Guide to enhance reliability of the dose estimates in dismantling

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Content

1. Specificities of dismantling activities
2. Analysis of three dismantling projects
3. Analysis of causes explaining the gaps between predicted and actual doses
4. Orientations of the guide

9 EDF units under decommissioning

1 pressurised water reactor (PWR)
Chooz A (300 MWe) - 1967-1991

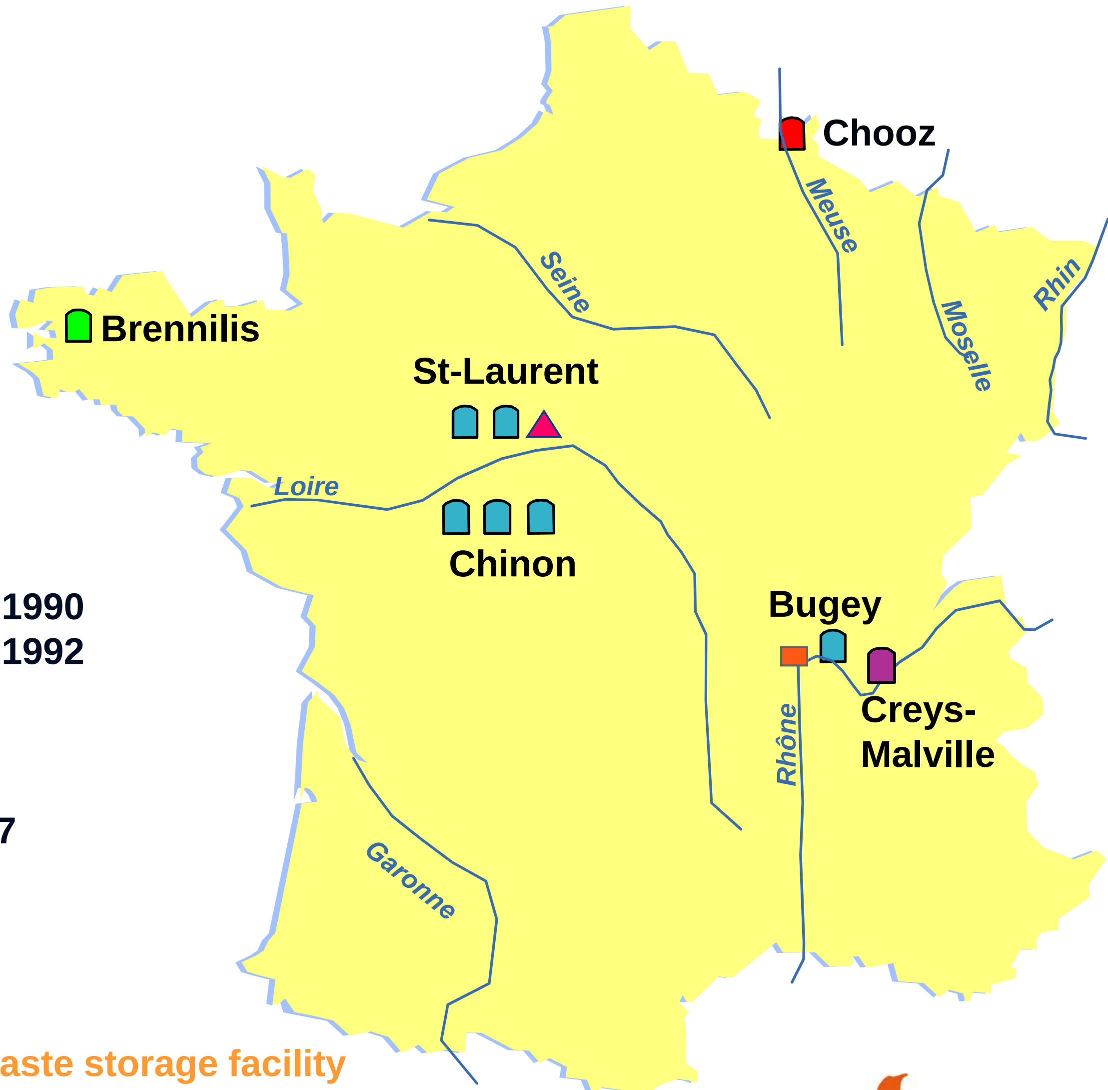
1 heavy water reactor (HWR)
Brennilis (70 MWe) - 1967-1985
(EDF - CEA)

