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Identification, assessment and management of NORM residue in Iodine production industries in Iran

Production of iodine from deep underground saline water is one of the industries that may lead to increase of natural radioactive materials (NORM) and have received little attention so far. Because of the existence of saline water in depth of 600 to 800 m, iodine producing industries are developed in the north-east of Iran, and it is important to consider NORM management programs in advance to protect public health and the environment. Radionuclides namely radium-226 and radium-228 found in these saline water are in soluble form and when they reach the surface, due to extraction process such as adding chemicals cause them to precipitate in different forms as NORM residues and wastes. NORM residues are often seen as hard scales, such as barium sulfate, in the wall of pipes or in the interior of stripping towers. NORM waste are accumulated as sludge in sedimentation ponds and detected in soluble forms in the wastewater.
After the investigation on the Iodine production processes, residue and waste generation units, and based on initial dosimetry, sampling program were planned. Various samples from saline waster, scales, sludge, and effluent were collected and analyzed. The results showed that the amount of 226Ra and 228Ra in scales, sludge and the wastewater increased and indicates existence of naturally occurring radionuclides. The amount of these radionuclides in saline water is about 3-5 Bq/l, in scales it reaches up to 12 Bq/g, in sludge varies between 5-7 Bq/g and in the wastewater varies between 3-5 Bq/l. After characterizing the residues including volume and their radionuclide content, different methods were considered for management of them. The volume of scales was not high, that attracted the attention to the option of reusing them as the drilling mud or in road construction after dilution and reducing the concentration of naturally occurring radionuclides below 1 Bq/g. The high volume of effluent and sludge are subjected to deep well injection beneath an impermeable layer and returning to the saline water reservoir. In order to ensure that these methods do not affected the shallow groundwater, safety assessment was performed and according to the most conservative scenarios, the results showed that the critical person would be exposed to 0.6 mSv/y in 67th year of operation in worst case. Besides, an environmental monitoring program is being implemented to ensure that management practices are in place.

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