Case Study

Earthquake Early Warning
Ignalina Nuclear Power Plant
Visaginas, Lithuania

GeoSIG
swiss made to measure

In Cooperation With
GeoSIG Partner

ELECTRO WATT

Background

The Ignalina Nuclear Power Plant is a closed two-unit RBMK-1500 nuclear power station in Visaginas municipality, Lithuania. Reviews of several Soviet-built nuclear power plants had shown that most of them have an unknown earthquake safety or are under-designed seismically. Before the Ignalina NPP closed in 2004, an earthquake early warning solution was sought to extend the use of the facilities while improving safety measures.

Challenge

The Baltic region is usually regarded as a region of relatively low seismicity. In comparison to Latvia, Estonia and Belarus, Lithuania has the lowest seismic activity. However, the available data indicates, that there is a possibility of strong earthquakes at a distance of some 50 km from INPP. The maximum possible earthquake in the surroundings of INPP is estimated to have a magnitude of 4.5 and a focal depth of 5 to 8 km.

For Soviet-designed nuclear power plants two levels of earthquakes were taken into account, i.e. the design earthquake and the maximum possible earthquake. The first is the maximum earthquake which may happen during the service life of a plant. The second is the maximum possible earthquake in the area. For the different structures and components of INPP, the design and maximum possible earthquakes have peak ground accelerations, respectively, of 0.012 to 0.05g and 0.025 to 0.1g. At the time of the design, this was considered adequate for a site with relatively low seismicity.

A review of the structural integrity of the plant was carried out in 1995. Measures aimed at strengthening the building structures and equipment were considered and judged to be uneconomical. Consequently, it was decided to install an earthquake early warning system as a first step to increase the plant safety in the event of a strong earthquake.

Solution

GeoSIG entered a joint venture with Electrowatt W.L.L., a leading electro-mechanical company under Al-Bandary Group. Electrowatt is an established, well-known name in their field, who specialises in HVAC, electrical-mechanical, plumbing, extra low voltage systems and fire alarms and firefighting. GeoSIG provided a custom Earthquake Early Warning System to meet the project's needs. The EWS consisted of six seismic stations encircling INPP at a radial distance of approximately 30 km and a seventh station at INPP. Each station included three seismic substations, each 500 m apart. The ground motion at each station was measured continuously by three accelerometers and a seismometer. The data was transmitted via telemetry to the control centre at INPP. Early warning alarms were generated if an acceleration threshold was exceeded.

The alarm was used to stop the nuclear reaction by insertion of the control rods. In the RBMK reactors at Ignalina, only 2.5 seconds were required for the insertion of the control rods. The pre-warning time provided by the seismic alarm system for earthquakes occurring at distances greater than 30 km from the site was approximately 4 seconds. Therefore, the nuclear reaction could be stopped before the earthquake arrived.

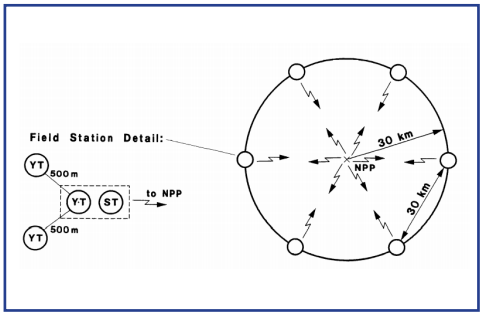
Another solultion with GeoSIG instruments and a capable partner showing that quality and reliability can also be cost effective.

Product links

SMS
AC-23

Ignalina Nuclear Power Plant in Lithuania. Photo by Schyll.

Map showing the Ignalina NPP, located in eastern Lithuana near Lake Drūkšiai.



Layout of earthquake early warning system of Ignalina Nuclear Power Plant (INPP). (YT: accelerometer, ST: seismometer)