



Strategies for Radiological Characterisation in Decommissioning

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OECD/NEA Workshop on Radiological Characterisation for Decommissioning
Studsвик, April 2012

Abstract

In the first half of 2011, the Radiological Characterization and Decommissioning Task Group (RCD) of the WPDD of the OECD/NEA has prepared a questionnaire on the characterisation of nuclear facilities that has been circulated among nuclear installations in various OECD countries. The aim of this questionnaire was to gather information on the approaches and methods that are used for radiological characterisation (RC) for systems and components, for buildings and for sites (land), on domestic and international guidance and regulations that govern RC, and on the experience with RC that is already available in the particular country.

The number of responses to this questionnaire that were received in the second half of 2011 was very satisfactory, so that a broad overview is now available from the following countries: Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, South Korea, Spain, Sweden, United Kingdom and USA. The presentation deals with the results that were obtained from the evaluation of these questionnaires and gives overviews of the objectives of characterisation, the input data for planning of characterisation, the measurement techniques that were used for metallic structures and components, for buildings and for sites, the data management and QA measures, the obstacles that were encountered, the experience with availability of as-built plans, the regulatory framework and guidelines, and the costs for RC. All information on RC is further broken down with respect to the operational phase (where RC is used for preliminary decommissioning planning), the transition phase (where RC supports decommissioning planning) and the actual decommissioning phase (where RC is needed for dismantling, decontamination and treatment of systems, components, buildings etc.). The presentation also offers conclusions on these subjects.

1. Introduction

A questionnaire on the Characterisation of Nuclear Facilities has been sent out by the Radiological Characterization and Decommissioning Task Group, which forms part of the OECD/NEA Radioactive Waste Management Committee (RWMC) and the Working Party on Decommissioning and Dismantling (WPDD). It was the aim of this questionnaire to gather and examine experiences in strategic considerations for characterisation of facilities undergoing decommissioning or of facilities that have already prepared decommissioning planning.

The questionnaire has been divided into following 5 sections:

1. Questions on the Facility
2. National Context
3. Characterisation of Systems and Components
4. Characterisation of Buildings
5. Radiological Characterisation of Soil and Groundwater



Answers have been received from the following 13 countries: Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, South Korea, Spain, Sweden, United Kingdom and USA. These answers often represent a single decommissioning project, but some cover a variety of projects, ranging from nuclear power plants to fuel cycle facilities.

While the number of answers received for sections 1, 2 and 3 was very satisfactory, answers for sections 4 and 5 were scarce so that this evaluation concentrates on the national context and the radiological characterisation for systems and components, i.e. mainly metallic parts of nuclear installations.

2. Evaluation of the questionnaires

The following observations can be made with respect to the various topics covered by the questionnaire:

2.1. Country-specific Context for Radiological Characterisation

The answers to the country-specific data reveal, that in most countries the approaches between various operators of decommissioning projects towards characterisation are not harmonised. Information exchange is generally taking place, but mainly only to a limited extent. The exceptions are of course those countries where there is only one operator of decommissioning projects, which are Denmark (Danish Decommissioning) and Spain (ENRESA).

Regulations that specifically pertain to characterisation are available in Spain. Most countries have only guidance documents, while some have developed neither regulations nor guidance. The answers to Sweden originate from four independently filled-in questionnaires and range from “none” to “specific regulations”, which needs further clarification.

Experience with characterisation (at least for metallic structures and components) is judged anything between poor and extensive (with a wide range again in Sweden). The answer provided at this point is generally in good agreement with the number of decommissioning projects that actually have been carried out in that country.

Both the number of contractors available for characterisation and the number of laboratories that can perform sample analysis and measurements are generally considered small or moderate, indicating that the number of contractors is growing only according to the actual requirement of capacities.

2.2. Objectives of the Characterisation of Systems and Components

The characterisation of systems and components during operation mainly serves for the preparation of the decommissioning plan and the environmental impact assessment which is often associated with decommissioning planning. Characterisation is also relevant for all issues of planning, radiation protection etc., but not for planning of specific projects. This changes in the transition phase, where issues of waste management planning, cost estimates, determination of nuclide vectors etc. become more relevant. In the implementation phase, all radiological issues like nuclide vectors, management of radiological hazards for workers and waste management planning have the highest importance.



2.3. Optimisation of Characterisation and Encountered Obstacles

During the planning phase, a good knowledge of the plant history is considered to be of highest importance. During the transition phase, other aspects like a clear idea of which radionuclides to include and for which objectives the radiological characterisation is to be carried out become equally important, as can be expected from the role the transition phase plays for a decommissioning project. Later in the implementation phase, all aspects are deemed equally important.

The most pronounced obstacle was obviously inadequate measurement techniques during the implementation phase of decommissioning, i.e. the phase where usually the most demanding measurement tasks have to be executed.

2.4. Data Management

The data that are obtained from radiological characterisation during the various phases of decommissioning projects need to be managed and kept for a rather long time. Usually, databases of some kind are used, ranging from simple spreadsheet implementations to purpose-built database applications. Some projects, however, use only simple tables, at least in their current status. The high importance of such a database, however, has been acknowledged by all decommissioning projects.

