Impacts of a nuclear power plant and a radioactive waste storage facility on the environment, Hungary

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For more than 20 years radiocarbon and tritium content of atmospheric CO_2, water vapour, hydrocarbons and hydrogen have been continuously monitored around the nuclear power plant of Paks (Paks NPP), Hungary. Our laboratory developed the differential radiocarbon and tritium samplers that take integrated samples from the ambient air, there. An automatic groundwater sampling device also has been developed in order to separately take anions and cations by means of ion exchange resins.

An experimental and modelling work was done focusing on the rain washout of tritium emitted from the Paks NPP using special sampling devices and high sensitivity ^{3}H analyses methods. Radiocarbon impact in the annual tree rings of a nearby pine tree from 2000-2009 was also studied there and comapred to the paralell atmospehic ^{14}C monitoring observations. Gamma emitters, tissue free water tritium (TFWT) and total organically bound tritium (T-OBT) measurements were performed on water, sediment and various aquatic organisms (snail, mussel, predatory and omnivorous fish and sediments) collected from the Danube river at the outlet of the warm water channel of Paks NPP.

We investigated the impact of low and intermediate level radioactive waste (L/ILW) disposal on the groundwater and ambient air in case of a near filed storage facility (Püspökszilágy, Hungary). Thousands of groundwater and air samples for ^{3}H, ^{14}C, ^{90}Sr and water chemistry have been measured. The results are the basis of a transport model that describes how radioisotopes could spread with the groundwater if they were getting out from the disposal.

During the storage of LILW significant quantities of gas may be produced, therefore, the measurement of gas mixing ratios from the headspace of radioactive waste drums was started by a quadrupole mass spectrometer. To obtain reliable estimations of the quantities and rates of the gas production in L/ILW, a series of measurements were carried out on numerous waste packages produced and temporarily stored at the site of Paks NPP and on real LILW storage near filed vaults at Püspökszilágy. We have demonstrated that estimation of the restored total tritium activity in a L/ILW vault can give realistic results by measurements of the decay produced helium isotopes.