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Methodology Development for Characterization in the Field of NORM Originating from Oil Industries by using a LaBr3(Ce) Scintillator

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The last decade LaBr3(Ce) scintillation detectors have become commercially available and are very promising due to their high light yield (> 65000 photons/MeV) that results in a better energy resolution compared to NaI(Tl) detectors (< 3% FWHM at 137Cs), their decay time of 35 ns and their material density (5.29 g/cm3) [1, 2]. Also, there is no need for cooling comparing to HPGe detectors. Thus, LaBr3(Ce) detectors could be a suitable choice for environmental radiation monitoring [3] and in-situ measurements of NORM [4].
Gamma spectrometry measurements and MCNP-X simulations were combined for the in-situ technique development. Factors that affect NORM analysis, such as LaBr3(Ce) internal background, detector efficiency and peak interferences, were considered in order to select the optimal NORM radionuclides from uranium and thorium radioactive series and the corresponding emitting peak energies that will be used for the measurements. The activities of other radionuclides in the series, in radioactive equilibrium with the measured ones, can be estimated. The detector efficiency calibration was evaluated by MCNP-X simulations after taking into consideration common NORM waste geometries originating from Oil Industries. Minimum detectable activities for the selected radionuclides were also determined. The radionuclides which are not possible to be determined based on gamma spectrometry were identified for sampling and radiochemical analyses, if needed. Then, NORM gamma spectrometry characterization measurements were performed by using the LaBr3(Ce) in the field.
This methodology can be effectively applied at Oil Industries for the fast and cost effective radiological characterization of NORM waste.

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