

§2. Environmental Atmospheric Tritium Monitoring with Automatic 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 background tritium level 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 CH₃T. The quality factors of these species vary significantly in the Japanese law for radiation protection. Hence, it is desired that these tritium species should be monitored distinctively.

Conventional technique of atmospheric tritium sampling is discriminate oxidization of tritiated species followed by collection of water with sieve beds. The technique has been confirmed as reasonable and proper though it was manually operated and rather complex. For the practical use of this technique, we have developed the automatic system for the sampling in last fiscal year. In this report we show the results of the environmental atmospheric tritium monitoring.

i) Radiation measurements

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 CH₃T) were mixed with the same amount of liquid scintillator (Ultima Gold LLT, Perkin Elmer). Twenty ml of plastic vials were used for counting the HT and CH₃T fractions while the HTO fractions were measured in 135 ml plastic 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.

ii) Results of measurements

The measured values of tritium concentrations in the air

are plotted in Fig. 1 with respect to each species. The early data before 2004 were obtained with the manual sampling system, and the data after 2004 were obtained with the present automatic system. Although some fluctuations are observed almost the same trend was obtained in comparison with both methods. The value for HTO varies according to seasons because environmental moisture varies. Average tritium concentrations of HTO, HT and CH₃T are obtained as 4.37, 10.0 and 2.42 mBq/m³, respectively.

The automatic system enables us to increase the sampling frequency. We now perform the measurement once a month steadily. Temporal change and regional difference of the tritium concentrations will be investigated in future research.

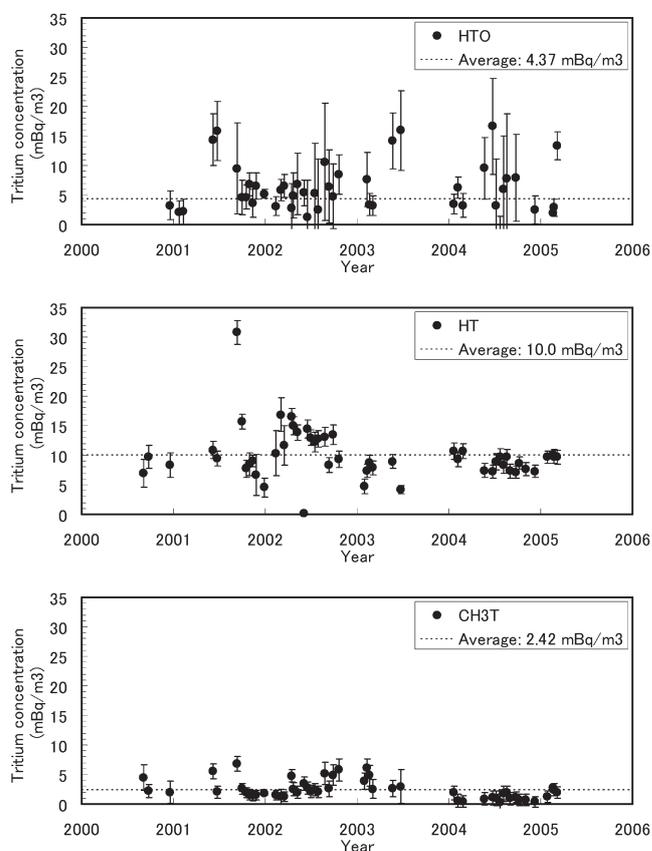


Fig. 1: Atmospheric tritium concentration in Toki area

Reference

- 1) Uda, T., Sugiyama, *et al.*: *ISFNT-7*, P3-21, Tokyo, May (2005).