# Low level Radio Active Waste Disposal

## Background and Objective

A sub-surface disposal site constructed about 50～100m underground is planned for low-level radioactive waste generated from the driving and decommissioning of a nuclear plant. In the safety evaluation of the sub-surface disposal facilities with the pit disposal facilities, a long-term evaluation is needed on the engineered barrier and natural barrier.

In this project, the engineered barrier and natural barrier in a sub-surface disposal facility decreases the uncertainty by efficient valuation over the long term. In addition to becoming a high valuation technique, we developed barrier material needed for quality inspective system construction.

## Main results

### 1. Proposal of an analytical method for evaluating the effects of gas migration on radioactive waste disposal facilities

In the current concept of repository for radioactive waste disposal, it is pointed out that hydrogen gas is generated inside the engineered barrier by anaerobic corrosion of metals. Thus, it is necessary to evaluate the effect of gas migration on the function of the engineered barrier. In CRIEPI, on the basis of the experimental facts obtained through gas migration tests, a gas migration mechanism in highly-compacted bentonite is proposed [N07005]. Furthermore, it is revealed that the results of gas migration tests can be simulated with accuracy by incorporating the gas migration mechanism into existing computer code “GETFLOWS” (Fig.1, Fig.2) [N09003].

### 2. Construction of a quality inspective system of cement system material at a disposal facility

In the sub-surface disposal facility, a long-term nuclear seed transference control function is needed for cementitious material, so management (quality inspection system) of construction, recuperation after grasping the influence of change in quality and scattering is important [N08081].

We developed a technique that can judge the quality of construction by non-destruction using a surface-layer permeability test in addition to grasping the fixed quantity-style relationship of quality, and obtained a forecast of application to a quality inspective system with a concrete recuperation condition in this laboratory (Fig. 3).

### 3. Effect of highly alkaline solutions leached from cementitious materials on the permeability of the compacted bentonite.

The alteration behavior and change in permeability of compacted bentonite which is one of the engineered barriers were estimated through the combined experiments of immersing and permeability test using highly alkaline solutions of varying chemical compositions [N09015]. In the results of the combined experiments over one year, the permeability of the compacted bentonite was almost constant under the assumed chemical environments of a low-level radioactive waste disposal facility (Fig.4).

A study of the above results is being reflected and has become the basic data for electric companies, a plan of a disposal facility in JNFL, and a safety valuation examination of AESJ academic standards formulation that affects sub-surface disposal and a JCSE academic technique report.

**Other reports** [N09014], [V09029]

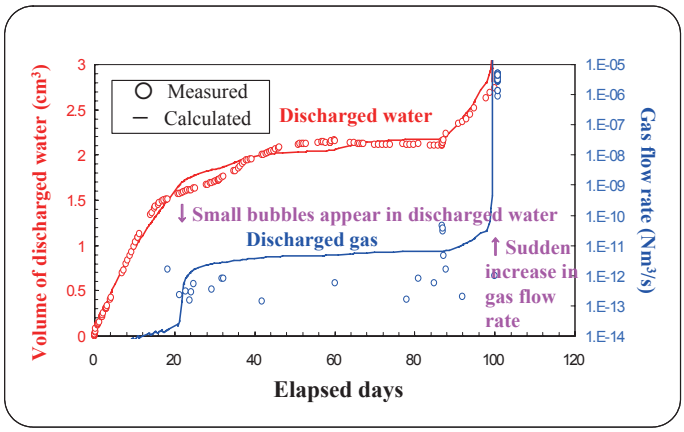
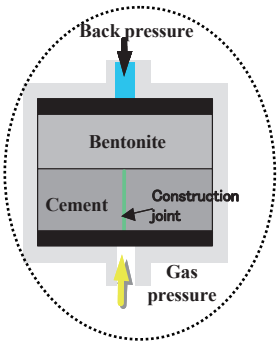



**Fig.1 Numerical simulation of gas migration tests for the bentonite specimen by the modified computer code**

By modifying the existing computer code "GETFLOWS", which was originally developed by Geosphere Environmental Technology Corporation, gas migration test results can be simulated with accuracy, in particular the time history of volume of discharged water and gas flow rate, days of small bubbles appearance and sudden increase in gas flow rate.




