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Conceptual Design of Landfill NORM from the Tin Industry in Indonesia based on the Regulatory, Security and Safety Aspect Overview

Indonesia is one of the major world's tin producer countries. The tin exploration, mining, and processing activities also generating waste and by-products containing enhanced natural radioactivity. The final tin slag from the smelting process remains an issue to the environmental problem due to it has potential long-term hazards. It comprises long-lived radionuclides with relatively high radiotoxicity. Therefore it is needed to be managed safely and securely to avoid the human health risk. In Indonesia, these materials of Naturally Occurring Radioactive Materials (NORM) are included in category 2 of hazardous waste from specific sources. The control limit of NORM waste is 1 Bq/g for radionuclide of U-238 and Th-232 and 10 Bq/g for the K-40. The regulations on NORM landfill are regulated in the presidential regulation No. 101 (2014) about Management of Hazardous Waste. The requirement and procedures for hazardous waste are regulated in the environment and forestry ministerial regulations no. P.63 (2016). Based on these regulations, we develop a conceptual design for the landfill NORM in Bangka Island, which is the location of the largest tin producer in Indonesia. For the NORM waste category, the waste must be carried out in the NORM landfill class I or class II. Hazardous waste in the form of tailings from mining activities that have the same level of radioactive contamination as NORM waste can be placed in a landfill facility in the form of a tailing dam. The landfill NORM shall be designed to minimize impacts on the environment, and it consists of cap system, waste layer, foundation and liner system, and systems for leachate and gas management.

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