Strategies for Radiological Characterisation used by Decommissioning Projects in OECD Countries

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Overview

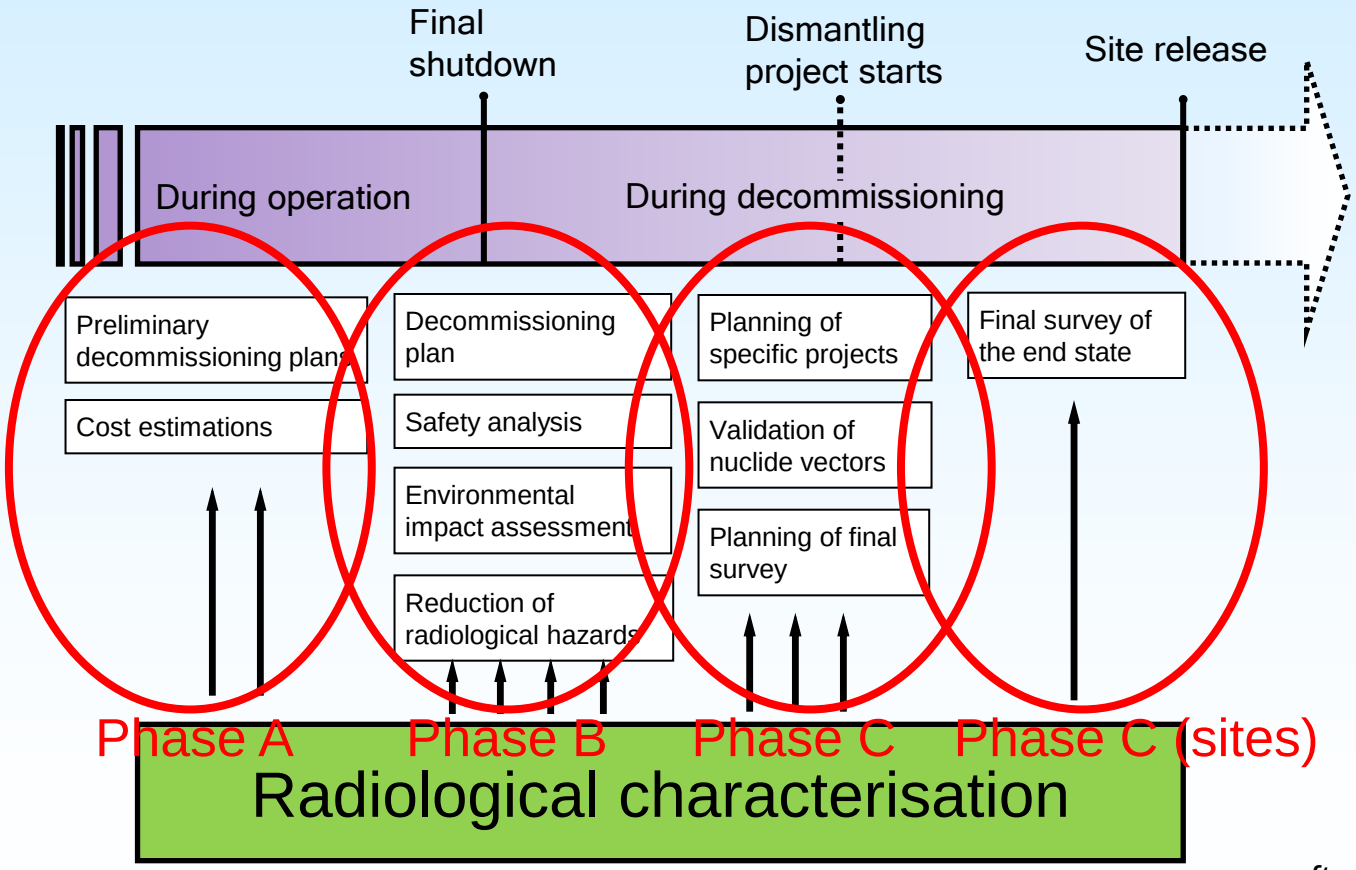
- Background
  - How data were obtained in the RCD Working Group
- Evaluation of a Questionnaire
  - Outline
  - Answers received until March 31, 2012
- Results with respect to radiological characterisation
  - Framework in various countries
  - Objectives and approaches
  - Methods

