Department of Applied Nuclear Technology

Key words Radiation protection, safety assessment, waste management. Environmental radioactivity, environmental dynamics, consensus building

Doctor of Engineering / Associate professor

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Education

Division of Sustainable Energy and Environmental Engineering, Engineering, Osaka University.
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Professional Background

Research on treatment method of soil containing radioactive materials and safety assessment of several situations in waste management stream and radiological protection in existing exposure situation.

Consultations, Lectures, and Collaborative Research Themes

safety assessment of radioactive materials / Current status of reconstruction of disaster area after TEPCO Fukushima Daiichi Nuclear Power Plant accident / Radiation transport calculation, safety assessment, dynamic of radioactive materials

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Main research themes and their characteristics

「Behavioral of radioactive Cs in soil in the early stage after environmental release and its application to waste treatment」

To know the interaction between radioactive materials and environmental samples, especially soil. It is one of the basic information that is important for understanding the behavior of radioactive materials in the environment or for safe management of radioactive waste. Previous studies have shown that as time passes after the accident, 137Cs migrates to the strong adsorption sites of clay minerals and becomes difficult to move. In Fukushima, vermiculite (weathered biotite) in soil has strong adsorption sites with high Cs selectivity, and it has been revealed that Cs is concentrated.

In this study, it was used as an adsorbent for Cs by further promoting the concentration of Cs in vermiculite that already exists in the soil. As a result of an experiment using 75 km of soil in Fukushima prefecture containing radioactive substances, Cs existing in relatively large particle size categories such as gravel and silt were transferred to clay minerals of small particle size by using potassium ion as an extractant. , It was demonstrated that it is possible to concentrate. A higher volume reduction rate was achieved by combining this chemical transfer treatment with the magnetic separation method. We proposed a waste treatment method to recover vermiculite with high Cs concentration by magnetic separation method, and verified the possibility using the local soil.

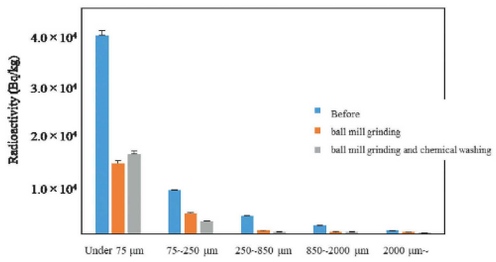

Fig1. The shift of the radionuclide to clay minerals by chemical washing

「Safety assessment of temporary storage site for very low level radioactivity caused from environmental remediation activity」

After the TEPCO's Fukushima Daiichi Nuclear Power Station accident, decontamination activities such as removing soil was carried out as part of environmental remediation activities in a part of the area contaminated with radioactive materials. Because of the huge amount of wastes containing low level radioactive substances, there was no facility to collect all of them immediately, so it was necessary to temporarily prepare temporary storage sites in living areas.

In this research, we performed a safety assessment of the temporary storage sites that was constructed in compliance with the safety requirements in the early stage after the accident, and evaluated it to verify whether the additional exposure dose actually met the regulation value. Exposure scenarios were created and evaluated for the 11 selected facilities by Monte Carlo particle transport simulation code PHITS and safety assessment code SAFRAN. As a result, it was shown that the additional exposure dose was suppressed to 1 mSv/year or less even in first year in all facilities, and the prescribed level was satisfied. I also showed that, the external exposure path way in normal situation is the most important, and from the viewpoint of optimization of Radiation protection, it is desirable to consider the protection measures related to this scenario when considering additional measures.

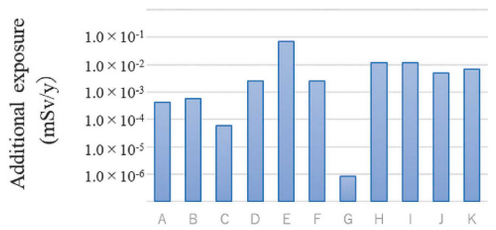

Fig2. Additional exposure by external exposure path way in normal situation

Major academic publications

N.Nomura, F.Mishima, Y.Akiyama, S. Nishijima,
"Fundamental Study on Removal of Arsenic by Magnetic Separation",
IEEE Transactions on Applied Superconductivity, Vol.22, No.3, 3700304, (2012).

K.Yukumatsu, N.Nomura, F.Mishima, Y.Akiyama, S.Nishijima,
"Development of volume reduction method of cesium contaminated soil with magnetic separation"
Progress in Superconductivity and Cryogenics, Vol.18, No.1, pp.10-13, (2016).