8–1 Implementation of Disposal Project of LLW Generated in Research, Medical, and Industrial Facilities

— Preparation of "Concentration Equivalent Dose Criteria" as the Standard for the Selection of Important Nuclides —

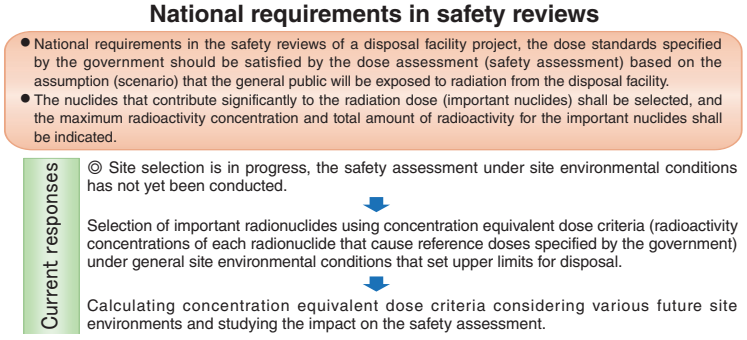
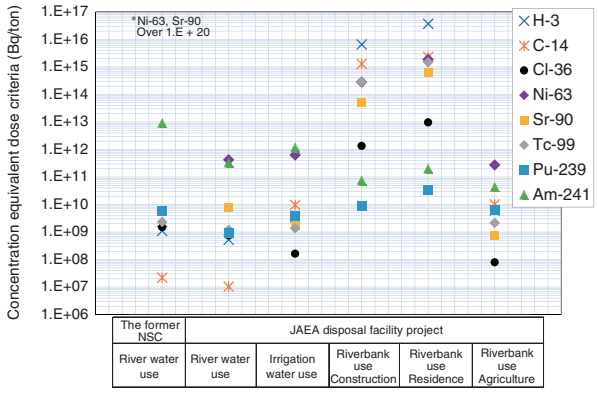


Fig.8–4 National requirements in safety reviews and current responses
Site selection is in progress; in the meantime, we are calculating the concentration equivalent dose criteria for each nuclide, taking into account various future site environments and examining the impact on the safety assessment.



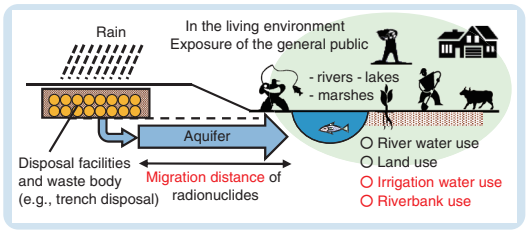


Fig.8–5 Estimation of exposure (scenarios) used in the calculation of concentration equivalent dose criteria
During the safety assessment of disposal facilities, exposure doses are evaluated based on the assumption that the general public will be exposed to the waste from the disposal facilities, and the concentration equivalent dose criteria is calculated. For example, a scenario involving river water use must account for exposure caused by drinking contaminated river water and eating livestock raised on the water.

Fig.8-6 Evaluation of the concentration equivalent dose criteria for trench disposal
The minimum value of C-14 was lower than that found by the NCS in the case of river water use. New nuclides (e.g., Cl-36) with high contribution to exposure were found in water used for irrigation on the riverbank. The established criteria will result in the selection of a wide range of nuclides that are likely to be selected based on the safety assessment that reflect actual site conditions, which will improve the reliability of safety reviews conducted by the government.

We are implementing the project (trench-type and pit-type disposal) at JAEA to dispose low-level radioactive wastes (LLW) generated from JAEA and domestic research, medical, and industrial facilities. National requirements in safety reviews of the disposal facility project, it is necessary to show that the dose standards specified by the government are satisfied by the dose assessment (safety assessment) based on the estimation that the general public will be exposed to radiation from the disposal facility (scenario), and to select the nuclides that contribute significantly to the exposure dose (important nuclides) and show the maximum radioactivity concentration and total radioactivity for the important nuclides.

Additionally, these important nuclides must be selected to promote the smooth implementation of the disposal project, as they are also considered when examining waste treatment methods and measurement and analysis methods of waste. An overview of these requirements and our responses are shown in Fig.8-4.

Important nuclides have been selected from nuclides that have a large ratio between the radioactivity concentration of each nuclide that causes exposure to the dose criterion set by the government (i.e., the concentration equivalent dose criteria) and the radioactivity concentration of the nuclide contained in the waste. Nuclides having a low concentration equivalent dose criterion are more likely to be important nuclides because their exposure doses are high even if the radioactivity concentration in the waste is low.

The concentration equivalent dose criteria established by the former Nuclear Safety Commission (NSC) has been used as the basis for determining the legal upper limit of radioactivity concentration for near-surface disposal. Efforts to select a location for the disposal facility are underway; as such, we established several scenarios that take various future site environments into account to calculate the concentration equivalent dose criteria in each scenario and study their impact on the safety assessment, as summarized in Fig.8-5.

An example of our calculated concentration equivalent dose criteria for representative nuclides assuming trench disposal is shown in Fig.8-6. In the scenario of river water use, the value of C-14, which was previously the minimum value, was found to be even lower due to the estimation of location environmental conditions (e.g., close living area, short migration distance) that would result in higher exposure doses. Additionally, scenarios that account for various site environments (irrigation water use, riverbank use) revealed several other nuclides that contribute significantly to exposure (e.g., Cl-36).

Based on the results of this study, we believe that the use of the concentration equivalent dose criteria based on a wide range of site environments will enable the selection of a wide range of nuclides that are likely to be selected in the safety assessment that reflect actual locations, and will improve the reliability for safety reviews conducted by the government.

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Reference

Sugaya, T. et al., Evaluation of Radioactivity Concentration Corresponding to Dose Criterion for Near Surface Disposal of Radioactive Waste Generated from Research, Medical, and Industrial Facilities, Volume 1, JAEA-Technology 2021-004, 2021, 79p. (in Japanese).