

## **Database of Contaminated Concretes and Its Role within Conception of Buildings Clearance - 11262**

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### **ABSTRACT**

In 2009 was proposed a new conception of building clearance within the decommissioning project of Bohunice NPP A1, Slovakia [1, 2]. The conception is based on recommendation of European Commission - RP113 [4, 5]. The new concept of free release of buildings was successfully agreed with the authority in the spring 2010. The documentation needed for licensing purposes is under preparation within the project, now. Planning and recording of all physical and measurement data will be controlled chronologically in particular database (contaminated concrete management DB - CMD), which is already being used by license owner for 2nd stage of decommissioning project of NPP A1 (JAVYS). The customized Concrete Management Database [6] (Database of contaminated concretes - DBCC) accomplishes all requirements of Slovak authorities for quality of measured data. The DBCC is effective tool for continuous filling in with new data, presentation of characterization and clearance measurements, and decommissioning status of building structures. The DBCC is important part of the new conception of building clearance and enables effective communication with experts and the authority but also it serves for confidence with the public.

### **INTRODUCTION**

Monitoring and decontamination of buildings surfaces precedes the clearance and free release of the building. In 2009 a new conception of building clearance was proposed within the decommissioning project of Bohunice NPP A1, Slovakia. The conception is based on recommendation of European Commission - RP113 [4, 5]. Its basis is that clearance measurements are performed in the erected building before the demolition. The main advantage of this approach is that the measured contamination of buildings structures (except of biological protection) is located in a very close distance (to the detector) during the measurement carried out. One of important parameter for contaminated concrete structures, depth of contamination, was experimentally investigated within the project. It was found that the penetration of contaminants (Cs-137) after about 30 years is rarely bigger then 1-2 centimeters.

### **CONCEPTION OF BUILDINGS CLEARANCE**

It is proposed to use limits for total surface contamination, which are specific for radionuclides according to RP113 [4, 5] (e.g. 10 Bq/cm<sup>2</sup> for Cs-137). For building rubble it was shown that after demolition of a typical concrete object (average thickness of walls is about 50 cm) the total surface activity limits from RP-113 comply with the mass activity criteria given in Slovak legislation [11], 300 Bq/kg for Cs-137 (radionuclides in the 1<sup>st</sup> class of radio-toxicity). Measurements of total surface contamination of radionuclides by properly calibrated devices for measurement of gross beta activity and determination of contamination depth for dominant Cs-137 by semiconductor detectors were proposed within the prepared concept.

The new concept of free release of buildings was successfully agreed with the authority in the spring 2010. The documentation needed for licensing purposes is under preparation within the project, now.

The concept of building clearance consists of 3 stages [1, 3]:

- Pre- decontamination
- Post- decontamination and characterization
- Clearance

### **Pre- decontamination stage**

Measurements within this stage are performed mainly by devices for measurement of surface contamination where total surface activity of Cs-137 is measured. Many surfaces are contaminated in depth and therefore it is suggested to remove the surface layer (1-2 mm) of surfaces with large potential of contamination before the measurements. From experiences it's known that with this layer 75 - 90 % of total activity will be removed.

Measurements are performed on regular grid (100 x 100) cm. Position of the measurement is stored with value in DBCC. Place with measured values above the clearance level are marked for decontamination purposes - see Fig.1.



Fig.1 Example of monitoring grid and place with measured values above the clearance level.

Because of concrete surfaces are contaminated in depth, it is necessary to make a correction to the measured values according to the depth of contamination (source efficiency). Depth of contamination is determined by in-situ HPGe gamma-spectrometry (peak-to-peak ratio) [8, 9, 10]. From places with maximum contamination core drill samples are taken as well. The samples serve to confirm the depth of contamination and to determine the radionuclide vector by laboratory analyses.

When the depth of contamination is known it is possible to correct the measurements of total surface activity. To determine the source efficiency, cement sources of Cs-137 were created. Sources had various thicknesses (simulating depth of contamination) and the same composition of elements as the concrete in building structures in NPP A1, Jaslovske Bohunice. The calibration

sources were measured and the efficiency with correction factors (gamma radiation, natural nuclides ...) were experimentally determined

### **Post- decontamination and characterization stage**

The primary purpose of the stage is to verify that decontamination of the surface is sufficient. In ideal case the measured values gained within this stage could be used in next one. It means that 100 % of the surface should be measured. The same method of measurement is used as in previous stage. The same measurement grid can be used again only in the case of homogeneous distribution of surface activity. Otherwise detailed grid has to be used (20 x 50) cm. Within the characterization all necessary radiological data should be gained (surface contamination in corners, piping, etc.)

### **Clearance stage**

Final survey is performed by independent organization to confirm the measured data. Monitoring grid should be different in this stage (results should be independent on beginning of the grid). After confirmation of measured values, the building can be demolished. Part of the building rubble will be checked via central monitoring system, which is licensed for clearance / free release measurements.

### **CONTAMINATED CONCRETE MANAGEMENT DATABASE**

Planning and recording of all physical and measurement data are controlled chronologically in particular database (DBCC), which is already being used by license owner for 2nd stage of decommissioning project of NPP A1 (JAVYS). The original CMD [7] was bought within the decommissioning project - phase I. from SCK-CEN (Mol, Belgium) and further customized according to the project needs (DBCC) [6]. The following tasks are ensured presently by the DBCC:

- Estimation of arising wastes from given surface, room or building.
- Decommissioning status of each surface, i.e. measurement, decontamination, characterization is performed.
- Datasheets with list of measured values for declaring of building, room and surface status.
- Export of measured values from DBCC with visualized levels of contamination (colored fields).
- Automation and informatics of measurement (import and direct on-line storing of measured values into the DBCC).
- User management (privileges for reading and/or editing the specific data tables).

The customized Database of Contaminated Concretes accomplishes all requirements of Slovak authorities for quality of measured data.

- QA of measured data (clearly identification of measured data by number referencing to object, room, surface and position of the measurement).
- System of classification of surfaces according to contamination potential.
- Continuously recording of measured data and communication with authorities.
- Long-lasting and reliable archiving of measured data, which assures possibility of back searching of determined problematic data.

- Declaration of building measurement via protocols from database.

## CONCLUSIONS

A new conception of Building clearance was proposed based on recommendation of European Commission RP113 [4]. The conception uses clearance levels for total surface contamination at level of 10 Bq/cm<sup>2</sup>, which is in agreement with clearance level for mass contamination stated in national legislation [11]. Monitoring of surface contamination is performed in three stages: Pre-, post- decontamination and clearance.

The new concept of free release of buildings was successfully agreed with the authority in the spring of 2010. The documentation needed for licensing purposes is under preparation within the project, now.

Planning and recording of all physical and measurement data will be controlled chronologically in particular database DBCC. The database ensures quality assurance of measured data and complementary requirements of Slovak authority.

The DBCC is effective tool for continuous filling in with new data, presentation of characterization and clearance measurements, and decommissioning status of building structures. The DBCC is important part of the new conception of building clearance and enables effective communication with experts and the authority but also it serves for confidence with the public.

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