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Environmental Monitoring of Naturally Occurring Radionuclides Contamination in Gachin Uranium Milling and Mining Facility

Many years of uranium ore exploration, mining and milling processes in Gachin uranium mine has resulted in a considerable amount of NORM waste. Mining of radioactive ores for uranium production has been initiated since 2005. This mine was closed in 2016. To deal with the legacy of past mining of radioactive ores, the environmental monitoring and waste characterization of old mining site are set as a priority for Atomic Energy Organization of Iran (AEOI). This paper provides basic information on radiomonitoring of Gachin uranium mine site and waste characterization planning that are needed for proper management of the NORM waste in compliance with the best national and international practices.

Uranium is processed by using conventional mining to excavate the ore and chemical processing to extract the uranium from the ore generates large volumes of solid and liquid materials and contaminated processing equipment and facilities. Liquid and solid wastes are typically collected and stored in tailing ponds. In addition, After mining and processing stopped, a large volume of low-activity tailings, contaminated equipment and buildings are remaining.

A two year monitoring of the Gachin uranium production site has been carried out, including: terrestrial gamma radiation dose measurement, uranium, thorium and potassium mapping. 80 samples including foodstuff, surface and ground water, soil and sediment, radon and external radiation were gathered and analyzed to investigate activity level of various radionuclides.

Activity level of various radionuclides has been determined by gamma-ray spectrometry in all soil samples. The measured specific activity for 226Ra, 232Th and 40K ranged from 24 to 9646, 9 to 88 and 18 to 872 Bq Kg-1 respectively. Total alpha/beta and gamma-ray spectrometry analysis has been performed in all drinking water, surface and groundwater samples. Total gross alpha/beta activity concentration for all water samples were 3 to 214 and 5 to 540 Bq l-1 and the activity concentration of 226Ra and 40K were 1 to 52 and 6 to 769 Bq l-1 respectively. Four radionuclides were analyzed in common food commodities, including animal products, fruits and vegetables.

In conclusion, Based on the results derived from environmental monitoring, waste characterization survey and provided basic information, remediation planning and decontamination techniques are needed for proper management of the uranium legacy waste in compliance with the best national and international practices.

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