6 gas-graphite reactors (GCR)
Chinon A1 (70 MW) - 1963-1973
Chinon A2 (200 MW) - 1965-1985
Chinon A3 (480 MW) - 1966-1990
Saint-Laurent A1 (480 MW) - 1969-1990
Saint-Laurent A2 (515 MW) - 1971-1992
Bugey 1 (540 MW) - 1972-1994

1 fast breeder reactor (FBR)
Creys-Malville (1240MW) : 1986-1997

graphite silos

ICEDA - conditioning and activated waste storage facility (project)



The specificities of dismantling activities

- Dismantling activities present specificities in comparison with activities during reactor operation, which will have consequences on the radiation protection preparation of the task:

  - **Lack of feedback experience:**
    - **Most of the time, new tasks and even sometimes unique tasks (i.e. most of dismantling activities of the Creys-Malville reactor),**
    - **Not yet enough feedback experience.**

  - **Difficulties to accurately evaluate radiological conditions:**
  - **Lack of knowledge about history of reactor operation,**
  - **Impossibility to perform measurements or old radiological maps,**
  - **Decrease of the source term following removal of equipments or due to radioactive decay,**
  - **Changing dose rates in waste storage,**

The specificities of dismantling activities

- Dismantling activities present specificities in comparison with activities during reactor operation, which will have consequences on the radiation protection preparation of the task:

- **Difficulties to accurately evaluate the exposed workload:**
  - **Difficult to evaluate the exact work duration for tasks, which last months or even years,**

- **Waste management :**
  - **Many waste of different types (VLLW, LLW, ILW) to manage.**

Analysis of dismantling projects

This analysis was based on three case studies. The objective was to identified the main causes, which could explained the important differences between estimated doses and actual doses at the end of the activities. The three case are not in high dose rate area. From 2012, the dose estimate is higher, between 300 and 900 H.mSv

- Extraction of the lateral neutron protections (PNL) at Creys Malville.
- Extraction of shells and waste packages at Chinon A3.
- Dismantling of the HK cavern (nuclear auxiliary building) at Chooz A.

Analysis of dismantling projects
Extraction of the PNL - Creys Malville

Validation/SP site de Creys-Malville

Duration of the task: 15 months

First dose estimate by CIDEN: 185 H.mSv

Optimised dose estimate by CIDEN : 84.4 H.mSv

First dose estimated by contractor : 66.4 H.mSv

Optimised dose estimate by contractor : 50 H.mSv

Final actual dose: 8.4 H.mSv

Analysis of dismantling projects Extraction of shells and waste package - Chinon A3

Duration of the task: 18 months

First dose estimate by CIDEN: 90 H.mSv

First dose estimated by contractor : 87.4 H.mSv

Optimised dose estimate by contractor : 78.1 H.mSv

During the work, three updates of the dose estimate (after 3, 8 and 16 months): from 78.1 to 8.0 H.mSv

Final actual dose: 4 H.mSv

Analysis of dismantling projects
Dismantling of the HK cavern at Chooz A

Duration of the task: from 15 months to 24 months

First dose estimated by contractor : 181.2 H.mSv (based on 15 months)

Optimised dose estimate by contractor : 172.3 H.mSv (based on 24 months)

The task has just started.

