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Japan Atomic Energy Agency

降水中と湧き水中のトリチウム濃度(および各種イオン濃度)から見た福島第一原発事故の影響評価

The Evaluation of the Accident of the Fukushima Daiichi Nuclear Power Plants by Applying the Concentrations of T and of Several Ions in Spring Water (and Precipitation)

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1. Introduction

Tritium (^{3}H or T) is one of isotopes of hydrogen and is one of radioactive materials as natural and artificial ones. The naturally occurring levels of T can be produced by the interaction of cosmic ray in the atmosphere, and its physical half-life is 12.3 years. In recent years, hydrogen explosion occurred at Fukushima nuclear power plants in Japan on 12-15th March, 2011. At the same time, lots of radioactive materials have been released including Tritium (T), and caused serious environmental impacts. Increasing of T concentration gives lots of worry. Considering the above-mentioned, we collected the spring water in mountains around Fukushima prefecture in recent three years (2012, 2013 and 2014) and precipitation in Niigata city, and observed T and major elements (Cl^-, Na^+, Ca^{2+}, and SO^{4-}, etc.) in these samples to find the effects of concentration and of these elements on the environment.

2. Experiment

The sample water was distillated first. After being distillated, each sample was subsequently enriched by electrolytic enrichment method (SPE method). Then after electrolytic enrichment, 30 mL of the enriched sample was introduced into 145 mL polyethylene scintillation vial, and added 100 mL of the liquid scintillation cocktail. At last, T concentration of each enriched sample was measured by a low-background liquid scintillation counter.

In addition, concentrations of Cl^- and SO^{4-} were measured by an Ion Chromatography, Ca^{2+} and Mg^{2+} by an Atomic Absorption Spectrophotometry, Na^+ and K^+ by a Flame Spectrophotometry.

3. Results and discussion

The concentration of T in spring water was measured in August, 2012, September, 2013 and July, 2014, and are shown in Fig.1. The broken line shows the average of T concentration of 6 spring waters in 2012. Comparing of T concentrations in 2012 and 2013 with each other, it is found T concentration of spring water in 2013 is similar to each other.

Comparing T concentrations in the three years with each other, it seems that the small variation of T concentration in the environment occurred. So it can be thought that the influence of Fukushima nuclear accident is so small.

Furthermore, from the figure, following (1) and (2) were found.

(1) The variation of T concentration in recent three years (2012, 2013 and 2014) can be clarified.

(2) The effect of the accident on spring water in mountains around the Fukushima prefecture is so small.

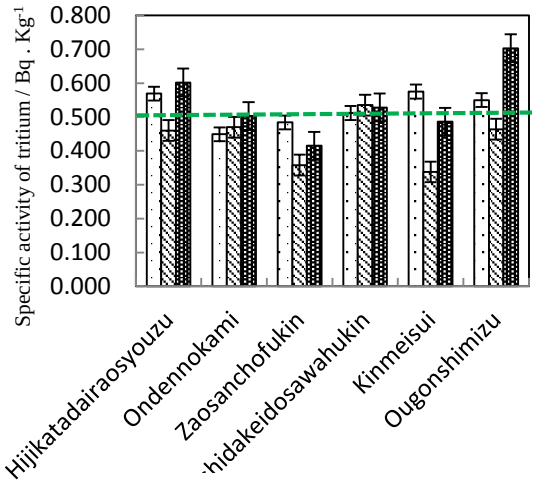

Fig.1　Specific activity of tritium in each mountains from 2012 to 2014

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