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NORM waste generation in different water treatment solutions – results of the LIFE ALCHEMIA project

The Basic Safety Standards Directive 2013/59/EURATOM of the European Union lists groundwater filtration facilities as one of the industrial sectors which involves naturally occurring radioactive material (NORM). Nevertheless, the generation of NORM waste in drinking water treatment plants is still poorly recognised in several countries.

The LIFE ALCHEMIA project „Towards a smart & integral treatment of natural radioactivity in water provision services“ (2017-2020) looks for a solution to this issue by the development of water treatment solutions for removing natural radionuclides from groundwater and, at the same time, minimising NORM waste generation.

Three pilot plants in Spain and one in Estonia have been set up for regular monitoring of drinking water purification efficiency and radionuclide accumulation in filter materials. The technological solutions include two-stage filtration combining different catalytic filter materials, which is used in the Spanish pilot plants, and Hydrous Manganese Oxide (HMO) process, which is tested on the Estonian pilot device.

The pilot plants were installed to existing water treatment facilities in municipalities where groundwater with elevated radium and uranium concentrations is used for drinking water uptake. Up to now, the local water treatment facility operators have tackled the problem by employing reverse osmosis (used in the Spanish municipalities) and gravitational filtration with catalytic filter material FMH and zeolite (used in the Estonian municipality).

Accumulation of radionuclides is observed in different waste streams of the water treatment solutions –solid filtering media and filter backwash liquids. The performance of pilot plants is compared with reverse osmosis and gravitational filtration employing catalytic filter material FMH and zeolite. The filtration technologies, in comparison to reverse osmosis, have shown the potential to significantly reduce energy and backwash water consumption. At the same time, the HMO process has demonstrated the possibility to decrease the rate of NORM accumulation more than three times. In case of the current gravitational filtration technology used in the Estonian test site, the annual accumulation rates for Ra-226 and Ra-228 in filter material have been estimated to reach 3400 and 4800 Bq/kg, respectively. The HMO technology would be able to reduce the yearly accumulation to 1000 Bq/kg (Ra-226) and 1200 (Ra-228) Bq/kg.

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