

Activity levels and disposal of NORM waste from waterworks according to criteria for drinking water quality and German regulations for radiation protection and transport of radioactive material

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Abstract

Waterworks that use groundwater for the production of drinking water may require filtration to reduce the activity concentration of naturally occurring radionuclides. The filter material will thus become radioactive and will have to be disposed of after use accordingly. From the radiological point of view, the operation of such waterworks has to comply with different legal requirements. These are, in Germany, the Drinking Water Ordinance (DWO), which requires the adherence to an indicator value of 0.1 mSv/a for the effective dose resulting from drinking water consumption, the Radiation Protection Ordinance (RPO), which limits radiation exposures of employees and - with respect to the disposal of waste at a landfill - the effective dose of the public by a guidance value of 1 mSv/a, and the transport regulations for dangerous goods with definitions for radioactive material and the respective requirements for shipment according to the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), if specified exemption values are exceeded. In practice, most operators of disposal sites for hazardous waste do not accept waste that has to be transported as radioactive material (as excepted package or as Low Specific Activity material), even if the RPO guidance value for radiation exposures of the public is met.

In 2011, a German waterworks attempted to comply with these regulations claiming adherence to the DWO indicator value also for infants (age group "< 1 a") on the basis of exposure scenario parameters as specified in the RPO. To achieve this objective, in addition to the primary filters of the waterworks, where gravel is used for iron and manganese removal, secondary filters with granular zeolites were operated not only for improved water purification but specifically for radium absorption. Investigation and modelling of Ra-226 and Ra-228 accumulation in the zeolites and subsequent Th-228 buildup revealed that the zeolitic filter material would have to be replaced after relatively short operation times of about two years to avoid an exceedance of the ADR exemption values (activity concentrations for exempt material), which are valid for the case of a purposive use of the secondary filters for

radium removal. A substantial mitigation of this problem resulted from the "Guidance for the investigation and assessment of radioactivity in drinking water" published in 2012 by the German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety, recommending sole application of the DWO indicator value for adults. On this basis, the DWO indicator value is already met by the characteristics of the untreated water. Consequently, radium absorption in the secondary filters is not required. As the NORM waste is now not produced purposively, for its shipment to a disposal site for hazardous waste, licensing according to ADR specifications for hazardous goods (class 7, radioactive material) is not required, if the activity concentrations of the material does not exceed 10 times the general ADR exemption values. Respective limits will not be exceeded within technically reasonable operation times of the zeolitic filter material.