The objectives for using such databases range from optimisation of treatment processes for various types of materials over the verification of requirements for clearance / release of materials to issues of waste storage and disposal.

The periods of time over which samples and documents on radiological characterisation have to be kept range from a few months over several years to the end of the decommissioning project.

2.5. Measurement Techniques

There are many measurement techniques that can be used for radiological characterisation, depending on the material and the purpose of the measurements. The following very general observations can be made:

- Dose rate measurements have a high importance in all phases of the decommissioning project.
- Sampling and subsequent analysis in a laboratory is of much lower importance during operation, while it becomes very relevant during transition and decommissioning. Gamma spectrometry is generally carried out in-house, while radiochemical separation for determination of hard-to-measure nuclides is done in external laboratories.
- Surface contamination monitors are ascribed only moderate importance in all phases for characterisation (this is different from actual clearance measurements).
- Wipe tests receive a higher importance for characterisation for transition and decommissioning than during operation.
- In-situ gamma spectrometry is generally seen of medium importance, slightly higher during transition.
- Statistical evaluation methods of the data from characterisation play no role during operation and have only medium importance for transition and decommissioning.
- Chemical analyses of samples are considered to have low importance during operation and transition and only medium importance for decommissioning.

2.6. Methods for Establishing “Fingerprints” / Nuclide Vectors

The methods for establishing “fingerprints” or nuclide vectors cover a wide range from taking the arithmetic mean of activity percentages from a set of sampling results over taking weighted averages to more sophisticated methods incorporating knowledge from other sources (e.g. the operational processes like burn-up calculations). The approaches used for single decommissioning projects depend on the purpose and the national context and cannot be described in detail here.

2.7. As-Built Plans

The availability of detailed as-built plans for the plant or for structures was generally judged as fairly or very good. One decommissioning project provides an indication of 80-100 %. This means that plans from the construction or operational phase are available in nearly all cases. However, the quality and accuracy of as-built plans is rated from variable to fairly good or even very good. This seems to indicate that most of the relevant features required for planning of radiological characterisation can be derived from these plans.

2.8. Regulatory Framework and Other Guidelines on Radiological Characterisation

Many decommissioning projects state that no specific parts of the regulatory framework on radiological characterisation exist, while the rest state that some parts of the regulatory framework are available. Some types of guidelines for radiological characterisation are available in most cases.

This means that radiological characterisation seems to be treated in nearly all countries as a more technically oriented issue that can best be dealt with using technical guidelines that can be adapted to the specific needs of a facility instead of making detailed and rigid prescriptions in the regulatory framework.

2.9. Costs for Radiological Characterisation

The range of costs that has been stated by the various decommissioning projects range from less than 1 % to less than 5 % (with the exception of Italy). There seems, however, to be a general range of 1 to 2 % of the overall decommissioning budget.

3. Overall Conclusions

The evaluation of the questionnaires as presented in section 2 leads to the following overall conclusions on issues and implementation of radiological characterisation in various OECD member states:

- Most decommissioning projects that have provided answers have a clear understanding of the procedures and the measurement techniques that are required for performing a meaningful radiological characterisation of nuclear facilities.
- The necessity for the management of the large number of data that arise from the radiological characterisation process is also understood. In particular, the importance of the operational history as a data source and the importance of these data for documentation of the facility and planning the decommissioning process as well as the high importance of implementing a suitable database are understood.
- The most commonly applied measurement techniques for radiological characterisation include dose rate measurements, particularly in the early phases of decommissioning, as well



as sampling with analysis in (own or external) laboratories and surface contamination monitors in all phases of decommissioning.

- A harmonisation of the approaches to perform the radiological characterisation process and requirements on measurements, at least to a certain degree, would probably be desirable. A quasi-standard that is mentioned by many decommissioning projects has been established with the extensive MARSSIM documentation. It is obviously not necessary to implement prescriptions on radiological characterisation on a legal level; recommendations and guidelines seem to be sufficient.
- The costs for performing radiological characterisation are estimated in the range of a few percent from the overall decommissioning budget. When interpreting this figure, it must be kept in mind that it just pertains to obtaining the data that form the basis for decisions on decontamination, for waste management, for the clearance procedure and for decisions on radiation protection measures during segmenting and handling the material, not to all these procedures and measures themselves. Costs in the estimated range therefore seem reasonable.
- The availability and the accuracy of documents that are available from the operational phase and can be used as the basis for planning and performing the radiological characterisation has been rated as good in many cases, suggesting that the plant documentation is usually kept at such a level allowing meaningful planning of radiological characterisation. This may not be the case for planning for dismantling and further waste treatment; however, these issues are out of the scope of this report.
- The availability of platforms for information exchange, either on a national or an international scale, has been deemed important. Obviously, such a process is not available in all countries. The WPDD or, more generally, the OECD/NEA could therefore offer to provide appropriate fora for information exchange.