Combination of Field Measurements, Laboratory Analysis and Statistics as an Effective Approach to Characterize Large Amounts of NORM Contaminated Materials

Jens Regner[1], Peter Schmidt[1], Hartmut Schulz[2]

[1]*Wismut GmbH, Jagdschänkenstr. 29, 09117 Chemnitz, Germany*

[2]*IAF Radioökologie GmbH, Wilhelm-Rönsch-Straße 9, 01454 Radeberg, Germany*

telephone: +49 371 8120159, fax: +49 371 812096153, e-mail: j.regner@wismut.de

Abstract

For the management of large amounts of NORM contaminated material often information on characteristic radiological key parameters is needed, as for instance the mean specific activity or the total alpha surface activity. Such parameters are to be determined for licensing procedures, are input for exposure analyses or serve as criteria for the release of material from regulatory control. The parameters must be representative for the whole material. Overall measurements, as for instance the determination of the surface activity on the whole surface of an object, are as a rule technically not feasible or require non-reasonable efforts. In practice, field measurements are more pinpoint-like.

For the representative determination of radiological key parameters of big volumes of material or of largely-contaminated areas, IAF Radioökologie GmbH in cooperation with Wismut GmbH developed a special measurement approach. It is based on the combination of easily to carry out field measurements, statistical interpretation of the field data and laboratory analysis.

Beta radiation screening measurements using a hand-held contamination monitor revealed as a suitable field method to in-situ characterize materials contaminated with radionuclides of the uranium and thorium decay chains. The beta method is not limited to measure surface activities; - it allows also determination of specific activities. For that, a follow-up calibration is required which takes into account the impact of the geometry, the nuclide vector, the beta absorption in the field and other factors. To establish the link between the field measurement quantity (in units of “counts per second”) and the required radiological key quantity (in units of Bq/q or in Bq/cm²) field samples are analyzed in the laboratory, using a gamma spectrometer. The laboratory measurements are part of the quality assurance and quality control for the measurement approach.

Interpretation of the field measurement data from screening requires statistical evaluation. Established frequency distributions for field data on natural radioactivity suggests the use of lognormal or approximately lognormal distribution functions for the evaluation of the measured data. In case, a reference/limit value must be obeyed when NORM contaminated material is managed (for instance a reference value for the release), then the upper limit of the confidence interval of the statistically interpreted field data is compared with the value.

The approach of combination of field measurements, laboratory analysis and statistics has been successfully applied since years in the management of residues from uranium mining and milling at the WISMUT sites in Germany. In the present paper it will be exemplified by measurements to release lowly contaminated scrap for smelting and by measurements to characterize the uranium contamination on a food-print area of a relocated waste rock pile.