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Sensitive Design Parameters to Radiation Dose in Disposal Facility of NORM Waste from the Oil and Gas Industries

In oil and gas activities, NORM can be deposited in tubular wells, surface pipes, ships, pumps and other manufacturing and processing plants. The primary radioisotopes of interest in waste from the petroleum industry are radium-226 (Ra-226) and radium-228 (Ra-228), while lead-210 (Pb-210) is of concern to the gas industries. Now, the petroleum industry is adopting methods for managing and disposing of NORM contaminated wastes that are more restrictive to provide better isolation of the radioactivity. The Indonesian Minister of Environment and Forestry Regulation Number 63/2016 on Requirements and Procedures for Hazardous and Toxic Waste Disposal in the Landfill Facilities regulates that NORM waste under 1Bq/g can be disposed of in class I or class II landfills. Several studies found some parameters that may affect radiation safety for people and environment. In this paper, a sensitivity analysis will be carried out on several design parameters in The Minister of Environment and Forestry Regulation Number 63/2016. The analysis will use a conservative scenario where landfill is assumed as residential area, with people living there and produce their food from that land. Landfill is also assumed without High Density Polyethylene (HDPE) geomembran layers as result of decomposing. Landfill design parameters that not listed in the regulation are taken from the PPLI Cileungsi hazardous landfill. Sensitivity analysis is done by varying the inputs into upper, middle, and lower values. The radiation dose generated from the upper and lower input values will be compared with the dose from the middle value to see the percentage change. Then all parameters that have been analysed will be sorted from the largest percentage change in dose. RESRAD (RESidual RADioactive) will be used to estimate the dose for the public. But, RESRAD allows only one layer of cover soil to be used. While such situations cannot be handled directly by RESRAD, these situation can still be analysed with the Hydrologic Evaluation of Landfill Performance (HELP) software. From simulation it can be concluded that the sensitive design parameters are the thickness of the landfill cover, the rate of erosion, the distance of the landfill to the body of water, and rainfall. Therefore, to improve radiation safety in NORM waste disposal activities in hazardous waste landfills should include improving the performance of landfill cover systems by thickening the cover layer and controlling erosion. Erosion control can be done by applying a good vegetation system.

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