

# North Anna Earthquake Summary

## Chronology

At 1:51 p.m. EDT on August 23, a magnitude 5.8 earthquake occurred near Mineral, Virginia, close to the North Anna Power Station. The earthquake caused the reactor plants to automatically shut down and resulted in a loss of off-site power. The plant declared an Alert, the second lowest of the four emergency classification levels used by U.S. nuclear plants.

No damage was reported to systems required to maintain the station in a safe condition. Several aftershocks felt in the region later that day did not affect the station.

As designed, the plant's four emergency diesel generators started and supplied power to important electrical equipment while off-site power was unavailable. One of the four emergency diesel generators was taken off-line to repair a coolant leak, and another generator available at the station was started to replace it until the off-site power was restored.

Later that evening, off-site power to the plant was restored, eliminating the need to rely on the back-up generators. On the morning of August 24, North Anna downgraded from an Alert to a Notice of Unusual Event, the lowest of the four emergency classification levels, while the reactor cool-down and inspections of plant equipment and systems continued.

The plant exited the Unusual Event on the afternoon of August 24 after completing all walk-down inspections of the equipment that is most susceptible to seismic activity. The inspections found that the equipment was in satisfactory condition.

Due to additional seismic activity, North Anna again declared an Unusual Event on August 25 following a reported 4.5 magnitude aftershock. The plant exited that Unusual Event later that week. North Anna again declared a new Unusual Event on the morning of September 1 for an aftershock, exiting the event shortly after noon that day. Over several weeks after the original earthquake, the plant experienced a number of aftershocks, none resulting in any impact to plant structures, systems, or components.

After completing reviews and inspections of plant equipment, Dominion submitted a restart readiness plan to the U.S. Nuclear Regulatory Commission (NRC) on September 17, 2011, that summarized the results of their inspections and readiness reviews.

## NRC Actions

Immediately following the earthquake, the NRC staffed an operations center to monitor the events at the North Anna Power Station. On August 29, the NRC dispatched an Augmented Inspection Team (AIT) to the North Anna Power Station to assess the circumstances surrounding the total loss of offsite power and dual unit reactor trip, the emergency diesel generator coolant leak and other plant equipment issues. On September 8, the NRC staff met with Dominion Power to provide the licensee an opportunity to discuss the preliminary findings from their inspections thus far and their future inspection plans.

The AIT will hold an exit meeting on October 3 near the plant to discuss the preliminary findings. That meeting will be open to interested members of the public and the news media,

and NRC staff will be available to answer questions after the results are presented. The AIT will also issue a written report 30 days after the completion of the inspection.

### **Seismic Activity at the North Anna Power Station**

The North Anna Power Station has two Safe Shutdown Earthquake ground motions, one for structures, systems, and components located on top of rock, which is anchored at 0.12 g, and the other for structures, systems, and components located on top of soil, which is anchored at 0.18 g. The plant has two corresponding Operating Basis Earthquake ground motion spectra, anchored at 0.06 g for rock and 0.09 g for soil.

At several frequencies, the spectral and peak ground accelerations as a result of the August 23, 2011 earthquake were greater than those used for the Operating Basis and Design Basis Earthquakes. These results appear to support the NRC's current seismic hazard assessment approaches and the basis for Generic Issue 199 reviews.

Continuing examination of the site indicates minimal earthquake damage, with all safety-related equipment performing as it should, with the possible exception of the coolant leak associated with one of the emergency diesels. The NRC will ensure the plant is capable of continuing to operate safely before the agency will authorize restart of the reactors.

This would be the first instance of an operating reactor in the U.S. exceeding its design limit for ground acceleration. In 1986 the Perry plant in Ohio exceeded its design basis limit while under construction, but it was found acceptable for operation before its license was issued. In 1979 the V.C. Summer plant in South Carolina exceeded its operating basis earthquake (half of the design basis) while under construction, but was found acceptable for operation before its license was issued.

The NRC continues its effort to have U.S. nuclear power plants better characterize seismic risk and their response to earthquakes. By the end of the year, the NRC expects to issue new seismic models and require some individual plant analysis; the plants' responses would be available within one or two years, depending on the analysis used.