Geophysical Research Abstracts
Vol. 21, EGU2019-14643, 2019
EGU General Assembly 2019

Multi-hazard and singular hazard screening review for European nuclear power plants: analysis and lessons learned

Eric Haecker, James Daniell, Friedemann Wenzel, and Andreas Schaefer

Geophysical Institute and Center for Disaster Management and Risk Reduction Technology, Karlsruhe Institute of Technology, Karlsruhe, Germany (eric.haecker@student.kit.edu)

As part of the EU Project NARSIS (www.narsis.eu), multi-hazard frameworks are being produced in order to create hazard curves and stochastic hazard sets with more than 2 perils simultaneously occurring or coinciding within the impact period of the events. In addition, various hazard parameters for the perils are examined in a vector-based form.

NPPs have had several incidents over the last decades some of which are associated with natural hazards. Two prominent examples are the flooding of the French NPP Blayais in 1999 that caused a shutdown of all four units and affected the safety systems of units 1 and 2 and the Tohoku earthquake of 2011 which lead to the Fukushima Daiichi accident. While the peaceful use of nuclear energy is a topic that is received differently throughout the EU and its different societies, nuclear power is a significant low carbon contributor to the energy mix of the EUs.

There are, 58 NPPs in the EU and Switzerland combined. While this number will most likely decrease over the next decades due to the plans of Germany and Switzerland to phase out their fleet of NPPs until 2022 and 2034 respectively other countries are currently constructing new reactors e.g. Olkiluoto 3 (Finland) and Mochovce 3 and 4 (Slovakia).

This study examined a compilation of a consistent data basis for NPPs situated in the EU and Switzerland with a focus on the design bases for different natural hazards. It was inspired by the European Nuclear Safety Regulators Group (ENSREG) "stress test" of 2011, that provided the unique opportunity to gain data of similar quality and scope on all European NPPs. Until now, although stress test reports were produced for every NPP, the data has been very difficult to come by, with repositories of these reports either missing, incomplete or partial; and details often not available from the synopsis report. Very little data was available for multi-hazard scenarios within the design bases with mostly singular hazards being examined historically.

In addition, different formats and languages have been used for the reports, meaning that data is difficult to find and synthesise. In this study, an aggregation of the stress test data is made examining the relative design levels and reported assumptions in a simplified form.

This is then tested against European scale hazard modelling curves and models for the various perils, however it can be seen that because of updates to most plants and sensitivities, the stress tests only provide a limited view of the redundancy in the plant design, thus the analysis provides the conclusion that theoretical locations using multi-hazard curves and combinations will be developed for generic and decommissioned sites within the project (i.e. earthquake-flood, tsunami-landslide etc.).