Overview
Draft New Safety Standards for Nuclear Power Stations
NRA, Japan

(January 2013)

Introduction

On February 7, 2013, the Nuclear Regulation Authority (NRA) submitted a draft gist of new nuclear safety standards for preliminary public comment. The draft consists of three parts: Design Basis Safety Standards; Severe Accident Measures; Safety Standards relative to Earthquakes and Tsunamis.

Close attention was given to several considerations during the draft preparation- most importantly lessons learned from the Fukushima Daiichi accident, IAEA safety standards and guidelines, and international best practices. A publicly stated pledge to acknowledge and incorporate the highest global safety standards also guided this exercise.

Various investigation reports and studies on Fukushima underlined certain vulnerability and failures in Japan's existing nuclear safety systems, procedures and standards, including a lack of the back-fit system that applies revised standards to existing nuclear reactors. An absence of effective severe accident management measures, vulnerability in countermeasures against the risk of earthquakes and tsunamis, and insufficient preparations against common cause failures are examples. These lessons had to be squarely faced in the formulating new safety standards before the authorities can hope to restore public trust in the nation's peaceful nuclear development and to prevent a recurrence of another nuclear accident.

Similarly, it was found that Japan lagged behind internationally accepted safety principles and guidelines, a situation which also needed redress and readjustment in crafting any new safety standards. Japan's position as a country routinely affected by extreme natural crises also forced the NRA to 'go the extra-mile' in order to achieve a strict and high level of nuclear safety.

After the current but preliminary round of public comment on the proposed draft regulations, a second round of a public consultation is then envisaged before a formal NRA decision is taken by July 2013 as required by the law.

Excerpts

Part I Design-Basis Safety Standards

- Structures, systems and components (SSCs) of critical importance for plant safety must meet strict requirements taking into account common technical standards, rules and guidelines. In particular, safety standards for design basis (DB) should be re-established, taking into careful consideration the lessons of Fukushima, the latest state-of-the-art knowledge and experience on nuclear safety at the national and international level including the safety standards developed and issued by the IAEA.

- Safety measures against natural phenomena (e.g., tornados, forest fires) and external man-made hazards (e.g., an aircraft crash), the reliability of off-site power supply, ultimate heat sink and the functions of SSCs, as well as fire protection measures on site should be strengthened.

Part II Severe Accident Countermeasures

- A strict application of Defense-in-Depth with the layer 4th or more will henceforth become a mandatory regulatory requirement including severe accident management (SAM) that has hitherto stayed on discretionary judgment of licensees.

- Licensees shall be bound by regulation to take countermeasures against:
  - Severe core damage under multiple failures;
  - Containment vessel failure;
  - Severe fuel damage in spent fuel storage pools; and
  - Severe fuel damage in a reactor during shutdown.

- Licensees shall also take measures:
  - To improve the safety margin of equipment for DB requirement against natural phenomena and external man-made hazards;
  - To establish procedures to cool reactors, containment vessels and spent fuel storage pools and to minimize the release of radioactive materials following large scale natural hazards or acts of terrorism;
  - To construct specific safety facilities (SSFs) designed for the case of terrorism

actions (such as an intentional aircraft crash), in order to suppress the release of radioactive materials due to containment damage;

- To prepare systems to suppress the release of radioactive materials outside the site in the case of containment failures; and
- To prepare an evaluation of the effectiveness of countermeasures against severe accidents.

- Regulations are functional requirements in nature. Accordingly, the followings are examples. Equivalent or better measures are acceptable.
  - For heat removal and depressurization of a containment vessel in the event of severe core damage: "filtered containment vessel venting system".
  - For injecting coolant into the bottom of a containment vessel in the event of severe core damage in order to cool melted core: "permanent and portable equipment (e.g., pump trucks, pressure resistant hoses)" which shall be redundant, diversified, independent and dispersed over a wide area.
  - For preventing a hydrogen explosion in a containment vessel: "hydrogen concentration control equipment" and "hydrogen and radioactive material concentration measurement equipment" to measure during severe core damage.
  - For preventing criticality, shielding and cooling the fuel in spent fuel storage pools in the event of Beyond Design Basis Accident (B-DBA): "portable alternate cooling water injection equipment (e.g., cooling water injection line).
  - For mitigating fuel damage and preventing criticality: "spray equipment", which shall be prepared as portable spray equipment (e.g., spray headers, spray lines, pump trucks).
  - For securing make-up water and water sources: "multiple alternate freshwater sources (e.g., water storage tanks, dams, reservoirs)", as well as sea water as a water source to provide sufficient water from the time when a B-DBA occurs until the time when the accident is managed.
  - For securing DC power sources: onsite DC power source equipment able to provide electricity for 8 hours without load-shedding plus 16 hours with load-shedding.
  - For requiring AC power sources: power generation vehicles and connecting facilities.
  - For the control room: an "emergency control room" shall be installed in case operators cannot remain in the main control room.

- Emergency Response Center: the center shall be prepared to command the site in the case of severe accident, and shall not lose their functions due to a design basis earthquake, and shall not be impacted by a design basis tsunami.

- Procedures and Drills
  - Licensees shall develop, in advance, procedures, a personnel drill plan and a necessary system that allow an accurate and flexible handling of B-DBA .

- Specific Safety Facilities (SSFs)
  - SSFs are designed to suppress the unexpected release of large amounts of radioactive materials due to acts of terrorism (including aircraft crash).
  - SSFs shall be located far enough away from reactor buildings to prevent simultaneous failures from terrorism actions (e.g., over 100 meters).
  - SSFs shall be designed to withstand a design basis earthquake and a design basis tsunami (earthquake resistant structures, in watertight buildings and/or located on high ground).
  - SSFs shall be installed with equipment to prevent containment vessel failure.

Part III Earthquakes and Tsunamis

- Although the "Regulatory Guidance for Reviewing Seismic Design of Nuclear Power Reactor Facilities" was revised in September, 2006, by the former Nuclear Safety Commission, further protective measures against earthquakes and tsunamis should be enhanced.

- In this regard, protective measures (e.g., sea walls against tsunamis, anti-inundation measures, no construction of Class S nuclear facilities on the exposure of active faults) should be prepared in line with a more stringent approach on earthquake, active faults and tsunami assessments.

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