Cement mortar blocks containing construction joints are combined with compacted bentonite to form a cement-bentonite composite specimen.

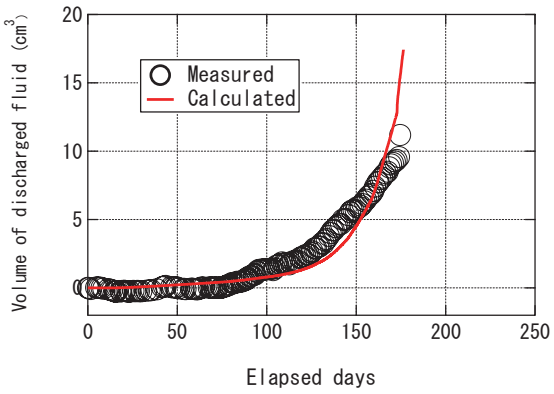



**Fig.2 Numerical simulation of gas migration tests for the cement-bentonite composite specimen by the modified computer code**

The results of the gas migration test for the cement-bentonite composite specimen, which simulates actual gas migration path, can be simulated with accuracy.

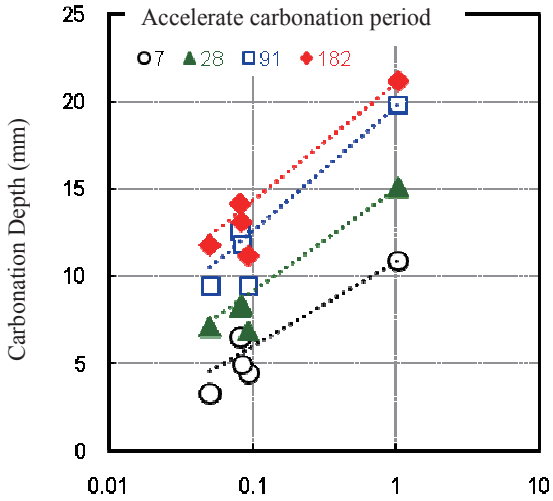



**Fig. 3 Non-destruction valuation by a surface-layer Permeability test related to quality of cement system material**

By implementing recuperation adequately, we showed carbonation resistance as a valuation index a thing that long-term durability property of cementitious material can expect but a making result of such material can detect by a surface-layer permeability feeling coefficient. To confirm whether to be gift with a core seed transference control function that is supposed to be necessary to sub-surface disposal after construction by applying a non-destruction test like this is enabled.

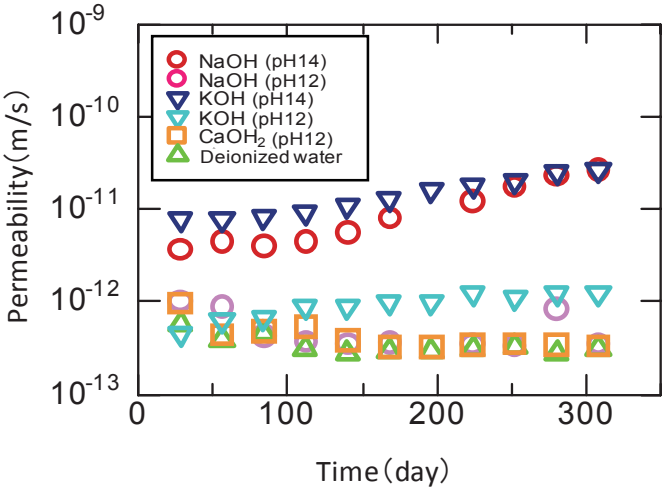



**Fig.4 Evolution in permeability of compacted bentonite immersed in various types of highly alkaline solutions**

The permeability increased with time in the case of alkaline solutions with pH14 as extreme chemical conditions. On the other hand, permeability changed slightly with time under the assumed chemical environments of low-level radioactive waste disposal facility.