Design bases for protection against natural phenomena.

Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these structures, systems, and components shall reflect: (1) Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) **appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena** and (3) the importance of the safety functions to be performed.

Regulatory Guidance

Standard Review Plan

4.2-2 (Rev.3)

The fuel system safety review provides assurance that …… (4) coolability is always maintained. General Design Criterion (GDC) 10, within Appendix A to 10 CFR Part 50, also addresses item 1 above. Specifically, GDC 10 establishes specified acceptable fuel design limits (SAFDLs) that should not be exceeded during any condition of normal operation, including the effects of AOOs.

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Conclusion:

NRC Staff Concerns

With the reduced EOL spacer grid strength, fuel assembly spacer grids may experience plastic deformation under SSE and LOCA loads. The coolability and the control rod insertability of the deformed fuel bundle could be degraded while the reactor is either at power or decay heat level.