

# IAEA Perspectives on Radiological Characterisation

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Requirements for characterization of radiological and other hazards in nuclear facilities are reflected in the IAEA Safety Standards. WS-R-5, *Safety Requirements for Decommissioning of Facilities using Radioactive Material*, includes a requirement that “During the preparation of the final decommissioning plan, the extent and type of radioactive material (irradiated and contaminated structures and components) at the facility shall be determined by means of a detailed characterization survey and on the basis of records collected during the operational period”. The subsidiary Safety Guide WS-G-2.1, *Decommissioning of Nuclear Power Plants and Research Reactors*, further elaborates that “A survey of radiological and non-radiological hazards provides an important input for the safety assessment and for implementing a safe approach during the work”.

Although the characterisation requirements addressed in the Safety Standards relate primarily to the detailed survey activities undertaken following the shutdown of the facility, it is evident that radiological characterization is of relevance to all major phases of the lifetime of a nuclear facility, including:

- the siting phase – baseline surveys are undertaken to determine background radiation levels;
- the construction phase – construction materials are retained to support future calculations of radioactivity distributions;
- the operational phase – surveys are done regularly, with additional surveys being required following incidents involving plant contamination;
- the transition phase – detailed radiological surveys are required to support the development of the final decommissioning plan; and
- the closure phase – a final survey of the site and any remaining structures will be needed to support an application for release of the site from regulatory control.

In the case of facilities that are already shut down, the main purpose of radiological characterisation is to provide a reliable database of information on the quantity and type of radionuclides, their distribution and their physical and chemical states – e.g. see IAEA report no. TRS-389, *Radiological Characterization of Shut Down Nuclear Reactors for Decommissioning Purposes*.

The collection of detailed data on the physical, chemical and radiological conditions in a nuclear facility, including activity calculations, in situ measurements and/or sampling and analysis, facilitates a detailed estimation of risk, cost and waste generation during decommissioning, and supports the selection of the overall dismantling strategy – e.g. partial vs. full decontamination, requirements for shielding and for partial removal of equipment and services – and its detailed planning. It also supports the assessment of different dismantling options and their consequences, including decontamination and dismantling procedures and tools required, and arrangements to ensure the radiological protection of workers, general public and the environment.

The extent and phasing of characterisation will depend on the selected dismantling strategy, with significantly more extensive characterisation being necessary in the case of an immediate dismantling strategy than in the case of deferred dismantling. Detailed characterisation of certain radionuclides may not be required, e.g. of short-lived radionuclides if a deferred dismantling strategy is followed and of alpha-emitting radionuclides where no fuel damage has occurred.

In conclusion, the process of radiological characterisation and the associated requirement for physical/structural and chemical characterisation provides important information for decommissioning planning and for safe and effective implementation of decommissioning activities, although careful planning and implementation is required to ensure that these objectives are met. This may require the use of significant resources and, accordingly, result in significant expense being incurred, e.g. relating to the use of knowledgeable and trained personnel, procurement of sampling equipment and instrumentation, laboratory capabilities, simulation/calculation codes, data management systems and record keeping. Ensuring the safety of workers undertaking characterisation is an important consideration, due to inherent uncertainty of the quantities being measured, and this aspect is leading to the increasing use of automated techniques based on the use of robotics.