Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

U06-11 Room:IC Time:May 24 15:05-15:30

Contribution of Earth scientists and engineers to seismic safety of nuclear power plants in Japan

Kojiro Irikura[1*]

[1]Aichi Institute of Technology

The 11 March 2011 giant earthquake with Mw 9.0 occurred off the Pacific coast of Tohoku, which was the largest in the earthquake history in/near Japan. The huge tsunami generated by this earthquake attacked the east-coast lines in the Tohoku, killing or missing more than 30,000 people. Severe accidents of nuclear reactors at the Fukushima Daiichi Nuclear Power Plants extended disasters.

There are four nuclear power plants near the source area of the Mw 9.0 Tohoku earthquake, the Onagawa, the Fukushima-No.1, the Fukushima-No.2, and Tokai-No.2. The Onagawa NPP is closest to the epicenter of the earthquake. But, those four NPPs are located to almost the same distance if closest distance to the source faults is taken.

When the earthquake happened off the Sendai, all of reactor-units at those four plants were automatically shut down and began to be cooled by cooling systems until they were attacked by big tsunami waves. All units at the Onagawa and Tokai Daini NPPs got out of troubles because the heights of tsunami waves were lower than the altitudes of the plant sites.

However, the Fukushima-No.1 and the Fukushima-No.2 plants were damaged by the big tsunami waves, because the heights of tsunami waves there were much higher the altitudes of the plant sites. The external electric power was stopped, water-tanks were broken, and further all of the independents power generation systems were broken. The independents power generation systems were located at the underground room of the turbine building without waterproofing. Therefore, the cooling systems at the Fukushima Daiichi NPP were completely broken. It made severe accidents of the reactors. On the other hand, the external electric power was temporally stopped, therefore the cooling systems at the Fukushima Dani NPP were temporally stopped. But, the water-tanks were not completely broken because the water-tanks were protected by rein-forced concrete buildings. Some of the independents power generation systems were located on ground surface and so not broken, although the rest of the independents power generation were located at underground room of the turbine building and broken by the tsunami waves. Therefore, the cooling systems at the Fukushima Daini NPP were soon recovered.

The severe accidents of the Fukushima No. 1 NPP were caused to deficiency of multifaceted protective mechanisms, not only the tsunami. If the Fukushima No.1 NPP had the defense in depth, the accidents might be minimized.

Most of Earth scientists and engineers have contributed their deep knowledge to seismic safety of nuclear power plants. They also played an important role in making regulatory guide for reviewing seismic design of nuclear power reactor facilities in Japan revised in 2006. The revised seismic regulations required more strict surveys of active faults near nuclear power site, careful evaluation of design basis ground motions and so on, to increase seismic safety of nuclear power plants. However, the accident of Fukushima Daiichi happened during the 3.11 Tohoku earthquake. It damaged public trust in science and technology for nuclear safety. We need to make best efforts to increase seismic safety of nuclear power plants to restore the public trust in science and technology from viewpoints of Earth scientists.

Even if nuclear power plants would be decommissioned, it is necessary to keep seismic safety of the nuclear reactors and fuel rods until the decommissioning projects will be completed.

Keywords: nuclear power plant, regulatory guide, design basis ground motion, design basis tsunami, active fault