

## Parameters on Iodine Leaching in Soil

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### Abstract

Iodine-129 (half-life,  $1.6 \times 10^7$  y) is one of the important radionuclides discharged from the first commercial nuclear fuel reprocessing plant in Rokkasho, Japan that must be considered for the assessment of radiation dose to the public. Part of the  $^{129}\text{I}$  discharged to the atmosphere from the plant is deposited on the land surface and retained in surface soil. Downward migration of  $^{129}\text{I}$  in soil is important for the prediction of its concentration in both ground water and surface soil during and after long-term operation of the reprocessing plant. The aims of this study are to evaluate the rate of downward migration of  $^{129}\text{I}$  in soil around the reprocessing plant and to clarify physico-chemical and biological factors affecting the migration rate. Since the behavior of iodine in the environment strongly depends on its chemical form, developing and applying speciation analysis methods of each chemical form of iodine in soil environment are also an aim of this study.

In FY 2011, preliminary experiments were conducted for establishment of experimental methods, and the following results were obtained.

- (1) Speciation analysis methods of both  $^{125}\text{I}$  and stable iodine in soil solution were examined. Separately, a determination method of  $^{125}\text{I}$  and  $^{125}\text{IO}_3^-$  in soil solution by using an anion exchange disk was developed. A method for routine analysis of stable I was established by combining a high performance liquid chromatograph (HPLC) and an electrochemical detector (ECD). Concentration of total iodine in soil solution was also successfully determined by the HPLC-ECD analysis combined with the UV irradiation technique to decompose dissolved organic iodine.
- (2) Two undisturbed soil core samples were collected in Rokkasho by which laboratory soil column experimental conditions for measurement of downward migration rate using  $^{125}\text{I}$  were examined. The experimental conditions, such as the preparation method of the soil column and chemical components and flow rate of simulated rain, were established.
- (3) To investigate the physico-chemical effect on speciation of stable iodine in soil, a sampling method of soil solution by high-speed centrifugation was developed. Effect of drying treatment of soil sample on leachability of stable iodine was also investigated. Drying treatment of soil drastically increased the leachability.
- (4) To investigate the effect of a specific type of plant on iodine speciation and downward migration rate in surface soil, rice plant cultivars were cultivated. The oxidation and reduction activity of the cultivars were measured by the 1-naphthylamine oxidization and triphenyltetrazolium chloride reduction method, and cultivars used for the experiment on the effect of the specific plant type on the iodine speciation were selected based on the measurement results.