§41. 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 sample. The range of tritium concentrations in precipitation were 0.24-0.70 Bq/l (average 0.45±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 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 by low background liquid scintillation measurement system combined with the electrolysis using solid polymer electrolyte.

Each river and lake sample was collected for the period from May 2003 to March 2007. The sampling locations in the rivers were in the middle of the stream to avoid the influence of sea water. The sampling was carried out in good weather to avoid collecting precipitation directly.

The fluctuation range with tritium concentrations of river and lake water (Fig. 2) 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. This mean value equals 43% of the mean value which was measured in 1982. 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 river, lake and rain water 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.

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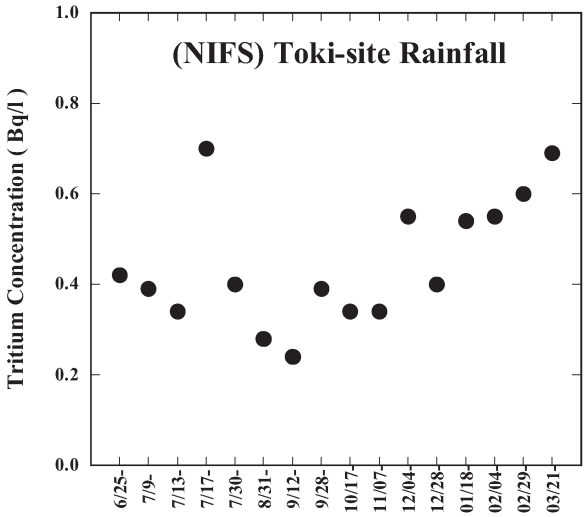

Fig. 1 Tritium concentration in rainfall at NIFS

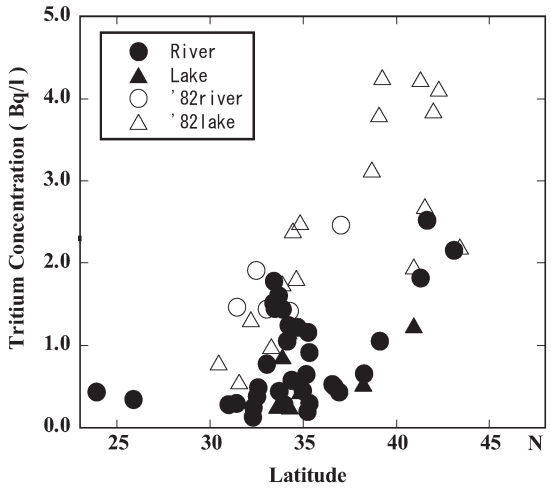

Fig.2 Tritium concentrations in river and lake samples