Contribution ID: **116** Type: **Verbal**

Separation of Uranium from Drinking Water in the Czech Republic

Friday, 16 May 2014 14:30 (15 minutes)

Natural ground water used for the preparation of drinking water contains a number of cations, anions, elements and other substances depending on the bedrock composition (Ca, Mg, Fe, Mn, heavy metals, radioactive elements, arsenic, chromium, carbonates, sulfates, phosphates, silicates, fulvic and humic acids etc.). Information about composition of drinking water is important to comply with all the requirements on sanitary of drinking water.
The elements that affect the quality of drinking water mainly from groundwater, also includes radioactive elements contained in bedrock sections where water is extracted. These are the elements with long half-lives, mainly alpha emitters (U, Ra, Rn, Th, and elements of the decay series).
Uranium and its decay products are found in all environmental compartments. Radionuclides come to the environment both naturally - weathering and leaching of the rocks, and as a consequence of human activities in connection with the use of raw materials.
Uranium occurs naturally in four oxidation states. The most mobility has hexa-valent state (uranyl ion). Uranyl is highly soluble form of uranium in water. Mobility of uranium in soil and water is affected by many factors.
Complex processes in soil and rock lead to redox reactions forming both insoluble compounds (lower valence forms of uranium) and soluble form of U (VI) (forming by reoxidation), which is again leachable into groundwater. The content of uranium in groundwater depends on the geological composition of the ground, and can reach up to hundreds of µg/L.
At present the issue associated with removing uranium from drinking water is solved in the Czech Republic. New limit for the concentration of natural uranium (234U, 235U and 238U) was recommended at a level of 15 µg/L as the highest limit based on the World Health Organization (WHO). Advice of the Chief Health Officer of the Czech Republic came into force on 1st January 2010, which decreased the limit for uranium in drinking water from original 30 µg/L to new 15 µg/L recommended by WHO. However, the WHO reported a new limit value of 30 µg/L in 2011 based on a new studies, which proved that 30 µg/L uranium in drinking water has not negative effect on the human organism (chemical toxicity). Limit in the Czech Republic remained at the same level 15 µg/L.
Change the limit leaded to solving the issue on the waterworks in the Czech Republic, which had not any experiences with radioactivity. Some waterworks installed a new device from Germany (ion exchanges), but did not solve what they do with saturated ion exchanges. Ion exchanges as the most suitable material for removing of uranium from drinking water is not reused (without regeneration), but it is used in the uranium industry, where is putted to start of processing of uranium ore. Ion exchanges are replaced with a new one in the waterworks and saturated ion exchanges are discarded in the uranium industry.
Regeneration of ion exchanges could be cheaper, because ion exchanges could be reused and processing of ion exchangers could be cheaper, because it is possible to put the regenerant before the process of precipitation of "yellow cake"in the processing of uranium ore.
This project TA02010044 was supported by TA CR.

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Session Classification: Radionuclides in the Environment, Radioecology 5

Track Classification: Radionuclides in the Environment, Radioecology