

Information note

Le Teil Earthquake, November 11, 2019

An earthquake occurred on November 11, 2019 in the Ardèche region in Le Teil municipality at approximately 10 km to the west of the city Montelimar. The ground motion lasted several seconds in the vicinity of the epicenter and was felt by the population in the south-east of France, particularly up in Saint-Etienne, Grenoble, Lyon, Montpellier and Marseille.

According to a preliminary review of the civil defense units, more than 250 buildings have cracks in the area concerned, leading to the necessity to evacuate several hundred people. Only one house collapsed in an old hamlet belonging to the municipality of Le Teil.

An earthquake can be characterized by its magnitude and its depth. There are several magnitude scales:

- The Local magnitude: magnitude estimated from the maximum amplitude-wave,
- The moment magnitude: magnitude estimated from the energy contained in the seismic signal,
- The surface wave magnitude: magnitude estimated from the amplitude of maximum surface wave.

IRSN has the following information on the earthquake in Le Teil, based on the observations of the monitoring agencies LDG, Renass, Sismalp, and the Côte d'Azur Observatory:

- Local magnitude between 5.1 and 5.4
- Moment magnitude of 5.0

IRSN does not have at this stage specific information about the surface wave magnitude of this earthquake.

The estimates of the depth of the earthquake are variable (3 km to 12 km).

The EDF Nuclear Power Plants of Cruas and Tricastin, each comprising four 900 MWe reactors, are situated respectively 15 km and 25 km from the epicenter.

The buildings and equipment of French Nuclear Power Plants are designed to withstand a certain level of earthquakes characterized by an Earthquake Response Spectrum. An Earthquake Response Spectrum is used to determine the stress of a building or equipment at different frequencies of vibrations produced by an earthquake,

The Earthquake Response Spectrum is often associated with the acceleration at higher frequencies known as 'timing value'.

As regards to the Cruas Nuclear Power Plant, the Earthquake Response Spectrum in force is the one used for the third review of reactor safety. It is setting of 0.26 g. This spectrum has been used for the reevaluation of seismic behavior of the entire installation at the third safety review.

It should be noted that for the nuclear power plant of Cruas, elastomeric paraseismic support have been installed in the construction, between the foundations and the major buildings.

As regards to the nuclear power plant at Tricastin, the Earthquake Response Spectrum in force is the one used for the third review of reactor safety. It is setting of 0.285 g. This spectrum has been used for the reevaluation of the seismic behavior of the entire installation at the third safety review.

The methodology used to determine these Earthquake Response Spectra is defined in specific technical regulations (RFS 2001-01).

This safety rule requests to establish specific areas (so-called seismotectonical areas). These areas are considered homogeneous from the point of view of their potential to generate earthquakes (homogeneous geology, seismic activity, faults...). Then the most important earthquakes known historically in each of these areas (instrumental and historical seismic activity) is identified (deterministic approach). The most important earthquake is then defined as the Maximum Historically Probable Earthquake (MHPE) and it is assumed that it can occur everywhere in its homogeneous seismotectonic area.

The Safe Shutdown Earthquake (SMS) is obtained by increasing the surface wave magnitude of MHPE by 0.5. In addition, the rules require that the indicators of the most ancient paleoearthquakes should be taken into consideration.

The seismic hazards defined according to this approach for the third safety review of the Nuclear Power Plants Cruas and Tricastin is based on the earthquake of 8 August 1873 to define a MHPE of surface wave magnitude of 4.7 to 4 km depth. This led ultimately to an SMS of surface wave magnitude of 5.2 to 4 km depth (below the installation). EDF also takes the Courthezon paleoearthquake as a reference because of its 6.5 magnitude and epicentral distance of 50 km from Cruas and 27 km from Tricastin).

The automatic protection provisions for the centrifuges of the Georges Besse II plant on the Tricastin site, defined for the protection of this industrial plant, have been triggered.

The Institute continues to mobilize its experts to monitor the evolution of the available information.