ID: **P2.4-416**   Type: **E-poster**

Impact of Radioxenon Emission from Spent Nuclear Fuel Reprocessing Plants on International Monitoring System Observations

Thursday 22 June 2023 11:31 (1 minute)

Given that the on-site inspection area should not exceed 1000 km2, finding the suspected nuclear explosion site is a difficult task requiring extremely accurate methods of assessment. One of the approaches used for nuclear explosion monitoring is to consider sources of radioxenon. Currently, mainly nuclear power plants and medical isotope production facilities are considered as a relevant and well-known sources of radioxenon that can impact International Monitoring System observations. The aim of this work is to investigate the possible radioxenon emission during SNF reprocessing caused by spontaneous fission of heavy elements. Curium-244 and Plutonium-240 are determined as main sources of spontaneous fission. Their presence in SNF leads to the formation of radioxenon and I-131 which are released during head-end operations. The approximate calculations were performed to quantify the amount of radioxenon formed and released during SNF reprocessing. It is estimated that the maximum release of radioxenon may be in the order of GBq/day and depends on fuel burnup and other parameters. Assuming the absence of an effective off-gas system which leads to the release of radioxenon into the environment, the results of the calculations show that industrial scale reprocessing plants should be considered as a weak but not negligible source of radioxenon.

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Promotional text

The study presented here is the first investigation ever made on the possible impact of spent nuclear fuel (SNF) reprocessing facilities on IMS radioxenon monitoring. It is shown that SNF reprocessing is a small but not negligible source of radioxenon.

Oral preference format

in-person

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Session Classification: Lightning talks: P2.4

Track Classification: Theme 2. Events and Nuclear Test Sites: T2.4 Atmospheric and Subsurface Radionuclide Background and Dispersion