Background

- RCD Working Group:
  - formed at beginning of 2011
  - to develop a WPDD Status Report on selection and tailoring of strategies for radiological characterisation and its importance for safe decommissioning of nuclear facilities
- Questionnaire:
  - development and agreement on a questionnaire to find out issues, strategies and open questions in radiological characterisation: April – June 2011
  - dissemination of questionnaire to decommissioning projects in OECD countries: July – Sep. 2011
  - presentation of first results: WPDD Meeting Paris, Nov. 2011
  - answers evaluated by S. Thierfeldt and K. Haneke of Brenk Systemplanung, Aachen: Sep. 2011 – March 2012

Questionnaire: Ares of Questions

Characterisation efforts are needed at all stages of a facility´s life time



after H. Efraimsson

Questionnaire: Structure

- 5 Areas:
  1. Description of facility
  2. Assessment of the national context with respect to characterisation
  3. Characaterisation of systems and components (metals)
  4. Characaterisation of buildings
  5. Characaterisation of sites

- Breakdown into phases:
  - Phase A = operation (preliminary decommissioning planning)
  - Phase B = transition phase (decommissioning planning)
  - Phase C = actual decommissioning (specific systems)

Questionnaire: Overview of Answers

Country	Response received as of 01 Jan. 2012
Belgium	Eurochemic Reprocessing Plant
Canada	research reactor and Hot cell facility at AECL Lab
Denmark	DR3 research reactor
Finland	NPP Loviisa
France	NPP Chooz-A
Italy	all four NPPs and all four fuel cycle facilities
Japan	FUGEN, JRTF（JAERI's Reprocessing Test Facilities), U Enrichment Demonstration Plant, U Refining and Conversion Plant, Pu Fuel Fabrication Facility
South Korea	U conversion plant
Spain	NPP José Cabrera
Sweden	NPPs Barsebäck, Forsmark, Oskarshamn, Ågesta, R2
UK	Sellafield, various facilities (AGR, MAGNOX, MOX Fuel Fabrication, Waste treatment, Reprocessing)
USA	Portsmouth Gaseous Diffusion Plant

Evaluation - Overview

- Evaluation
  - performed for WPDD Topical Session, November 2011
  - evaluation of all questions of sections 2, 3
    - national context
    - characterisation of systems and components
    - for all phases
  - new evaluation for WPDD Workshop Studsvik, April 2012

- Evaluation of sections 4 and 5 (buildings and sites)
  - number of answers too small for meaningful comparison

Evaluation: Country-specific data

Country	Information Exch. / Approaches	Regulations	Experience	Contractors / Laboratories
Belgium	available, limited various approaches	only guidance	extensive	small number small number
Canada	available, limited various approaches	not for characterisation	moderate	small number small number
Denmark	only internal inside Danish Decommiss.	none	moderate	small number small number
Finland	available, good various approaches	only guidance	poor	small number moderate number
France	available, limited various approaches	only guidance	moderate	moderate number small number
Italy	not available various approaches	only guidance	moderate	small / moder. number small number
Japan	available, limited various approaches	none (DP checked by authorities)	moderate	small number moderate number
Korea	not available various approaches	no regulations exist	poor / moderate	small number small number
Spain	ENRESA only oper. of decomm. projects	detailed regulations	extensive (metals, bld) poor (sites/soil)	moderate number moderate number
Sweden	limited to good harmonised approach	“none” to “detailed regulations”	poor / moderate / extensive	small / large number Labs: small number
United Kingdom	available, limited various approaches	only guidance	moderate / extensive	moderate number small number

Evaluation: Objectives of Characterisation of Systems and Components

Objective	Phase		
	A	B	C
Preparation of the (preliminary) decommissioning plan	H	H	L
Planning of specific projects	L	M	M
Determination of nuclide vectors / scaling factors / fingerprints	M	H	H
Validation of nuclide vectors / scaling factors / fingerprints	M	M	H
Overview of hazardous substances (asbestos, PCB etc.)	M	H	M
Cost estimations	M	H	M
Environmental impact assessment	H	H	L
Safety analyses	M	H	M
Management of radiological hazards for workers	M	H	H
Planning for radioactive waste management / waste minimisation	M	H	H
Reporting to national radwaste inventory	M	M	M
Planning of decontamination (extent, methods)	M	M	M
Asset management (physical state of systems and components)	M	M	M

