

§2. Atmospheric Tritium Measurement with Discriminate Sampling of Water, Hydrogen and Methane Gases

Uda, T., Tanaka, M.

Considering the environmental radiation safety issue, atmospheric tritium monitoring will be profitable for the future experiments of LHD deuterium plasma discharges. The variation of environmental tritium level at Toki site should be understood previous to the deuterium experiments and the tritium levels will be required to monitor periodically.

Atmospheric tritium is assumed to consist of three different chemical forms HTO, HT and carbon hydrate like CH_3T . Conventional technique of atmospheric tritium sampling is discriminate oxidization of tritiated species followed by collection of water with molecular sieve beds. For the practical use of this technique, we developed the automatic air sampling equipment. We accumulated the atmospheric tritium monitoring data recent seven years. In the present report it mentions recent data.

i) Sampling and radiation measurements

The atmospheric air was collected about 20 m^3 at a rate of $500 \sim 1000 \text{ cm}^3/\text{min}$ once a month outside of the diagnostic laboratories in NIFS Toki site. The sampling time spent to 300 - 650 hours. After collecting the air, water samples were recovered from the molecular sieves beds, which were regenerated at 400°C , passing through N_2 gas 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, Perkin Elmer). 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 1.2 Bq/L and 0.29 Bq/L, respectively.

ii) Results of measurement

The measured levels of tritium concentration through one year are shown in Fig. 1 with respect to each species. Some measured values of HTO and CH_3T are near the detection limit, so that it is difficult to exactly discuss the fluctuation of the tritium concentration as the seasonable variation. On the other hands, the tritium concentration of HT is sufficiently large to show the levels. When look all over the concentrations in one year, tritiated water concentration tends to be high in summer. This is because the humidity is high in summer. On the other hand concentrations of HT show almost constant level, but precisely looking the data considering seasonal fluctuation, it tends to be high in

winter and spring. Especially the tendency that the maximum concentration is observed in spring is called spring peak. Another reason of such a seasonal fluctuation is being observed might be caused by an oceanic climate in summer and the westerly wind from the continent in spring and winter. Tritiated methane concentrations were low and almost the same level through one year, but according to long span monitoring, the levels had been decreased comparing to the levels of several years ago. It is important to remark the fluctuation of tritium concentration by an environmental factor and an artificial factor. So it will be desired to continue monitoring.

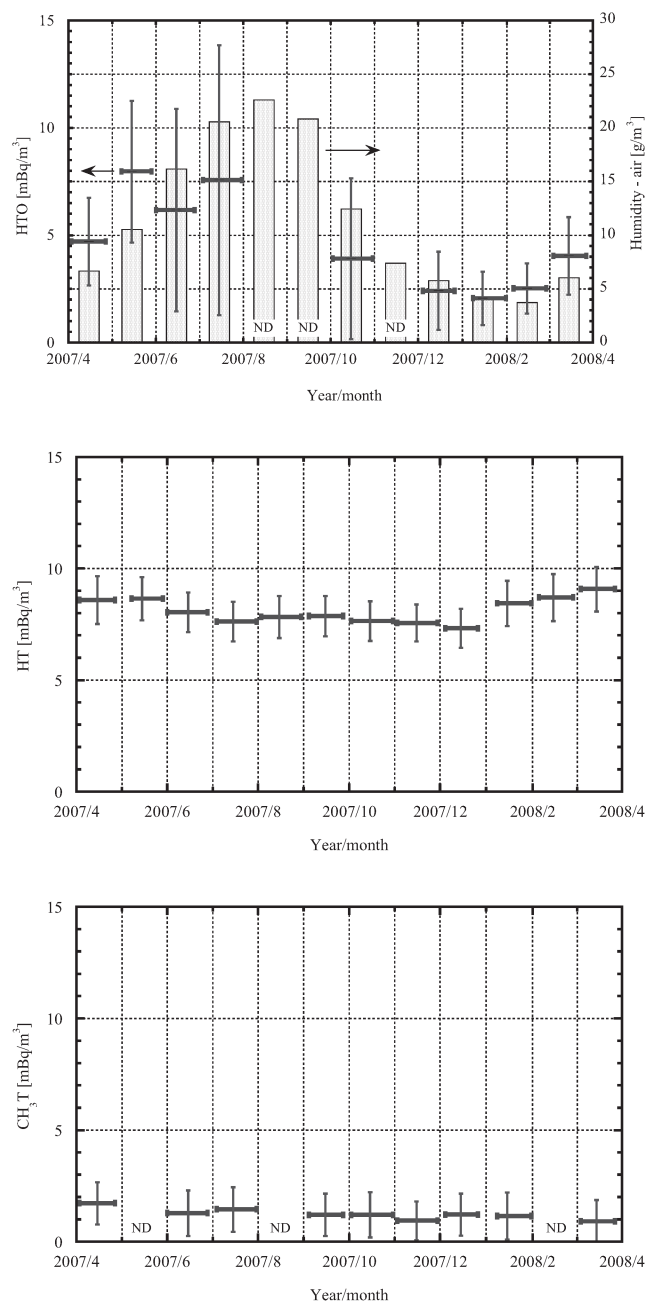


Fig. 1 Atmospheric tritium levels measured in each chemical form of water, hydrogen and methane at Toki area