§24. Study on Behavior of Environmental Tritium and Assessment of Influence on Environment

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The levels of tritium in the atmosphere nowadays are those of natural origin before the nuclear test. Nuclear power stations, nuclear reprocessing plants and fusion facilities are observed as a further occurrence source. Then, in order to appraise the influence of nuclear facilities and long distance transport from the continent where tritium level is relatively high, it is necessary to investigate background levels of tritium.

The primary purpose is to develop the technique to evaluate the environmental tritium behavior of the facility origin. Because there are a seasonal variation, a year change and a climate change in the environmental tritium behavior, the continuous investigation is necessary. The electric conductivity and the flow rate of the river were investigated continuously in the NIFS neighborhood. At the same time, the isotopic-ratio of oxygen and hydrogen and the tritium concentration of the precipitation collected at NIFS site were measured. Fig. 1 shows the tritium concentration in precipitation, river water and ground water samples. The range of tritium concentrations in precipitation were 0.09-0.78 Bq/l (average 0.38±0.14 Bq/l). The tritium concentration is low in the summer and the autumn and is high in the winter and the spring. The tritium concentrations of river water(R-10,R-15 and Toki) and ground water were average 0.32, 0.34, 0.34 and 0.25 Bq/l, respectively.

A river water sample for some precipitation events was collected at every hour. Fig. 2 shows a result of measurement of temperature, flow rate, conductivity, rainfall and isotopic-ratio of oxygen at the time of the precipitation of 2009/11/10. The change of the flow rate, the conductivity, the oxygen isotope concentration could be seen to the peak with rainfall in 1-3 hour late. We can separate a runoff component using combined these changes.

The 2nd purpose is to verify safety than the level of the other domestic area in the change level with tritium concentration around the facilities. Tritium concentrations of 34 river waters and 6 lake waters in Japan were determined. The fluctuation range with tritium concentrations of river and lake water were 0.36-2.66 Bq/l (average 1.06±0.60 Bq/l) and 0.48-1.43 Bq/l (average 0.81±0.37 Bq/l), respectively. The entire mean value was 1.03±0.57 Bq/l. It was possible to calculate 11 years as an apparent half-life. The latitude effect which becomes as high as high latitude is seen.

The water sample was distilled twice and enriched with an electrolytic enrichment system (XC-282C, XZ001-1, and XZ001-2, Permelec electrode Ltd.) because of low level tritium concentration. The tritium activities were measured with a low background liquid scintillation counter (LSC LB-2, LB-5, Aloka Ltd.) after mixing 50 ml of enriched water and 50 ml of scintillation cocktail (Ultima GOLD^{TM} LLT, Perkin Elmer) The detection limit value is 0.036 Bq/l in this system.

This work is performed with the support and under the auspices of the NIFS Collaboration Research Program. （NIFS07KOBS011）

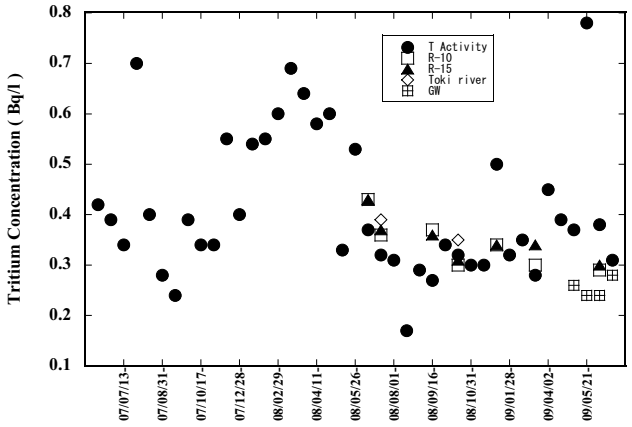

Fig. 1 Tritium Activity in precipitation, river water (R-10, R-15 and Toki) and ground water at NIFS site

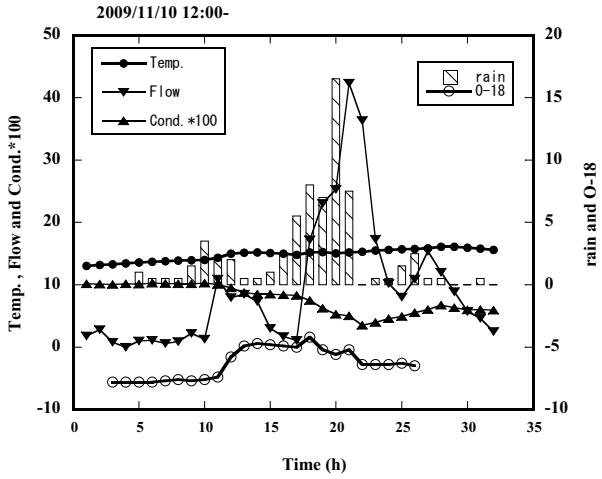

Fig.2 Variation of temperature, flow rate, conductivity, rainfall and O-18 ratio in river water at one rain event