



Tsunami impact on SEVESO establishments: the case of Setubal municipality, Portugal.

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The seismic activity in Portugal mainland is low, being the largest event the one occurred on November 1, 1755, which generated a tsunami with devastating consequences along the seashore nationwide, namely in Lisbon and Setubal. Nowadays, Setubal municipality has seven working SEVESO establishments, five of the upper-tier category and two of the lower-tier. Therefore, it's of a great relevance to model, describe and understand the tsunami locally, to assess its direct and indirect consequences on the SEVESO establishments and its surroundings. Thus, in this study, we considered the 1755 Lisbon Tsunami as the worst-case scenario. The location and portrayal of the SEVESO establishments was attained from previous studies conducted by the authors for the Setubal's municipal government. The relevant information present on the Hazard Map of Mitrena Peninsula and the compulsory information to the public provided by the Seveso establishments operators were also considered. All the sensitive infrastructures potentially affected by the tsunami in each SEVESO establishment were identified, as well as its contents to help to determine the most likely major accident hazard associated. Whenever possible, a buffered zoning was fixed, based on the probable effects and its consequences. An inventory of transport routes, public and recreational sites, and residential areas nearby the affected SEVESO establishments was made, as well as a portrait of the neighboring population based on the latest national Census. Finally, an assessment of the exposed elements was accomplished.

The tsunami numerical model results show that the tsunami inundates all the low ground areas, with an average inundation depth of less than 1.5 m at the SEVESO establishments. Furthermore, there are several waves over four hours after the earthquake, being the second one the highest. The numerical model results also show that the tsunami arrives at the first Seveso establishment about 35 minutes after the earthquake. It takes about 50 minutes for it to strike the other SEVESO establishments, located on the most eastern region of Setubal municipality. Only one facility is located on high ground and it's not affected by the tsunami, while five establishments are slightly affected, since only their docks are inundated, with mean inundation depths between 0.60 m and 1.42m. However, there is one SEVESO establishment that raises more concern due to the type of stored and manufactured substances. Its precinct is completely inundated, with a mean inundation depth of 0.81 m. The closest residential area from an affected zone of a SEVESO establishment is about 1500 m away. Moreover, the main road that runs along the shoreline and gives access to most SEVESO establishments located on the eastern region of Setubal is not affected by the tsunami but can be compromised by the major accidents triggered by it. The possible inundation of these establishments by a tsunami can trigger a chain of events with severe consequences, either for the environment as well as for humans. Therefore, a solid commitment is required between public authorities and industrial operators to mitigate whatever outcomes from a scenario like this one.