

Assay of Waste drum based on Passive Neutron Counting Technique

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Characterization of alpha emitting nuclide and other fission products in the radioactive waste generated in reprocessing plants is a regulatory requirement for their disposal. The assay of plutonium in the solid radioactive wastes could be carried out either using gamma spectrometry or neutron counting, depending mainly on the surface dose of the container. Presence of large amount of fission products renders the use of gamma spectrometry inappropriate due to the increased background radiation. In order facilitate the detection of plutonium in such instances, a passive neutron based assaying system for alpha bearing solid wastes has been designed and developed. The detector system has been fabricated in a semi-circular shape to assay the alpha bearing solid wastes in a 200 L capacity SS drum. This detector employs eight numbers of ^3He neutron detectors embedded in High Density Poly Ethylene (HDPE). All the detectors were identical with an active length of 900 mm and a diameter of 50 mm filled with a gaseous mixture of 75% ^3He and 25% Kr at 3 bar pressure. For deploying this system in an environment with reasonably high beta gamma background radiation, 25 mm lead shield in front of the detector was used.

Studies reveal that, the rotation of the drum during the assay improves the accuracy of the results. However, only rotation by supplementary angles was found to yield results with minimum error which was found to be in the range of $\pm 20\%$. Hence two measurements at 180° apart were found to be sufficient for satisfactory assay. This system was calibrated with plutonium source typically handled in fast reactor fuel reprocessing facilities. The minimum detection limit of typical of research reactor grade plutonium has been estimated to be 35 mg with a 99.9 % confidence level for the back ground prevailing in the site. It has been determined that a gamma radiation background of up to 5 mSv/h could be tolerated without loss of accuracy.

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