In Situ Method Development for the Oil Based Mud (OBM) Radiological Characterization Originating from Oil Industry by Using a $LaBr_3$(Ce) Scintillator*

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Drilling muds are one of the primary wastes generated from oil drilling operations. They are used to lubricate and cool the drilling apparatus, transport drill cuttings to the surface and seal porous geologic formation [1, 2]. A typical composition of OBM (w/w) is: Barite (69.5%), Base Oil (25.8%), $CaCl_2$ (2%), Emulsifier (1.8%) and others (0.9%) [2]. Indicative radionuclides concentration range in the bibliography are 0.02-0.6 Bq/g for uranium chain and 0.03-0.8 Bq/g for thorium chain [3, 4].

Gamma spectrometry measurements were carried out for the 1.5'x1.5' $LaBr_3$(Ce) scintillator full characterization (FWHM, energy and efficiency calibration). Then, MCNP-X simulations for the detector efficiency curves were compared with the experimentally calculated efficiencies for the detector crystal geometric model determination. Factors that affect NORM analysis, such as $LaBr_3$(Ce) internal background and peak interferences, were considered to select the optimal emitting peak energies that will be used for the spectra analyses.

The development of the method for in-situ NORM characterization is based on the detector efficiency evaluation by MCNP-X simulations after taking into consideration common geometries of containers for NORM originating from Oil Industries and the experimental validation of the MCNP-X models in the field by using homogenous waste packages of known radioactivity of NORM. Also, potential layer distributions of radioactivity were modeled in the packages in order to estimate the inhomogeneity index for selected measurement configurations.

This method is sensitive, fast and accurate enough to characterize OBM packages in the field. Homogeneous drilling mud in containers with specific activities at the general clearance levels can be analyzed by a 30 min measurement with 30% relative error.

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