11-2 Reasonable Uranium Waste Disposal
—Safety Assessment for Sub-Surface Disposal of Uranium Waste—

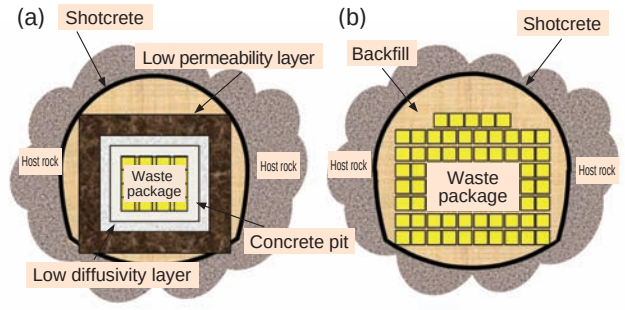

Fig.11-4 Disposal cavern concept
(a) Structure of a typical disposal cavern.
(b) Structure of the disposal cavern in this study.

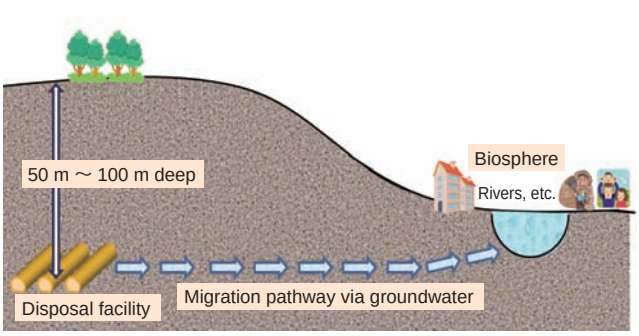

Fig.11-5 "Groundwater scenario" concept
Radionuclides will be transferred to surface water from a disposal facility via groundwater. As a result, the public will be exposed when using surface water. This typical assessment scenario is called a groundwater scenario.

Table 11-1 Scenario development and parameter set-up for safety assessment
The assessment scenarios are arranged with assumed natural events, and change events assumed in the assessment scenarios are set as parameters that change over time.

Assessment scenarios	Assumed change events	Parameter change in safety assessment
Climate change —global cooling	・Decrease in rainwater recharge (recharge volume) ・Drop in sea level	・Decrease in groundwater flow rate over time
Climate change —global warming	・Increase in rainwater recharge (recharge volume) ・Rise in sea level - Intrusion of seawater to the migration pathway	・Increase in groundwater flow rate over time ・Change in chemical condition of groundwater (from reductive to saline)
Tectonics —uplift/erosion	・Disposal cavern comes close to the ground surface due to uplift/erosion ・Increase in permeability by the weathering process (increase in groundwater flow rate) ・Decrease in distance from the disposal cavern to a river due to erosion of the ground surface	・Increase in groundwater flow rate ・Change in chemical condition of groundwater (from reductive to oxidative) ・Decrease in migration pathway length

Radioactive wastes are generated by various activities at the nuclear facilities of JAEA. Safe disposal of these radioactive wastes is an important issue for unimpeded advancement of our activity. We are carrying out safety assessments to confirm the safety of disposal of uranium waste over a long period of time.

Because the half-life of uranium is extremely long, the engineered barriers (low diffusivity layer, low permeability layer, etc.) cannot maintain their confinement function over a long period of time. We therefore devised a reasonable disposal cavern without making use of them (Fig.11-4).

The object of our study is the assessment of public exposure when radionuclides in the disposal facility migrate to the surface water via groundwater (Fig.11-5), when the disposal facility comes close to the ground surface due to uplift/erosion, and so on.

In the safety assessment, it is important to confirm that the public is safe from exposure over a long period of time. Natural events, such as climate change and geomorphological change, are assumed, and it is necessary to predict what will change, and how and when its state will change in the future, based on scientific data. Table 11-1 shows an example of arranging the assessment scenarios (a number of natural events), the related change events, and parameter changes in the safety assessment. The parameters are referenced to data supporting scientific knowledge because a concrete disposal site has not been fixed at present.

Under the conditions mentioned above, we carried out development of assessment scenarios that were assumed to correspond to the groundwater scenario, and performed parameter setting and safety assessment. As a result, we confirmed that the exposure dose to the public was very low even when various event changes were considered.

We assume that in the future it will be important to perform more detailed safety assessments considering specific parameters, the rate of change in the events, and so on.

Reference

Nakatani, T. et al., Study of Subsurface Disposal Concepts for Uranium Waste (5), JAEA-Research 2009-028, 2009, 47p. (in Japanese).