

## Study of particular problems appearing in NORM samples and recommendations for best practice gamma-ray spectrometry

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### Content

The applied raw materials and processed substances within Naturally Occurring Radioactive Materials (NORM) industries have a huge diversity regarding their chemical composition and physical nature. Due to this diversity, various problems may occur for gamma-ray spectrometry of NORM. Because of overlapping gamma-lines, X- and gamma-rays, or X-rays in coincidence, the aimed determination of specific radionuclides is challenging and requires suitable corrections for the different NORM samples. In order to perform traceable, accurate, and standardized measurements and to ensure a safe and cost optimized use of raw materials, products and by-products, improved measurement practices and procedures are required for NORM industries. Within the Joint Research Project IND57 MetroNORM in the framework of the European Metrology Research Programme (EMRP) the difficulties, which arise in the measurement of NORM samples are analyzed and new actions are proposed. This paper describes the study of spectral interference in selected NORM key-materials. Moreover, the improvement of measurement procedures based on gamma-ray spectrometry for NORM including the definition and testing of suitable correction factors is presented. For that purpose, two radon tight volumetric sources for measurement of the activity of each photon emitting nuclide in the sources were prepared. The sources were used to perform a intercomparison exercise, aimed to identify the main sources of interference and evaluate the applied methodology of the project partners. This included a critical peak-by-peak evaluation on spectral interference, self-attenuation, coincidence summing and counting statistics problems. Besides K-40 and La-138, the following gamma-emitting radionuclides of the natural decay series were part of the investigation: Ac-228, Bi-212, Bi-214, Pa-231, Pa-234m, Pb-210, Ra-223, Ra-226, Th-227, Th-230, Th-234, Tl-208 and U-235. Special attention was given to the radon tightness of the applied sample containers. Based upon the work, a proposal for solutions and recommendations for best practice gamma-ray spectrometry of the investigated NORM key-materials is given. The EMRP is jointly funded by the EMRP participating countries within EURAMET and the European Union.

### About the Presenter

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