

Grouping of Japanese Islands based on spatial-temporal tendencies of natural phenomena

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Post closure safety of a HLW repository is assessed by dose calculations based on comprehensive scenarios which describe likelihood of natural events and potential impacts on the functions for isolation and containment of radionuclides. In principle, likelihood of natural events which may cause adverse impacts on the safety functions, such as fault activities, is evaluated by extrapolating the past tendency into the future. The extrapolation assumes that the tendency of natural events in the past have been maintained no shorter than the period of assessment in the future. It has also been acknowledged that the tendencies of natural phenomena vary depending on the local tectonic evolutions in Japan. NUMO prepares a technical report which develops a pre-selection site-specific safety case where no specific area is specified. Spatial-temporal distribution and tendencies of natural phenomena in Japanese Islands were compiled and grouped to provide basic information for development of natural event scenarios.

The following results were derived based on the latest literature information. The island arc of Japan is divided into the forearc/backarc areas of the volcanic fronts with respect to the existence of Quaternary volcanoes. The backarc areas are subdivided into the closer area from the volcanic front where Quaternary volcanoes are densely distributed and the farther ones where the volcanoes are sparse or absent. The volcanic fronts have almost been fixed since the Pliocene or older ages. Various volcanic activities and spatial-temporal evolutions are identified in the backarc areas during this period. Active faults tend to distribute along the boundary between mountains/hills and basins/planes. Areas are also divided into three with respect to the spatial density of active faults (high/moderate/low). Various styles of faulting and periods of activities are identified within each group. With respect to the average uplift rate during the last 100,000 years, areas with high uplift rate and that with low rate or subsidence are identified. During the longer period of Quaternary, some areas indicate possible occurrence of inversion from subsidence to uplift within several tens of hundred thousand years.

Some implications for the scenario development are described below. Areas in the forearc areas do not have to expect any volcanism, those in the backarc areas need to consider occurrence of volcanic activities, and those far away from volcanic fronts require careful assessment including magma generating processes. With the assumption that the higher the density of fault distribution is, the more likely the area is to be influenced by disruptive events, such area needs to consider the occurrence of events such as branching, extension and induced movement of active faults. Areas with possible inversion from subsidence from uplift during the Quaternary need careful assessment even though the uplift rates during the last 100,000 years are low.

This kind of grouping will help to understand relative position of a certain area within Japan and provide basic information on future occurrence of natural events for scenario development.

Keywords: geological disposal, volcano, fault, uplift/subsidence, likelihood, scenario