

## **Build-up of organically-bound tritium in crops: experimental setup, sampling and measurement techniques and results analysis**

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Results of experimental research of build-up of organically-bound tritium in crops are presented. During three field seasons, over 50 experiments were carried out to expose crops to HTO atmosphere and to study organically-bound tritium build-up in such crops as tomatoes, wheat, potatoes, lettuce. The plants were grown in non-covered soil, with the exposure in the active growth phase of plants both in the day- and nighttime. For the exposure period, a bed with experimental plants was placed into the greenhouse. To study the effect of HTO ingress to plants through the soil, the exposure was implemented in the soil both covered and non-covered.

During the experiments, air volume flow rates at entry to and exit from the greenhouse, air temperature and relative humidity in the greenhouse, HTO activity in the air of the greenhouse, in the tritium source and the soil of the greenhouse, CO<sub>2</sub> concentration in the greenhouse's air were controlled and measured. Plant samples were taken prior to exposure, immediately after the exposure, in 1, 5, 15 days and in harvesting period. Leaves and fruits were sampled. In plant samples, tritium activity in free water (TFWT) and that of organically-bound tritium (OBT) were measured. The TFWT activity in plant leaves increased by the end of exposure time and then decreased during a number of days. In the harvesting time, OBT activity in fruits and grains essentially exceeded that of TFWT in the same organs of plants.

Soil samples for HTO activity were taken before the experiment, after it and at harvest. The soil was 'cut out' by glass in six points of allotment, mixed together and the average soil sample was taken. Crops' leaves and fruit samples for measuring TFWT and OBT activity were taken from all crops growing in the allotment. Soil and crops samples were stored in glass pots with hermetically closed covers in a freezer at temperature -18 °C.

Measurement of tritium activity in the samples was made after extraction of HTO from the soil, as well as TFWT and OBT from the crops using thermal vacuum desorption technique. OBT extraction of the sample solid residue was performed using the same technique after its pyrolytic decomposition in presence of V<sub>2</sub>O<sub>5</sub>. Water vapors were collected in the cold trap. In case the solution was turbid or colored one, KMnO<sub>4</sub> was used for oxidation of organic matters' remains. To avoid errors during the extraction of both TFWT and OBT, the weight of the desorbers and cold traps was controlled at each stage.

Tritium activity in the obtained water samples was measured by liquid scintillation counter. "Dead water" with tritium activity of 0,03 Bq/l was used as a background sample in order to bring the samples to the required volume.

The obtained results were used to define the parameters of OBT buildup in crops as well as to develop and verify mathematical models of organically bound tritium buildup in crops.