Radiological Characterisation – Know your objective

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Workshop Radiological Characterisation
Studsvik 17-19 April 2012

Radiological Characterisation – Know your objective

- Different objectives
- Specify clearly
- Execution
- Deliverables & data
- Optimise

Confidentiality - None (C1)

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Radiological Characterisation – different objectives

A radiological characterisation can be prepared with the objective of addressing several different issues:

- Predict waste activity inventories
- Dimension waste facilities
- Perform decommissioning cost estimates
- Estimate dose budgets
- Estimate radiological releases
- Free release of facility or site

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Prediction of waste activity inventories 1 (2)

It is important to have an indication of the waste activity inventory in order to plan the following functions

- Waste handling logistics
- Waste packaging
- Other waste management aspects

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Prediction of waste activity inventories 2 (2)

Example: Decommissioning logistics and waste management for Barsebäck 1 and 2

- In service operation, decommissioning project starts 2018
- Study of decommissioning logistics and waste management by Vattenfall Research & Development AB during 2011-2012
- Activity and material inventories based on previous radiological characterisations and calculations

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Dimensioning of waste facilities 1 (2)

The waste activity inventory is also significant when dimensioning future waste disposal and treatment facilities.

- Conservative or best estimate
- Waste Acceptance Criteria (WAC) – long-term safety
- Benefits of measurements versus calculations

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Dimensioning of waste facilities 2 (2)

Example: Dimensioning of the extended SFR – Final repository for short-lived low- and intermediate level decommissioning waste

- Inventories of waste activity and amounts
- Transport planning
- Waste packages
- Long-lived nuclides can be a challenge

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Decommissioning – cost estimates 1 (2)

Radiological characterisation is a factor in performing cost estimates for decommissioning.

- Scope of the cost estimate
- Timing and status of the plant
- Uncertainty
- What dominates the total cost?
- Objective and focus of the cost estimate

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Decommissioning – cost estimates 2 (2)

Example: Ågesta
decommissioning cost
estimate

- Activity and material inventories
- Final destination of the waste
- Understanding of uncertainties and objective of previous characterisations
- End-state yet to be decided

THE ÅGESTA REACTOR

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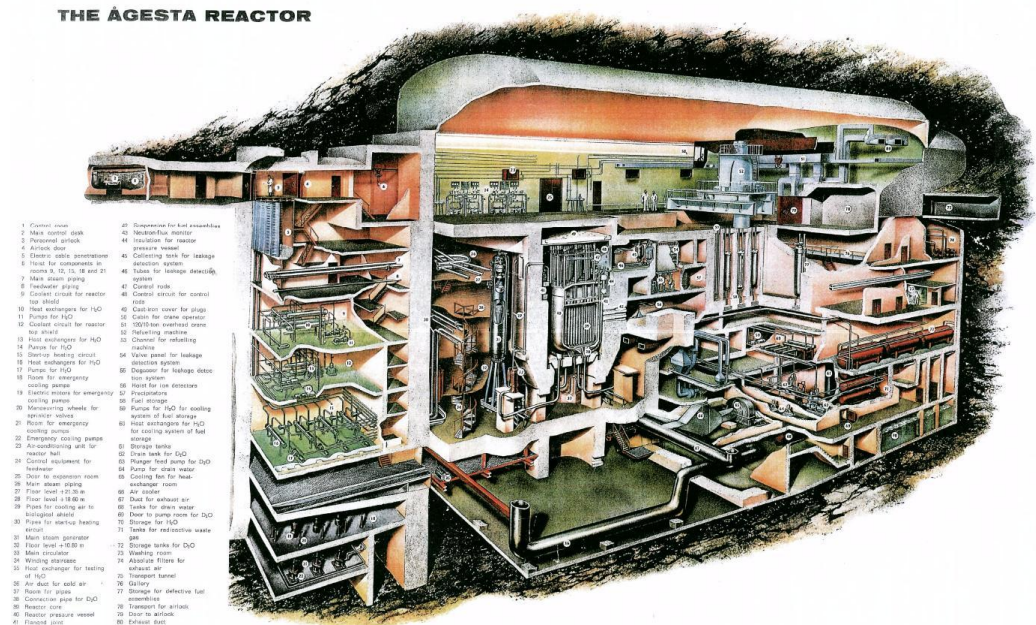
Estimating dose budgets 1 (2)

Dose budgets are based on activity inventories.

- During operation
- Decommissioning/dismantling
- Waste management
- Dose budgets should generally be conservative

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Estimating dose budgets 2 (2)

Example: Handling of reactor internals at Forsmark NPP

- Dose budgets based on previous measurements
- Conservative estimation

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Estimation of radiological releases 1 (2)

Radiological releases are usually estimated as a basis for licenses and compliance with regulatory requirements

- Theoretical calculations and measurements
  - During operation
  - During dismantling
  - From waste repositories
- Release paths – normal operation and accident conditions

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Estimation of radiological releases 2 (2)

Example: SFR – Final repository for short-lived low- and intermediate level (operational waste)

- Different nuclides – different release paths
- Dose evaluation

Example: Fukushima

- Vivid example of challenges associated with an extraordinary event
- Tracking of relevant release paths

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Free release 1 (2)

When applying for free-release of a facility or a site, certain aspects of the radiological characterisation are important

- Comprehensive study needed
- Measurements
- History of the facility
- Regulatory requirements

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Free release 2 (2)

Example: Ågesta former nuclear power plant (auxiliary buildings and surrounding area)

- Old facility, in operation 1964-1974

- An extensive study of archives, operational history etc was performed

- Additional radiological characterisation

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Writing a Specification for radiological characterisation

When specifying a radiological characterisation programme there are many things to consider:

- Which radionuclides to include
- Appropriate degree of conservatism
- How should uncertainties be taken into account and applied to the results?
- Are there acceptance criteria that need to be met?

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Execution of a radiological characterisation programme 1 (2)

During the execution of a radiological characterisation programme it is important to keep in mind:

- What assumptions apply?
- What are the limitations?
- How to handle unexpected results
- How to handle non-operation related radioactivity
- Can benchmarking be performed? Iterative approach during decommissioning phase

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Also think about:

- Missing data – how can this be compensated?
- Values that cannot be measured – how can these be modelled?
- The advantages of calculations versus measurement
- QA in sampling programme
- Evaluation of the results

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Deliverables / data appropriate for the objective

The deliverables and data produced should be appropriate for the objective and end use. The following should be considered:

- How easy is it to change values/assumptions?
- Account for radioactive decay
- Grouping of data – what is the most useful for the objective?
- Uncertainty
- Conservatism
- Choice of database tool

Confidentiality - None (C1)

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Optimisation

There should be an attempt to optimise the characterisation and some compromises may be necessary

- Schedule for performing the radiological characterisation
- Access
- Consider the value added
- Precision required
- Compromise might be necessary if multiple objectives

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Summary and conclusions

- There can be several different objectives when performing a radiological characterisation

- It is important to clearly define these objectives when specifying a radiological characterisation

- Different objectives can affect the execution of a radiological characterisation programme

- The deliverables and data produced should be appropriate for the objective and end use

- There should be an attempt to optimise the characterisation and some compromises may be necessary

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