§12. Environmental Atmospheric Tritium Monitoring with Discriminate Sampling of Different Chemical Forms

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As an environmental radiation safety issue, an atmospheric tritium monitoring system is necessary for the experiments of the LHD deuterium plasma discharges. The detailed variation of environmental tritium level at Toki site must be known before the experiments start and the tritium level must be monitored after the experiments start.

Atmospheric tritium mainly consists of three different chemical forms, that is, HTO, HT and CH_3T. Conventional technique of atmospheric tritium sampling is discriminate oxidization of tritiated species followed by collection of water with molecular sieve beds[1]. For the practical use of this technique, we have developed the automatic system for the air sampling[2]. We present the results of atmospheric tritium monitoring from April 2005 to March 2006.

i) Sampling and radiation measurements

The air was collected about 20 m^3 at a rate of 2 l/min once a month at NIFS Toki site. The sampling time spent to 168 hours. After collecting the air, water samples were recovered from the molecular sieves beds, which were regenerated at 400°C, passing N_2 gas through it for 3.5 hours.

Radioactivity of tritium was counted by a low background liquid scintillation counter (LB-III, Aloka). The stocked water samples (65 g for HTO, 10 g for HT and CH_3T) were mixed with the same amount of liquid scintillator (Ultima Gold LLT, PerkinElmer). Twenty ml of vials were used for counting the HT and CH_3T fractions while the HTO fractions were measured in 135 ml vials. Counting time was 1500 minutes for each sample, where measurements of 50 minutes were replicated for 15 times and the cycle was repeated twice. The detection limits of 20 ml and 135 ml vials were 1.6 Bq/L and 0.38 Bq/L, respectively.

ii) Results of measurements

The measured values of tritium concentrations of the water samples are shown in Fig. 1 with respect to each species. The measured values of HTO and CH_3T are near the detection limit, so that it is difficult to discuss the fluctuation of the tritium concentration as the seasonable change. On the other hands, the tritium concentration for HT is good enough values for the discussion of the seasonal fluctuation. The result is that it seems to be higher in autumn and spring, and the minimum lies in summer. The reason of the fluctuation might be influenced by an oceanic climate in summer and the westerly wind from the continent in spring and autumn. Thus we need to remark the fluctuation of tritium concentration by an environmental factor even after starting the deuterium plasma discharges.

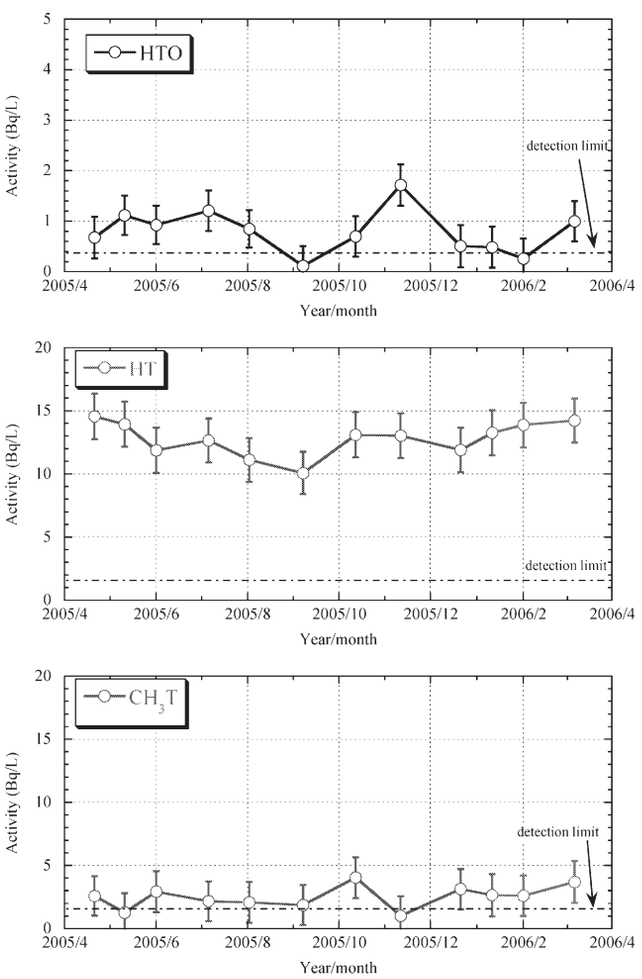

Fig. 1: Atmospheric tritium concentration in Toki area

References

1) K. Shinotsuka, *et al.*, Journal of Radioanalytical and Nuclear Chemistry, **258**[2], (2003), 233
2) T. Uda, *et al.*, Fusion Engineering and Design, **81**, (2006), 1385