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Radionuclide distribution in corrosion layers of historic radioactive waste of NPP A1

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The radioactive waste management in Slovak Republic complies with the waste acceptance criteria for repository of Slovak Republic. The essential criterion is a declaration of radionuclides disposed in waste packages. The group of 19 limited radionuclides comprises various gamma, beta and alpha radionuclides. The activity of alpha radionuclides is monitored as a total alpha radioactivity, the limit for the total alpha activity per one waste package is 400 Bq.g-1 in average, or a local activity and then the local limit is 4000 Bq.g-1, which is usually applied for the smallest produced unit of a RAW (200L drum, 60L drum, or compacted product after high-pressure compacting).
Legacy radioactive wastes treated during D&D of NPP A1 represent greater amount of conditioned RAW disposed in the repository. Nuclear power plant A1 was shutdown after an INES 4 accident in 1977, when one of fuel assemblies had melted down in a reactor channel. Any kind of deactivation process had not been applied since shutdown of NPP and basically all deactivation and pre-decommissioning works have started in 90', and therefore there were lot of possibilities for corrosion of contaminated materials. This corrosion impacts also more than 300 pieces of casks used for spent fuel assemblies storing. Cladding defections and also deformations caused by incorrect storage conditions caused other cladding defects, which led to massive contamination of spent fuel casks. Outer and inner surface of casks is contaminated mainly by 137Cs, 90Sr and alpha RN (241Am and Pu isotopes). According to the pre-disposal measurements by alpha scanner fragmented casks cannot be disposed without treatment because of exceeding limit for total activity of alpha RN. The paper describes analyses performed with samples taken from inner surfaces of fragments of spent fuel casks to prove that contamination is only in a corrosion layer and not in core material of casks (carbon steel). This proof would help to enhance waste management of spent fuel casks. Determination of alpha isotopes by alpha PIPS spectrometry and determination of gamma emitting radionuclides by gamma spectrometry is described. Separation of 241Am and Pu isotopes 238,239,240Pu was carried out by means of extraction chromatography with TRU-resin sorbent. The depth distribution of contamination was performed on the assumption that during electrochemical sampling with identical conditions same amount of iron will be taken. After determination of iron concentrations by AAS it was possible to calculate thickness of corrosion and subsequently calculate depth distribution of radionuclides in several layers of corrosion. These data should help to enhance process of managing legacy metallic RAW from NPP A1.

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