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Revision of Examination Guideline for Seismic Design of Nuclear Power Reactor Facilities of Japan

Summary

The Nuclear Safety Commission (NSC) approved the examination guideline for the seismic design of nuclear power reactor facilities on September 19 in 2006, which was revised through the five-year intense discussions in the subcommittee composed of the specialists in the field of earthquake (see Appendix). The main motivation of the revision was the reflection of the significant technical advancements occurred after the former guideline was accepted in 1981 and partially revised in 2001. The advancements include the technologies for the geotechnical investigation for the active faults, the numerical prediction of the strong earthquake motion, and the earthquake-proof design such as seismic isolation, which were enhanced especially after Hyogo-ken Nambu earthquake that caused significant damage in the city of Kobe. The new guideline will be applied to the regulation for the reactor construction in the future. For the existing plants, NSC recommended to the Nuclear and Industrial Safety Agency (NISA) to take actions so that the utilities make an appropriate review on the seismic safety of the nuclear facilities based on the new guideline.

The guideline is used to provide the basis of the judgement in the licensing process for the seismic design policy of the nuclear power plant, and describes the basic procedures to determine the design-basis-ground-motion (DBGM), the classification of the nuclear facility components and systems according to the importance to prevent the radiological hazard, the principle of the seismic design, and the load combination and allowable limit. The basic policies of the guideline are summarized as follows:

- 1) The DBGM (denoted by "Ss" in the guideline) shall be determined conservatively through the consideration of the possible ground motions caused by sufficiently strong earthquakes with clearly-defined source-location or those without clear ones.
- 2) Classification of the nuclear components and systems shall be established according to the importance to avoid radiological hazards to the environment.
- 3) The nuclear components and systems classified in the highest importance level shall be designed to maintain safety functions against DBGM.
- 4) Buildings and structures shall be settled on the grounds having sufficient supporting capability.

Regarding the introduction of the seismic PSA to the guideline, the subcommittee concluded that the seismic PSA is not matured sufficiently enough to provide the quantitative basis for the regulatory judgement. In stead of the quantitative use of the

PSA, the subcommittee recommended to analyze the exceedance probability of DBGGM to provide complementary information to discuss the adequacy of the conservatism in determining DBGGM.

The subcommittee also concluded that the qualitative use of the exceedance probability in the licensing process is helpful to provide opportunities to find and solve problems in calculating the probability, promote the study related to the seismic PSA, and contribute the future risk informed regulation.