



The first European early warning system (EWS) for deep strong Vrancea earthquakes is working

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EWS made by NIEP in frame of SAFER (Seismic eArly warning For EuRope) Project-FP-6(Contract nr.036935) is the first European system for real-time early detection and warning of the seismic waves in case of strong deep Vrancea earthquakes. EWS uses the time interval (28-32 seconds) between the moment when earthquake is detected by the borehole and surface local accelerometers network installed in the epicenter area (Vrancea) and the arrival time of the seismic waves in the protected area, to deliver timely integrated information in order to enable actions to be taken before a main destructive shaking takes place. In this time interval the following actions at the user level could be made: shut down critical processes in the chemical factories, slowing down or stopping the trains, moving in a safety position of elevators, stopping the gas or water in the pipes, alarming the civil protection and hospitals in order to be prepared, starting the backup processes for the most important databases belonging to banks, police or companies etc.

The destination of the EWS includes large category of users for many industrial processes and finally, to save life of people. It can be included very easy in the user's infrastructure. An irradiation nuclear installation from "Horia Hulubei National Institute of Physics and Nuclear Engineering" is using the EWS and other 2 nuclear units from Pitesti(Nuclear Reactor) and Turnu Severin(Heavy Water Factory) are connected to EWS. For alerting the 54 hospital surgery rooms and starting of emergency generators from Bucharest it will be installed EWS and the project is on way. For the gas distribution system it was designed inside of NIEP a special device(Patent No.117731/2002) that automatically shut down (directly in the user's facilities) the gas flow in the pipes using locally the first arrival of the P waves.

EWS is meant to contribute for mitigation of the consequences of catastrophic seismic events in particular in large towns and highly populated areas. Early warning system should be viewed as part of an European real-time information system that provide rapid information , about an earthquake impending hazard, to the public and disaster relief organizations before (early warning) and after a strong earthquake (shake maps).This early warning system will offer the first input data in shake map construction.

The innovation with comparable or related systems worldwide is that NIEP will use the EWS to generate a virtual shake map for Bucharest (140 km away of epicentre) immediately after the magnitude is estimated (in 3-4 seconds after the detection in epicentre) and later make corrections by using real time dataflow from each K2 accelerometers installed in Bucharest area, inclusively nonlinear effects.EWS made by NIEP can be considered the first stage to generate and develop the shake map for Bucharest to deep Vrancea earthquakes. Shake Map, new product on work of National Institute for Earth Physics will provide a sound starting point for immediate loss estimation using such methods around of Europe **during** and for **immediate post-earthquake decision-making**.

Early warning- and rapid disaster information systems are important means for strengthening the resilience of our society against the negative consequences of major earthquakes and, therefore, should become central nodes of disaster mitigation. This value added warning information is viewed as a decision support system to European built environment assessment.