Sub-seabed disposal concept from a viewpoint of a construction of a safety case with an emphasis on palaeohydrogeology

Shigeyuki Saito[1]

[1] Radioactive Waste Management Dept.,MMC

1. Introduction

Safety case is an important concept which explains how to address the reliable safety of geological disposal (OECD/NEA,1999). If based on the concept, hydrological behavior of coastal underground water with an issue of saltwater - freshwater interface and how to deal with spatial and temporal evolution of hydrochemistry are ought to be addressed by understanding the essence of the issue.

2. Safety case and palaeohydrogeology

Important points in the safety case would be a collection of arguments and a given stage of repository development according to the definition by OECD/NEA(1999). This paper presents probable issues in case of taking into consideration of sub-seabed disposal from the viewpoint of palaeohydrogeology.

3. How to understand sub-seabed disposal from the viewpoint of papaeohydrogeology

Sub-seabed disposal concept can be addressed as follows.

#Favorable argument: If formation water has existed which was related to the formation and evolution of the strata, the groundwater shows steady-state existence for the resembling time frame, and the evidence and its knowledge will contribute to sufficient understanding of long-term stability of the geological environment.

#Present issues: At present, theoretical discussion and impact assessment of saline-fresh water interface using groundwater flow analysis have mainly been dealt with, however such issues that are provided by application of darcy velocity or setting up of rough hydrogeological structure and boundary conditions, have not been addressed enough due e.g., to lack of sufficient demonstration data. As a result, there might be a possibility that such a groundwater flow analysis has been conducted that has dealt with different hydrological conditions from a reality.

#Construction of the logic regarding palaeohydrogeology on coastal sedimentary soft rock

Neogene and Quaternary sedimentary soft rocks have widely been distributed along coasts of Japan. Especially, in such a region which has situated in an environment of erosion in regression and sedimentation in transgression for several Ice ages, basic hydrogeological environment can be presented of recharge of meteoric water in regression time and stagnance of the mixed underground water under the virtually zero condition of hydraulic gradient in transgression. Since most of the formations were of marine, the origin of the groundwater was marine. So, groundwater of such a region can be explained by mechanisms of mixing of seawater-origin groundwater and meteoric water in transgression time, progress of water-rock interaction after sedimentation, activity of microbes, etc.

4. Issues provided by inadequate palaeohydrogeological information

It is important to construct an appropriate plan for investigation and gather appropriate palaeohydrogeological information such as hydrochemistry, isotope and mineralogy when drilling investigation is conducted. If those would not be conducted, such problems would be provided as disagreement of explanation of groundwater evolution and geologic history, impossibility of explanation of hydrochemistry by groundwater flow analysis, difficulties of understanding of evolution of effluent groundwater chemistry due to excavation of tunnels and misunderstanding of spatial and temporal variability of groundwater environment after its construction, and inappropriate application of groundwater chemistry to an assessment of engineered barriers.

5. Conclusion

To appropriately understand palaeohydrogeological information mainly on Neogene formations which have been distributed in a direct influence region in transgression and regression, will be one of important pillars for the construction of a safety case on sub-seabed disposal.

[references] Confidence in the Long-term Safety of Deep Geological Repositories - Its Development and Communication - (OECD/NEA, 1999)