§32. Study on Development of Environmental Tritium Behavior Model Incorporating Organically Bound Tritium in Plant

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The purpose of this work is to build the behavior model of tritium released to the environment at the time of in normal or an accident and to evaluate the model. The organically bound tritium (OBT) to become the accumulation part of tritium in the environment was paid attention in this study. About the case that HTO was released around nuclear fusion facilities, it is important to analyze tritium environment change in the atmosphere, groundwater, river water, soil water and a plant by the model calculation to evaluate facilities influence. This study group is constructed in a model construction group and an experiment group of tritium in the environment. At first the result of the model construction group was reported.

A compartment model (Fig. 1) describing tritium transfer in the ground surface environment was developed and compared with a sophisticated and process-based model, SOLVEG, of which meteorological part had been validated. The compartment model describes inventories of tritium in the air compartment, the soil water compartment, the TFWT (tissue free water tritium) compartment and the OBT compartment. Both models were applied to a hypothetical case with pine trees exposed to the atmosphere having a constant HTO concentration under an actual meteorological condition measured during a three month period in summer in Japan.

The comparison of the results between models showed that, although the increase in the soil water HTO inventory during the first several days of the exposure was in a reasonable agreement between the models, the compartment model had a tendency of systematic underestimation after the several day period. According to the analysis of the calculation results of SOLVEG, the temporal variation during the first several days represented an asymptotic variation in the soil water HTO in the very thin surface soil layer approaching to an equilibrium with the atmospheric inventory. The increases in the later period in the SOLVEG result were analyzed to be caused by flashing of the surface soil layer by precipitation, causing continuing increase in the inventory, which was not accounted for in the compartment model. The OBT inventory was also found to be considerably underestimated the compartment model. It was concluded from these results that the configuration and the transfer coefficients of the compartment model should be improved.

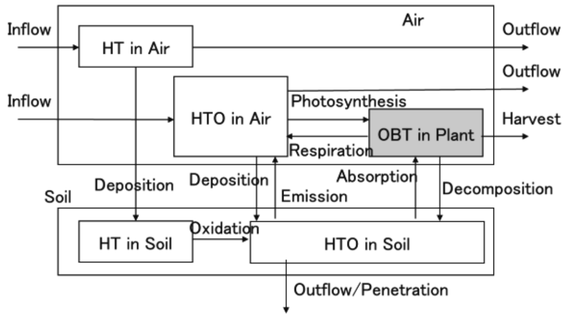

Fig. 1 Compartment Model

The environmental tritium measurement data were reported successively. Because pretreatment for the OBT measurement and the measurement of OBT need complicate work, there is extremely little measurement data. We continue the collection of OBT date built in a previous study and utilize OBT data of tritium released by The Fukushima Daiichi nuclear disaster as on case study.

Table 1 shows TFWT and OBT concentration of pine needles in Fukushima prefecture.

Table 1 TFWT and OBT concentration of pine needles

Point	Date	TFWT	E+NE OBT	NE-OBT
Akougi	2012/4/10	2.59 ± 0.09	5.39 ± 0.22	5.37 ± 0.24
Bajikoen	2012/4/9	2.35 ± 0.09	2.84 ± 0.21	2.73 ± 0.21
Yotsukura	2012/4/10	2.11 ± 0.09	1.72 ± 0.20	1.50 ± 0.20

unit：Bq/L

The measurement of the OBT concentration in pine needles without the influence of accident as background data was performed. The tritium concentration of pine needles after the accident increased to around 100 times, but in 2012, decreased. We gather the tree of cedar in 10 cities, towns and villages of Fukushima around nuclear power plant and analyzed OBT in every annual ring. The movement to a plant of tritium released by the accident and the preservation as OBT were analyzed.

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