Analysis of causes explaining the gaps between predicted and actual doses

- **Evaluation of the dose rates:**
  - **Overestimation of dose rates when they are modelled with computer,**
  - **Old or inadequate dose rate maps: for instance, dose rate measurements do not fit with workstations,**
  - **Radioactive decay not taken into account, in particular decay of Co-60 (5.3 years) for tasks, which last many years.**

- **Evaluation of exposed time:**
- **Difficult to make an accurate evaluation for long jobs,**
- **Difficult to take into account operational improvements.**

- **Evaluation of the exposure factor k:**
  - **Difficult to evaluate for dismantling activities as these are new activities without feedback experience,**
  - **Sometimes this factor is not well understood (and then misused) by the persons preparing the job.**

Analysis of causes explaining the gaps between predicted and actual doses

- **ALARA culture:**
  - **A conservative dose estimate is often preferred to prevent the occurrence of unexpected exposures,**
  - **Lack of dialogue between the different actors: between CIDEN and the contractors, between engineers and operators, etc.**

- **Problems of the precision of measurement devices for low doses and dose rates.**

- NB. Even if improvements are possible, the fact that dose estimates are not as accurate as for outages jobs does not mean that dismantling jobs are not well managed (especially due to the specificities of dismantling jobs).

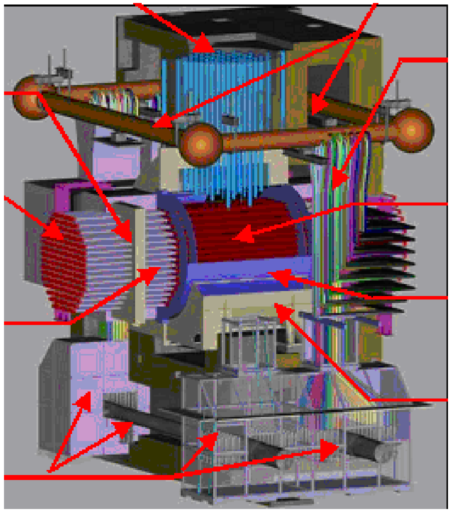
Orientations of the guide

- Objective: methodological guide designed to help CIDEN and contractors to improve dose estimates and the content of the radiation protection studies prior the jobs

- **The guide integrates:**
  - **Specificities of dismantling jobs,**
  - **Good radiation protection practices to be considered.**

- **Not only focused on dose estimates but on the complete ALARA procedure:**
  - **Preparation, follow-up, feedback experience.**

- **For each step:**
  - **Objectives,**
  - **Questions to be considered,**
  - **Outputs.**

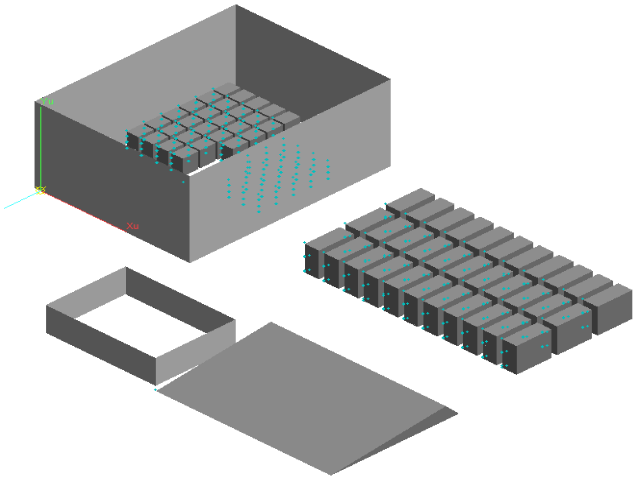


The orientations of the guide

- Describe precisely how to prepare dose estimates:
  - In particular, the importance of initial data: dose rates, contamination risk, etc.

- Importance of follow up data to adapt radiation protection to reality:
  - Dose estimate and optimisation actions can evolve during the activity, especially for long-duration jobs
  - Importance of sensibility analysis for data and actions.

- Importance of feedback experience for dismantling activities: need for data



Thank you for your attention