Geophysical Research Abstracts
Vol. 12, EGU2010-13715, 2010
EGU General Assembly 2010

Natech Events of August 17, 1999 Kocaeli Earthquake: Aftermath and Lessons Learned

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Kocaeli earthquake (Mw 7.4) on August 17, 1999 was one of the most devastating natural disasters in the modern history of Turkey. Occurred at 03:02am local time, the earthquake resulted in about 17.500 fatalities and 44.000 injured, affected 15 million people with a total property damage of over 15 billion USD. The area struck by the earthquake is one of the industrial heartlands of the country; it is densely populated and heavily industrialized, accounting for 35% of the gross national product. The earthquake caused significant structural damage, machine and equipment loss at industrial facilities, which led to many Natech events ranging from small-sized toxic chemical releases to enormous fires. Among these events, two of them were especially remarkable due to their extent and consequences: the massive fire at the TUPRAS Izmit Refinery and the acrylonitrile (ACN) spill at the AKSA acrylic fiber production plant.

TUPRAS Izmit Refinery, one of the four refineries in Turkey, was the industrial facility that suffered the most damage in the earthquake. Breaking of pipes at the port terminal caused significant amount of oil spill to the sea. Collapse of a stack initiated a fire at the crude oil unit, meanwhile sparks created by the bouncing of floating roofs initiated another fire at the naptha tank farm. The damage in the infrastructure and reduced human resources owing to the earthquake hindered response and fire fighting activities. All population in the vicinity of the refinery had been evacuated that prevented rescue activities from the debris. The fire at the tank farm lasted for 3 days and could only be extinguished by international cooperation. The refinery became operational within 2.5 months and reached its full capacity in 12 months at a cost of 57.8 million USD.

The earthquake damaged three of the storage tanks at the AKSA acrylic fiber production plant and caused 6,400 tons of ACN, which is a highly flammable, toxic and carcinogenic, to be released into air, sea and groundwater. As in the refinery case, the event resulted in the evacuation of nearby towns hindering rescue activities. Although there were no human casualties, all animals and vegetation within the 200m radius of the tanks died. About 200 lawsuits were brought against the company requesting to cover the damage to livestock, farmland, and public health, most of which concluded in the favor of plaintiffs. Although official health statistics are not available, there are serious doubts about increased cancer incidents due to the event. The company setup a comprehensive clean-up program to clean the shallow groundwater aquifer under the facility polluted by ACN. The initial concentration of 80,000 ppm is decreased down to non-detectable levels in 4 years by pumping out 53,000 m^3 of ground water for treatment and recovery.

Although current disaster management legislation in Turkey recognizes the possibility of the occurrence of Natech events during natural disasters and requires them to be taken into account in emergency response plans, regulations are missing for guiding authorities how and in which extent this should be done. Facilities, especially those experienced such events in the past, are mostly self-motivated for implementing precautionary measures against Natechs. In order to give an insight to the current status of Natech awareness, this study reviews Natech preparedness of TUPRAS and AKSA facilities. For this purpose, first, TUPRAS and AKSA events are described in detail. Time-lines of the events are given and their aftermath, including environmental and socioeconomic consequences are presented. The deficiencies in the response and the management activities are highlighted. Recovery works are summarized and precautionary measures that have been put in practice after the events are described. Finally, based on the these information, the lessons learned from the events are discussed.