



Groundwater dating in the Chernobyl aquifer

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Following the 1986 Chernobyl nuclear powerplant explosion, forest and soils have been contaminated around the site. Contaminated soils and plants and dispersed fuel were removed and stored in trenches dug in a two-layer alluvial and aeolian sand aquifer. Currently these trenches constitute a source of contaminants that are gently transported within the aquifer. A project has been devoted in the framework of the TRASSE research centre to the establishment of a hydrogeological conceptual model for the aquifer. Groundwater dating has been applied to this aquifer in order to constrain flow properties. Two groundwater sampling campaigns were carried out in 2008 and 2009 and CFCs, SF6 and 3H-3He dating methods were investigated.

Both sand layers present different chemistry and groundwater residence time. In the aeolian upper layer, groundwater presents short residence times, i.e. less than a few years. Both CFC and 3H-3He ages are in good agreement. In the upper part of the lower alluvial layer, CFC ages are older than the 3H-3He ages with apparent recharge occurring around 1985-1990 and 2000-2005 respectively. In the lower part of the alluvial layer at 20 to 30 m depth below ground surface, both methods agree and indicate older ages (with recharge around 1980 and 1960).

Part of the SF6 measurements show extremely high concentrations, much higher than that at equilibrium with atmosphere. When plotted against CFC ages, a "peak" is observed around 1986, which may be related to the power plant explosion. However, corresponding 3H/3He ages appear younger, with recharge occurring around 2000. Therefore, an alternative interpretation would be that these high SF6 values represent the tail of a contamination that started back in 1986. Potential processes for SF6 and 3He production in relation with produced radionuclides, and their implications for the groundwater dating, are discussed along with the hydrogeological models.