

§17. LHD Project and Estimation of Biological Effects of Tritium

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The following three tasks were studied in this program in 1999. (1) Uptake of heavy water and loss by rice plant and potato in the heavy water vapor release experiment in a greenhouse as a substitute for tritiated water. (2) Incorporation of tritium from tritiated organic compounds and tritiated water into DNA of mouse tissues during chronic exposure.

On September 30, 1999, a criticality accident occurred in the tank at uranium conversion building of the JCO in Tokai-mura. Then, (3) tritium, deuterium and gamma nuclides in plant leaves in the JCO campus were investigated assuming that as case of tritium accident release.

The followings are the abstracts of these tasks.

(1) Investigations on tritium behavior in crop plants in the local environment are limited and required for dose assessment purpose before the start of the operation of a nuclear fusion reactor. However it is very difficult to do tritium release field experiments in Japan due to public acceptance problem. Thus heavy water (D_2O)

vapor release experiments in a greenhouse were carried out in the Mito campus of Ibaraki University using deuterium as a substitute for tritium. Rate constants of D_2O uptake in rice plant leaves were $0.7-1.3 \text{ hr}^{-1}$ and the steady state concentration ratios were in the range of 0.6-0.7. As for potato leaves, the uptake rate constant was almost the same that for rice leaves but the steady state concentration ratio was about two-thirds. Rate constants of loss of D_2O in leaves of rice plants and potato were in the same range of uptake rate constants. Organically bound deuterium (OBD) was concentrated in unhulled rice.

(2) In this study, we used tritiated compounds with 100 times of concentration based on the fact that the highest concentration in the rain after the nuclear test during the 1960's was 700 Bq/l rainwater. Mice were chronically fed with each one of tritiated compound, 3H -Thymidine, 3H -Leucine, 3H -Glucose or HTO for comparison, and the excretion and distribution of tritium in mice and tritium content in DNA in each tissue were determined for 300 days. Throughout the experiments period, no significant differences were found between the dose rates estimated from DNA-bound tritium after the long-term ingestion of tritiated organic compounds and that of HTO.

(3) No significant differences were detected between tritium and deuterium concentrations in tissue free water in the plant samples collected from the JCO campus and those from outside JCO including Tokyo. Organically bound deuterium concentration in any plant sample was lower than free water deuterium concentration. ^{140}La and ^{140}Ba were detected in one plant sample in JCO.