Introduction to MetroDECOM work package 1:

Characterisation of materials present on decommissioning sites

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2nd ENV54 (MetroDECOM) Workshop
JRC Ispra, Italy: 11th October 2016

Scope

- Introduction

- Task 1.1   Mapping inside nuclear facilities

- Task 1.2   Sampling strategies

- Task 1.3   Radiochemical analysis procedures

- Task 1.4   Scale factors

- Final comments

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Introduction to WP1

- Overall aims

  - The aim of this work package is to improve the characterisation of materials and items at decommissioning sites, prior to disposal.

  - A variety of techniques will be investigated
    - (i) initial assessment by (where possible) remote measurement,
    - (ii) planned and statistically robust sampling,
    - (iii) radiochemical analysis and measurement of sampled material, and
    - (iv) the derivation of improved scaling factors for future work

  - These outcomes provide feedback for future decommissioning work, so that each iteration of the *assessment-sampling-analysis/measurement-scaling factors* cycle enables the next iteration to be carried out more effectively

  - Ultimate aims: Continually improving the processes in order to better utilise resources
    Accurately sentence waste arisings

Tasks within the work package

- Mapping inside nuclear facilities (**SCK•CEN**, CEA, ENEA, IFIN-HH, NPL, STUK)

  - Devise techniques for mapping internal contamination within a nuclear facility to inform subsequent strategy for decommissioning

- Sampling strategies (**NPL**, ČMI)

  - Ensure that the sampling of materials is carried out in a statistically valid manner, without taking excessive numbers of samples

- Radiochemical analysis procedures (**NPL**, PTB)

  - Analysis of long-lived and less common radionuclides

- Scale factors (**ENEA**, CMI, NPL, SCK•CEN)

  - Apply the principles set out in ISO 21238:2007 to the measurement of contaminated areas in decommissioning sites

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Task 1.1: Mapping inside nuclear facilities: Objectives

- To devise techniques for mapping the internal contamination within a given nuclear facility in order to inform the subsequent strategy for decommissioning the facility. These techniques include the determination of contamination by a variety of methods, including

  - surface contamination determination,
  - identification of localised hot-spots by using γ-detectors (cadmium-zinc telluride, lanthanum bromide, etc.),
  - in-situ γ-spectrometry,
  - determination of depth distribution of radionuclides,
  - remote α detection

- Improvement and enhancement of these techniques to determine the levels and location of γ-, α- and α-/γ- contaminated areas will better inform the planning of sampling for further radiochemical analysis and the overall decommissioning strategy

Task 1.1 topics; led by SCK•CEN

- Improve the traceability & accuracy of surface β-contamination measurements

- Realise response characteristics of the quantitative performances of the GAMPIX γ camera

- Develop UV based stand-off detection methods for detecting & monitoring of α contamination

- Execute & examine a case study (contaminated floor in PWR): different techniques, number of measurements, geostatistics

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Task 1.2: Sampling strategies: Objectives

- The aim of this task is to ensure that the sampling of materials prior to and during decommissioning is carried out in a statistically valid manner, without taking excessive numbers of samples, but limiting the risk of operating sampling strategies of returning false negatives.
    - investigation and summary of differing sampling techniques
- Statistically based sampling strategies will streamline sampling to deliver reliable data without excessive sampling and analysis, making the analytical work supporting the overall decommissioning strategy more cost effective

Task 1.2 topics; led by NPL

- Summarise current sampling strategies

- Employ Bayesian analysis techniques

- Reduce sample numbers without increasing false negative rate

- Report outcomes

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Task 1.3: Radiochemical analysis: Objectives

- The aim of this task is to build on the work completed in JRP ENV09 on the automated analysis of radioactive material, which has established dissolution procedures for concrete, separation procedures for ^{90}Sr, ^{99}Tc, uranium isotopes, plutonium isotopes and ^{241}Am as well as measurement procedures for α and β-emitters.

- The need, therefore, is to be able to measure a wider range of radionuclides in a more diverse set of matrices:
  - activation products,
  - fission products,
  - isotope dilution tracers

Task 1.3 topics; led by NPL

- Prioritise list of radionuclides

- Devise, test and validate rapid laboratory based analysis techniques

- Combine individual techniques into sequential analysis routines

- Review and report outcomes in the open literature

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Task 1.4: Scale factors: Objectives

- The aim of this task is to apply the principles set out in ISO 21238:2007 to the measurement of contaminated areas in decommissioning sites. This standard addresses the measurement of packaged waste, and not individual areas, but the principles of operation remain the same.

- Drawing on the nuclide list in tasks 1.3 and task 5.2, as well as the sampling principles laid out in task 1.2, together with existing databases in Germany, USA, Japan and others, scaling factors for particular sites for some of the listed radionuclides

  - Summarising and systemising knowledge

Task 1.4 topics; led by ENEA

- Identify and evaluate sources of information

- Take information from T1.2 provide good statistical basis for the determination of nuclides of interest

- Write a Good Practice Guide for scaling factor determinations (based on ISO 21238:2007)

- Derive scaling factors for BR3

- Provide user guide

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Final comments

- Approaches
  - To achieve the aims of this work package, a number of novel techniques are being developed
  - All address shortening the sampling, measurement and assessment of contaminated areas
    - Monitoring of contaminated areas using conventional monitoring and stand-off techniques
    - Sampling strategies better directed to draw defendable conclusions, whilst limiting the number of samples taken
    - Radiochemical analyses for long lived and hard to measure nuclides
    - Realisation of better scaling factors
  - These measurement solutions will be developed in the course of the project and deliver relatively strategies that shorten the time for suitably assessing levels and extent of contamination prior to decontamination and demolition

Thank you.
Any questions?

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LGC — Setting standards in analytical science

nel — technology for life

National Measurement Office

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