5-8 Evaluating the Radioactivity Concentration of Radioactive Wastes below Which They Can Be Disposed
–Dose Calculation to Derive the Upper Bound of Radioactivity Concentration in Disposal of Transuranium Wastes–

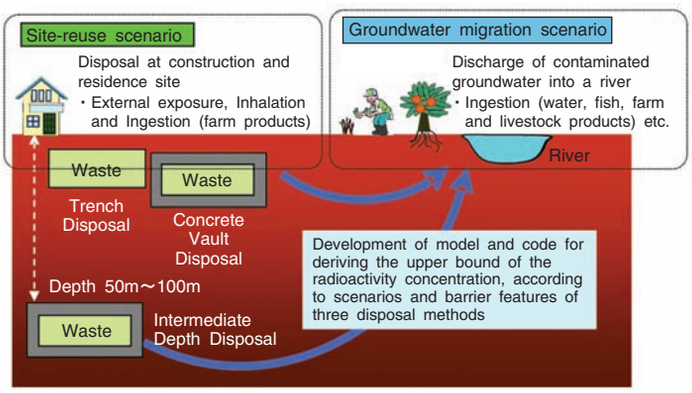

Fig.5-16 Scenarios and exposure pathways used to derive upper bound of radioactivity concentration in disposal
We developed an assessment code (GSA-GCL ver. 2) to derive the upper bound of radioactivity concentration for three disposal methods: trench disposal, concrete vault disposal and intermediate depth disposal. This code supports the dose estimation for the exposure pathways of a site-reuse scenario and of a groundwater migration scenario.

Table5-1 Recommended values of upper bound of radioactivity concentration for 3 disposal methods
We calculated exposure doses resulting from three disposal methods for low-level radioactive wastes. Based on the results, the NSC decided the upper bounds, considering both easiness of measurement of radioactivity concentration and concentration distribution of radioactive waste to be disposed of.

Radionuclide	Recommended Values of Upper bound of Radioactivity Concentration(Bq/ton)		
	Trench Disposal	Concrete Vault Disposal	Intermediate Depth Disposal
C-14	—	1E+11	1E+16
Cl-36	—	—	1E+13
Co-60	1E+10	1E+15	—
Ni-63	—	1E+13	—
Sr-90	1E+07	1E+13	—
Tc-99	—	1E+09	1E+14
I-129	—	—	1E+12
Cs-137	1E+08	1E+14	—
α-radionuclide＊	—	1E+10	1E+11

(＊)The values of upper bound for radionuclide emitting α radiation are represented as those for Am-241 for trench disposal and Np-237 for intermediate depth disposal, respectively.

The upper bound of radioactivity concentration during disposal means the maximum concentration of radionuclides of waste repository allowable in a license application for that repository. In Japan, there are three concepts for methods of disposing of low-level waste categories: near surface disposal without an artificial barrier (trench disposal), near surface disposal with an artificial barrier (concrete vault disposal), and intermediate depth disposal. The Nuclear Reactor Regulation Law has not been amended to set the upper bound of the radioactivity concentration for each of these disposal methods of transuranium (TRU) wastes. We developed an assessment code (GSA-GCL ver. 2) to derive the upper bound of radioactivity concentration for TRU wastes, according to geological and artificial barrier features in three disposal concepts. This code supports the dose estimation for the exposure pathways in two typical scenarios: (a) the site is a residential area and (b) the groundwater from the site is discharged into a river (Fig.5-16). We specified important radionuclides and their dose levels based on calculations using our code, setting appropriate geological and artificial barrier conditions for each disposal method. These dose estimations were adopted in the report published by the Nuclear Safety Commission (NSC); "Upper Bounds of Radioactive Concentration in Burial of Low-Level Radioactive Solid Waste (in Japanese), May 2007". In this report, the NSC recommended upper bound values considering both ease of measurement of the radioactivity concentration and the variation in concentration of radioactive waste to be disposed of (Table5-1). Their recommended values were prescribed by ordinance of Ministry of Economy, Trade and Industry in 2008. This work was performed by JAEA under contract with Nuclear and Industrial Safety Agency in Ministry of Economy, Trade and Industry.

References

Takeda, S. et al., Estimation of Radioactivity Concentration Limit for Trench Disposal of Transuranium and Uranium Wastes (Contract Research), JAEA-Research 2008-044, 2008, 64p. (in Japanese).
Takeda, S. et al., Estimation of Radioactivity Concentration Limit for Intermediate Depth Disposal of Transuranium and Uranium Wastes (Contract Research), JAEA-Research 2008-045, 2008, 60p. (in Japanese).
Sawaguchi, T. et al., Estimation of Radioactivity Concentration Limit for Concrete Vault Disposal of Transuranium and Uranium Wastes (Contract Research), JAEA-Research 2008-046, 2008, 62p. (in Japanese).