Evaluation: Optimisation of Characterisation and Encountered Obstacles

Aspects for ensuring optimisation of characterisation	A	B	C
Early interfacing with stakeholders (e.g. authorities)	M	M	M
Use of proven measurement techniques	M	H	M
Good knowledge of operational history	H	H	M
Clear idea of which radionuclides to include	M	H	M
Clear objectives for the characterisation	M	H	M
Obstacles considered for / encountered during characterisation	**A**	**B**	**C**
Inadequate measurement techniques (detection limits too high etc.)	L	M	H
Additional / unexpected radionuclides encountered	L	M	M
Some areas inaccessible for which characterisation had been planned (e.g. ALARA consideration)	M	M	M
Missing guidelines for performing characterisation	M	M	M

Evaluation: Input Data for Planning of Characterisation

Information/data used as input	Phase		
	A	B	C
Facility documentation	M	H	M
Operational history	M	H	M
Results from measurements during operation	M	M	M
Results from measurements after shutdown	L	M	M
Interviews of former operating personnel	M	M	M
Data from similar facilities	M	M	M
Calculation methods (various)	M	M	M

Evaluation: Data Management and QA Measures

- Data usually entered into database
  - types of databases vary considerably

Measures for QA	Phase		
	A	B	C
Data entered into a database for access in later stages of decommissioning	H	M	M
Use of accredited laboratories	M	M	M
Internal auditions	L	M	M
Independent control measurements	L	L	L
Evaluation of plans for characterisation by external experts	L	L	L
Evaluation of measurement results by external experts	L	L	L
Clarification on the accuracy of measurement techniques	M	M	M

Evaluation: Measurement Techniques used for Metallic Structures and Components

Technique	Phase					
	A		B		C	
Dose rate measurements	2.0		2.0		2.0	
Sampling and analysis with gamma spectrometry – own/external lab	1.4	0.9	1.7	1.2	2.0	1.2
Sampling and analysis after radiochemical separation – own/external lab	0.7	1.2	0.8	1.9	1.1	1.3
Surface contamination monitors	1.4		1.7		1.4	
Wipe tests / smear tests	1.4		1.6		1.8	
In-situ gamma spectrometry	1.3		1.6		1.5	
Use of statistical evaluation methods	1.1		1.2		1.6	
Chemical analyses/composition analyses (impurities)	0.9		0.8		1.1	

Evaluation: Methods for Establishing “Fingerprints” / Nuclide Vectors

- Methods cover a wide range
  - taking the arithmetic mean of activity percentages from a set of sampling results
  - taking weighted averages
  - more sophisticated methods incorporating knowledge from other sources
    - burn-up calculations
    - activation calculations

Evaluation: Periods for Keeping Reference Samples

- Broad range of requirements for the period over which reference samples have to be kept
  - 3 and 6 months,
  - 1, 5, 10 years,
  - until the end of decommissioning.

Evaluation: As-Built Plans

- Availability of detailed as-built plans
  - for the plant or for structures
  - overall estimate:
    - fairly or very good
    - 80-100 %.
  - plans from construction or operational phase available in nearly all cases
- Quality and accuracy of as-built plans
  - overall estimate
    - variable, depending on age
    - to fairly good or even good
  - most of the relevant features required for planning of radiological characterisation can be derived from these plans

Evaluation: Regulatory Framework and Guidelines on Radiological Characterisation

- No specific parts of regulatory framework exist on radiological characeterisation
  - 8 of 15
- Guidelines available:
  - 11 of 15
- Specific guidance found to be missing:
  - 8 of 15

Evaluation: Costs for Characterisation

- Range of costs:
  - less than 1 % to
  - less than 5 %
  - one case: 15-20 %

- General range:
  - 1 to 2 % of the overall decommissioning budget

Conclusions (1)

- Clear understanding of procedures and measurement techniques required for performing RC
- Management of the large number of data
  - importance of the operational history as a data source
  - importance of data for documentation of the facility
  - implementation of suitable database
- Measurement techniques available and applied as needed
- Harmonisation of approaches for RC desirable
  - quasi-standard: MARSSIM

Conclusions (2)

- Costs for RC within reasonable ranges
  - costs cover just RC process
  - not the measures for which RC forms the basis (decontamination, radiation protection, RWM, clearance)
- Availability and accuracy of documents / plans on facilities obviously adequate for RC
- Availability of platforms for information exchange would be desirable
  - perhaps WPDD or OECD/NEA in general could continue to act as a platform for such information exchange