§29. 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 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 and rainfall. The range of tritium concentrations in precipitation were 0.17-0.70 Bq/l (average 0.42±0.14 Bq/l). The tritium concentration is low in the summer and the autumn and is high in the winter and the spring. Fig. 2 shows the isotopic-ratio of oxygen and hydrogen in precipitation and river water sample. The typical values of slope and intercept at Japan were observed.

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 36 river and 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 October 2007 to December 2008. 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 was 0.21-0.89 Bq/l (average 0.50±0.21 Bq/l). The latitude effect which becomes as high as high latitude is seen. The concentration at Okinawa was nearly equal to south part of Kyushu island, although the difference of latitude between these points. This may be an effect of a long range transport from continent, but there is not a clear reason.

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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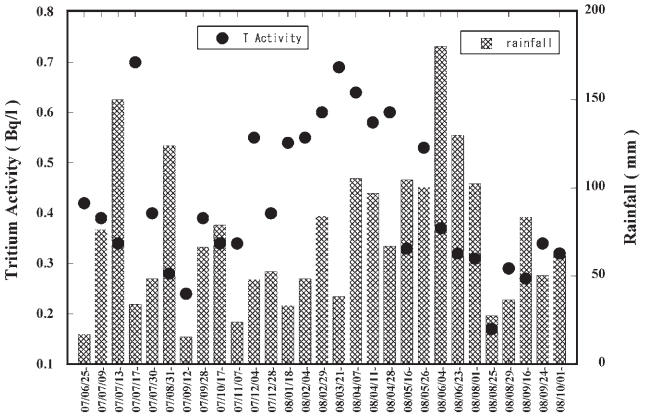

Fig. 1 Tritium Activity in rainfall at NIFS site

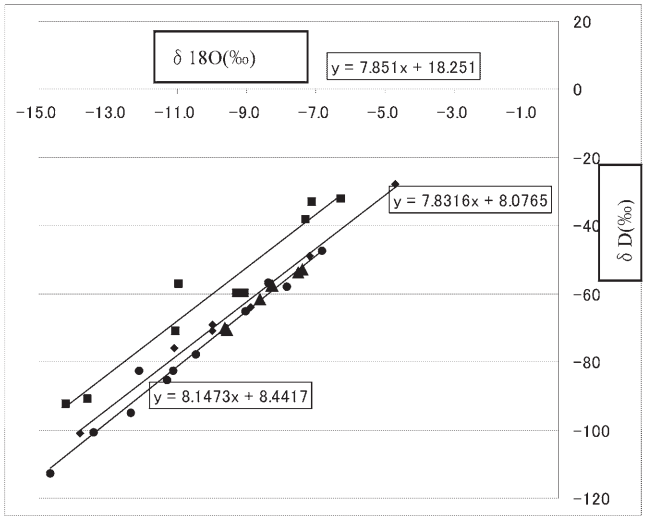

Fig.2 Delta diagram of rain and river water at NIFS site