FACT SHEET ON NIIGATAKEN CHUETSU-OKI EARTHQUAKE IN JAPAN

The purpose of this fact sheet is to provide an overview of the earthquake that occurred in Japan on July 16, 2007 and its impact on the Kashiwazaki Kariwa nuclear power plant. This paper also provides summary information about the design of US nuclear power plants for earthquakes.

Background

An earthquake with a magnitude 6.6 struck the west coast of Japan on July 16, 2007, at 10:13:28 AM local time, July 15, 09:13:28 PM Eastern Daylight Time. The epicenter of the main shock (37.574°N, 138.440°E) is located about 240 km North-North-West of Tokyo, Japan, and is estimated to have occurred 8-15 kilometers from the Kashiwazaki Kariwa Nuclear Power Plant. The earthquake occurred at the depth of 10 km beneath the earth's surface. The earthquake caused loss of life and multiple injuries, collapsed houses, and cracked highways.

(Image from Google Earth with Overlays by NRC Staff)

At the time of the earthquake, three of the units at the Kashiwazaki Kariwa Nuclear Power Plant were operating and one unit was being restarted following an outage. Those units were automatically shutdown and are being maintained in a safe shutdown condition. Three of the remaining units were shutdown for routine maintenance at the time of the earthquake and remain shutdown.

Impact of the Earthquake on the Kashiwazaki Kariwa Nuclear Power Plant

The following information regarding minor damage to the Japanese nuclear facility was transmitted to the NRC by the Nuclear and Industrial Safety Agency, the Japanese nuclear regulator. The Kashiwazaki Kariwa nuclear power plant experienced two minor leaks and a fire, none affecting the safety of the reactor.

The first leak, reported to be slightly radioactively contaminated water well below regulatory release limits, was detected at Unit 6, which was shut down for maintenance at the time when the earthquake struck. Tokyo Electric Power Company indicated that the leak did not affect the safety of the reactor and did not cause environmental damage. TEPCO indicated that a second leak was identified in the main ventilation stack of Unit 7. They detected iodine, chromium-51, and cobalt-60 being released. The discharge was stopped, but the source had not been identified. The radioactivity of the released materials was well below the regulatory limit, and should not cause environmental damage. There were also several hundred waste drums that tipped over during the quake, and some were found with their lids open. There has not been a confirmed radiation leak from those drums. The earthquake also triggered a fire at an electrical transformer in the switchyard of Unit 3. The fire was extinguished within two hours and did not affect the nuclear reactor.

