

Abstract

The thesis focuses on an analysis of the results of long-term monitoring of the concentrations of ^{137}Cs , ^{90}Sr and ^3H in hydrosphere in the vicinity of Temelín Nuclear Power Plant.

The monitoring was carried out during the period 1990-2008 subsequently in several projects, which include Research of impacts of Temelín Nuclear Power Plant on hydrosphere and other components of the environment (National project no. N 03-331-867), Research on impacts of nuclear facilities on the environment (VaV/510/1/96), Strategy and methodology of integrated studies of long-term trends in landscape development in close and wide vicinity of Temelín Nuclear Power Plant (VaV/640/8/03), Programme on monitoring and assessment of impacts of Temelín Nuclear Power Plant on the environment, and Monitoring for Czech Power Works, a.s., Nuclear Power Plant. The thesis was carried out in T. G. Masaryk Water Research Institute, public research institution.

The radionuclides were monitored in surface water, river sediments, aquatic flora and fish species. The main objective of the thesis was to analyse and integrate all of the knowledge on concentrations and behaviour of these radionuclides, which originate mainly from residual contamination, in order to assess the impacts of Temelín Nuclear Power Plant (Temelín plant) on hydrosphere in these indicators during its standard operation and possible accidents. The radionuclides were analysed in terms of spatial and temporal variability in their concentrations and their inflows and outflows, mainly into and from Orlik Reservoir. The analysis included standard radioecological characteristics, which are applicable for assessing long-term development and behaviour of radionuclides in the environment affected by their possible accidental releases on the territory of the Czech Republic or outside this territory.

For all of the components of the environment, the concentrations of ^{137}Cs and ^{90}Sr , which were used for calculation of their effective and ecological half-times, were decreasing. For ^{137}Cs in surface water and fish, the rates of the decrease in the first and second monitoring period were different. The rate of the decrease in ^{90}Sr concentration was invariable. The results of the monitoring showed that 86 % of suspended solids and 60.7 % of ^{137}Cs inflowing into Orlik Reservoir accumulates in the reservoir while accumulation of ^{90}Sr was not substantiated. Outflows of ^{137}Cs and ^{90}Sr activities were assessed in relation to their concentrations that were accumulated in individual basins until 1986 consequently to Chernobyl accident and tests of atmospheric nuclear weapons. The results for the whole area of the Vltava, Lužnice and Otava River basins upstream from the Vltava River at Solenice showed that during the period 1986-2008 only 0.48 % of ^{137}Cs activity and 3.2 % of ^{90}Sr activity that accumulated in the basins was washed and flowed out from the area. Distribution coefficients derived from summary analysis of sediments were $2.4 \cdot 10^4$ l/kg for $K_{d137\text{Cs}}$ and 413 l/kg for $K_{d90\text{Sr}}$. Mean values of concentration factor in fish were 298 l/kg for $\text{CF}_{137\text{Cs}}$ and 117 l/kg for $\text{CF}_{90\text{Sr}}$, and in reed 49.8 l/kg for $\text{CF}_{137\text{Cs}}$ and 19 l/kg for $\text{CF}_{90\text{Sr}}$. Concentrations of ^3H in river sites not affected by Temelín plant were slowly decreasing and their values were substantially below those from the sites affected by the plant.

Key words: caesium 137, strontium 90, tritium, effective half-time, ecological half-time, concentration factor, distribution coefficient, radioecology, surface water, sediments