What are the Fukushima actions being implemented or planned by Sweden regulators ?

Kjell Spang

Consultant to the Swedish Radiation Safety Authority (SSM)

Stress testing

March 24-25, 2011: The council of EU declared that member states shall begin assessment of risk and safety (stress testing). The criteria should be defined on the basis of experiences gained from the situation in Japan.

May 25, 2011: SSM required all Swedish NPPs to perform reassessments in accordance with the joint specifications for the stress tests as agreed between European nuclear safety regulatory authorities and the European Commission within the framework of ENSREG. Also includes the Swedish central interim storage facility for spent nuclear fuel (CLAB) and *the scope of the Swedish stress tests has been extended to contain evaluations of extreme weather conditions*.

October 31, 2011: Licensee reports delivered to SSM

December 31, 2011: National report shall be delivered to EU

Before April 2012: Peer review by EU

Extreme situations assessed

- Earthquake
- Flooding
- Weather conditions
- Loss of electrical power
- Loss of ultimate heat sink
  - combined with loss of electrical power
- Severe accident management
  - Loss of core cooling
  - Preservation of containment integrity in the event of fuel damage
  - Loss of containment integrity
  - Loss of cooling in the fuel pool

Earthquake

Only the two youngest Swedish NPPs, Oskarshamn 3 and Forsmark 3, were originally analysed and designed to withstand a specified earthquake $1*E^{-5}$ per site per year.

The other eight Swedish NPPs were not initially analysed and designed to withstand a specified earthquake and are not fully verified against Design Basis Earthquake, which will limit the possibility to perform complete analyses.

Assessments directed towards $1*E^{-7}$ per site per year.

Simultaneous flooding and earthquake is not considered

The cooling of the fuel pool may need to be improved.

Flooding

The level of the Design Basis Flood (DBF) is stated for a probability level of 1E-5 per site and year.

Sloshing as a phenomenon may occur if the main cooling water pumps suddenly stop, which will cause a raised water level in the seawater inlet chamber. This is considered for those NPPs where the phenomenon is possible.

Only external flooding is considered. Flooding caused by failure of equipment inside the plant is not considered. Tsunamis are extremely unlikely in Sweden and are therefore not analysed further.

The analyses will be performed up to the level of flooding where the plant will suffer severe damage to the fuel.

Flooding, example Ringhals

Highest anticipated water level increase 2,65 m (based on 1 event per 100000 years)

Ground level 3 m

Stress test for 3,3 m, 4 m, and > 4 m

Conclusions

3,3 m: no damages to the fuel are expected

3,3-4 m: Damages to the fuel are possible

>4 m: Damages to the fuel will occur and essential areas and systems will be out of function.

Weather conditions

The licensees have proposed that weather conditions will not be analysed as a separate item in the stress test reports. SSM will evaluate whether this is sufficient.

Implementations of bad weather conditions in the stress tests as an aggravating circumstance will be determined.

Loss of electrical power

The EU “Stress tests” specifications are interpreted as a renewed safety evaluation of the NPPs’ ability to withstand prolonged loss of power, regardless of the reason for this occurring

Loss of outside power” (LOOP), “LOOP + loss of ordinary back-up source” and “LOOP + loss of ordinary back-up source and loss of any other diverse back-up source

In-depth knowledge in electrical system design is vital not only for the assessment of “loss of power” but also for most of the other stress test scenarios. Therefore the identification and allocation of resources, in order to interact also with other parts of the stress test assessments, is an area of concern for the licensees.

The instrumentation in the filter may need to be further reviewed. Also other actions and strengthening of resorses on the electrical side may be needed. Access to transportable diesel generators may be discussed.

Loss of ultimate heat sink and Loss of ultimate heat sink combined with loss of electrical power

The definition of alternative ultimate heat sink has not been fully settled. It will be further discussed as to whether or not the capabilities of steam generators together with the atmosphere for PWR, and the capability of an isolation condenser for BWR, should be considered alternate ultimate heat sinks.

Severe accident management

The description of accident management consist of two parts: one containing a general description, and one providing a more detailed review of existing strategies, including the strategy for handling the aggravating factors specified in EU “Stress tests” specifications. A similar approach will be used for emergency preparedness

Performance of the Multi Ventury Scrubber System filter (MVSS) is analysed considering long-term accident conditions (more than 24 hours). Analyses are performed to identify cliff-edge effect, specifically related to the performance of the MVSS. This includes estimating the time after which the venting system will have reduced capability to limit the radioactive releases to the environment.

The preparedness and handling of simultaneous damages to more than one unit need to be strengthened. Organisation of access to external water supply is one of the tasks.

Multi-Venturi-Scrubber-System (MVSS)