

Characterisation of buildings concrete surfaces for decontamination and free-release at NPP A-1, Slovakia

Alojz Slaninka¹, Ondrej Slávik¹

¹VUJE, Inc., Okružna 5, 918 64 Trnava, Slovakia, slaninka@vuje.sk, slavik@vuje.sk

Characterisation of concrete surfaces in Slovakia is focused mainly to NPP A-1 that is under 2nd stage of decommissioning project. The NPP A-1 has been shut down after nuclear accident with fuel core melting. Consequently, dominant contamination is caused by long-living ¹³⁷Cs that possibly occurs in concrete structures, as well. In dependence on contamination way the contamination occurs in the concrete surface layer of several mm thicknesses. Therefore, the base of the characterisation process is determination of total activity in the structure per unit surface area [Bq/cm²] that is in compliance with international recommendation RP-113. This recommendation prescribes clearance level of 10 Bq/cm² ¹³⁷Cs. This value will be specified (decreased) after including hard to detectable radionuclides contents.

Characterisation is required for decontamination as well as free release of buildings purposes.

Aim of the characterisation before the decontamination is determination of contaminated areas boundaries, depth of contamination as well as decontamination method depending on the find contamination depth. Characterisation for free release means the evaluation of all information and measured data obtained by particular monitoring methods and proposal of a free release monitoring plan.

Combination of various non-destructive and destructive measurement and sampling methods are applied in particular characterisation stages. These characterisation measurements shall be performed in compliance with national legislation that prescribes reference area of the monitoring (1 m² on evenly or 0.1 m² on non-evenly distributed contamination on monitored surface), using of metrologically certified measuring instruments etc.

Developed characterisation process of concrete surface at NPP A1 consists from the following monitoring methods:

Firstly dose rate survey monitoring is carried out aimed at identification of “hot spots” and significantly contaminated areas identification (> 10 µSv/h or > 2 µSv/h). Prior decontamination of these areas means the decrease of an external interfering radiation and dose burden.

In the pre-decontamination phase, taking out of samples from the concrete structure (core or common drill) is required for the effective contamination depth determination and hard to detectable radionuclides contents estimation. Knowledge of effective contamination depth is necessary for selecting appropriate decontamination technique and for applicable the total activity in the structure per unit surface area monitoring. This monitoring was proposed to be performed by means of hand-held gamma-spectrometer InSpector 1000 with a non-shielded scintillation LaBr detector placed on the monitored surface in the regular grid 1 x 1 m². Effectively monitored area is 1 m² and minimum detectable activity of ¹³⁷Cs for counting time 100 s and common radiation background is on the level 0.5 Bq/cm². Measured values are compared with clearance level value for ¹³⁷Cs. Derivation of this level require consideration of hard-to-detect radionuclides contents (first derivation use historical information on RN vector). The monitoring and decontamination processes are repeated until entire monitored surface fulfils the clearance level.

In dependence on the contamination potential (determined by classification of monitored surface) the checking of non-evenly activity distribution on the surface is necessary. This monitoring is performed by standard surface contamination measurements by means of hand-held instruments based on sum beta activity measurement with sensitivity area less then 1000 cm² (legislation limitation). Measured surface activity values are compared with the limit level derived from the clearance level and the instruments and source efficiency of beta radiation in the concrete structure. The last one is strongly influenced by effective

contamination depth (consideration of). The data for gross beta activity efficiency depending on contamination depth was obtained empirically by means of measuring variously thick concrete slabs (2 to 10 mm) with reference ^{137}Cs activity prepared in laboratory.

Drilling core samples through the all depth of concrete structure are used to demonstrate that no contamination occurs in concrete internal material.

In the final stage of the clearance characterisation process all obtained data are summarized, evaluated and supplemented by missing data from inaccessible places etc. On this basis a monitoring plan for clearance measurement is proposed using metrologically certified equipments.

First experiences with clearance and characterisation of underground large concrete tanks was obtained recently within the above mentioned project. It will be discussed in more detail in the presentation.