Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SCG068-01 Room:104 Time:May 22 14:15-14:30

Focast of natural phenomena and safety analysis for safety of geological disposal

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Since Japan is located in a tectonically active zone, requirements for implementing the geological disposal system will include selection of the repository site from locations where significant impacts of natural phenomena such as volcanism, fault activity and uplift/erosion can be avoided in the future. Future occurrence of such phenomena should be forecasted based on trends that have occurred around the area in question in the past to forecast whether significant impacts can be avoided in the future. Data on the geological environment of the disposal sites and on long-term geological evolution are then obtained to allow selection of a location with suitable conditions for ensuring long-term post-closure safety.

Forecasts of natural phenomena in the future have been made, based mainly on an extrapolation method. In Japan, there is consensus that forecasting natural phenomena one hundred thousand years into the future will be possible based on geological records for the past hundreds of thousand years. However, for a geological disposal system based on confinement and isolation, the time when the maximum dose occurs may substantially exceed one hundred thousand years and strategies for evaluating natural phenomena further into the future are required. Activities for addressing this issue are ongoing as described later.

Management of uncertainties is a key issue for NUMO's quality assurance activities. Generally, uncertainties associated with site characterization include those associated with data and conceptualization of the geological environment, and with forecasts of natural phenomena. Information on such uncertainties will have to be provided for the repository design and safety assessment. Through coordination of repository design and safety assessment, key structures, geological environment characteristics and phenomena that affect the feasibility of constructing the disposal facility and long-term post-closure safety should be identified and reflected in the investigation plan for the subsequent stage (or phase), which should have the effect of reducing uncertainties.

Activities to support safety assessment from the scientific point of view have started recently in NUMO. Scientific advances in the last decade in areas such as plate movement, volcanism, fault activity and uplift/subsidence have been compiled, together with international perspectives on the evaluation of natural phenomena and safety assessment, to identify issues for discussion. The results of the discussion stimulated a study on the stylization of natural phenomena on an individual area-phenomenon basis. The Tohoku area in northern Japan was subdivided into several regions based on differences in the mode of crustal deformation and trends in uplift/subsidence for each region will be investigated on the very long-term.

Keywords: geological disposal, siting, safety analysis, natural phenomena, future forcast, uncertainty