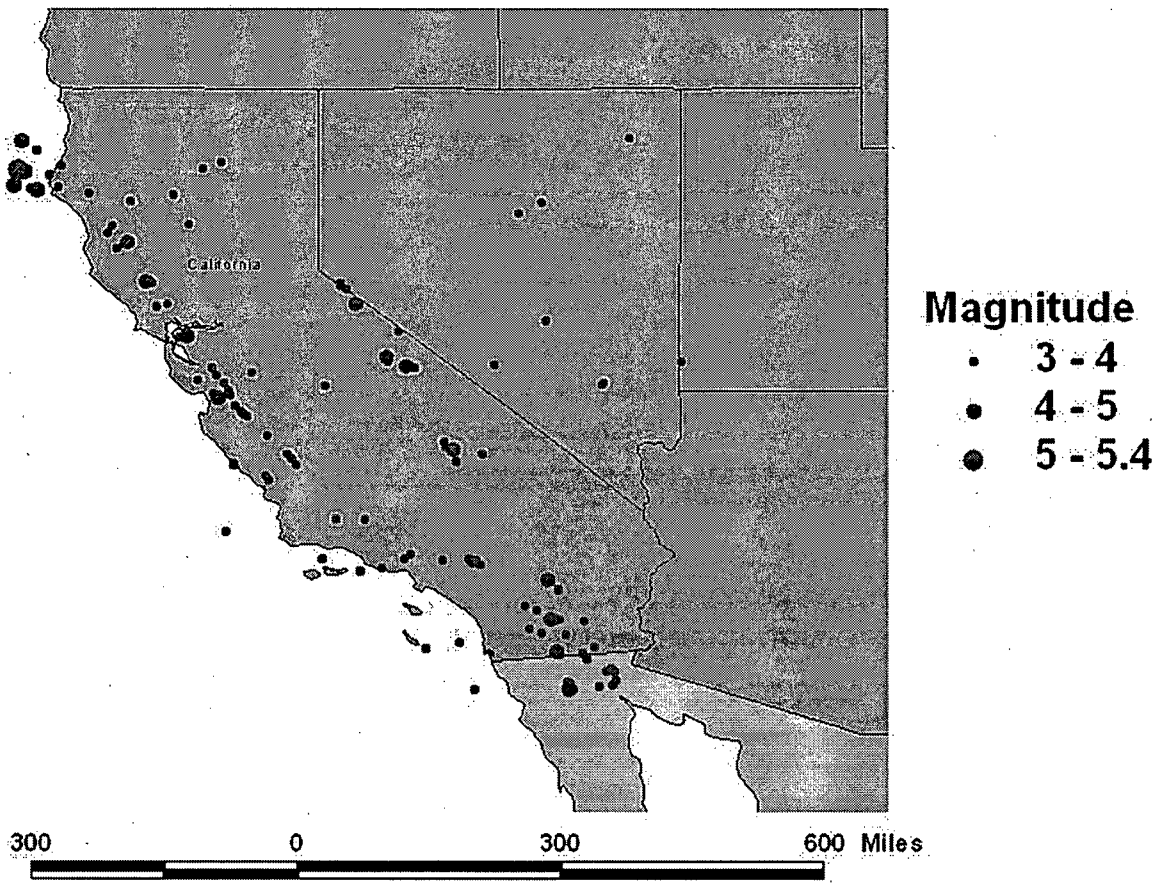
Seismic Design of Nuclear Power Plants

The seismic design of Japanese nuclear power plants is similar to the US designs. However, Japan is located in an earthquake-prone environment, therefore, the Japanese nuclear plants seismic design levels are relatively high. The US nuclear power plants are designed to withstand site-specific naturally occurring events, including earthquakes. NRC regulations require that US plants be designed to safely withstand potential earthquake effects considering local and regional geology and seismology.

2007 Seismic Activity in Japan

(From Kyoshin Network, National Research Institute for Earth Science and Disaster Prevention)

2007 Seismic Activity in California



The US facility located closest to a potentially active fault, the Diablo Canyon plant in California, is built to withstand a seismic event exceeding the magnitude of the quake that occurred in Japan. The Diablo Canyon plant is located ~5 km from the nearest fault, and has been evaluated for a magnitude 7.5 earthquake. The other US plant located in California is San Onofre, which is located ~8 km from the nearest potential fault, and is designed for a magnitude 7.0 earthquake. These California plants are designed to withstand an earthquake greater than the one that occurred in Japan. Other plants in the US are located in areas of much lower seismicity than that of California. Is should be noted that the seismicity at various NPP sites varies depending on the location of any particular power plant. At the power plant site in Japan, the estimated seismicity is substantially higher than that for any US NPP east of the Rocky Mountains. US NPPs are designed to meet the criterion in 10 CFR 100, Appendix A, which requires the ground motion be determined by the maximum historical earthquake.

All of the US nuclear power plants are equipped with seismic instrumentation installed at various locations in the plant. The Diablo Canyon and San Onofre plants also have an auto-trip mechanism for earthquake initiated plant shut-down. Other plants in the US have procedures requiring reactor shutdown

following a significant seismic event to inspect the facility prior to resumption of operations. For a map showing the locations of operating nuclear power plants in the US, click here: http://www.nrc.gov/info-finder/reactor/

In addition, the oldest ten US reactors were also subjected to a Systematic Evaluation Program (SEP) to ensure their seismic adequacy since they were designed to older criteria than that which was used in the design of later generations of US reactors. Further, during the late 1980s and 1990s, all operating US reactors were also evaluated under a program for Individual Plant Examination for External Events (IPEEE), to evaluate the safety of operating US nuclear plants during various external events, including seismic events exceeding the design basis earthquake. Under this program, detailed walkdowns were conducted for each nuclear plant, and identified vulnerabilities were removed. This program improved the seismic capability of the existing plants, and generally determined each plant was capable of withstanding an earthquake higher than the design basis earthquake. Information about this program may be found here: http://www.nrc.gov/reactors/operating/ops-experience/fire-protection/plant-examination.html

The NRC staff will continue to monitor the event and evaluate the results of ongoing facility safety inspections in Japan to identify earthquake-related damage. NRC staff will evaluate the lessons learned from this event to identify any actions necessary to be implemented at operating US reactors and for future US reactor designs.