Bel V activities in the Belgian context of dismantling research reactor and fuel cycle facilities
Contents

- Overview of decommissioning projects in Belgium
- Main actors & licensing approach
- Bel V (AVN/Corapro) activities
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D&D projects in Belgium

- History - Main D&D programmes
  - since 1987: R&D and small pilot projects (D&D techniques, performances, costs)
  - 1989: BR3 research reactor at SCK°CEN is selected as pilot dismantling project by EC
  - 1990: industrial decommissioning of Eurochemic reprocessing plant at Belgoprocess
  - June 2008: starting of demolition of Eurochemic plant
  - end summer 2008: decommissioning license granted for MOX-plant at Belgonucléaire (effective dismantling foreseen early 2009)
D&D projects in Belgium

- BR3 PWR at SCK°CEN (1)

PWR-type reactor: one primary loop, P = 10.5 MWe

964.6 GWh / 11 successive operation campaigns (1962 – 1987)

Some figures:

- 33,675 tons of material
- 24,402 m³ (density 1.38)

Plant status:

- Core defuelling -> 7 CASTOR casks at Belgoprocess.
- Core internals, SG, RPV: dismantled and cut.
- Decontamination of neutron shield tank.

Start of decommissioning: 1989
D&D projects in Belgium

- BR3 PWR at SCK°CEN (2)
  
  - global objective: demonstrate technical feasibility and acceptability by the public of dismantling NPP just after its shutdown
  
  - general strategy
    - develop, test and optimize the implemented technologies
    - collect from different operations data regarding cost, amount of waste and dosis
    - develop expertise in dismantling nuclear plants
    - develop dry and underwater cutting techniques for highly activated core internals
D&D projects in Belgium

- **BR3 PWR at SCK°CEN (3)**
  - important step: extensive decontamination of the primary circuit
    - reduces doses when cutting primary pipes, reactor internals and pressure vessel
    - 3 successive cycles of decontamination process removed 90% of activity of primary circuit
  - decontaminating operation after segmentation (MEDOC for METal Decontamination by Oxidation using Cerium)
D&D projects in Belgium

- Eurochemic reprocessing plant at Belgoprocess (1)
  Consortium of 13 OECD countries operated this demonstration plant (1966 – 1974)
  180 tons natural & low-enriched + 30 tons high-enriched U fuels

Some figures:
- 12,500 m³ concrete (55,000 m² concrete surfaces)
- 1,500 tons metal structures

Plant status:
- Evacuation of the equipments: done.
- Decontamination: nearly done.
- Demolition: 1/3 of the building.

Start of decommissioning: 1990
D&D projects in Belgium

- Eurochemic reprocessing plant at Belgoprocess (2)
  - pilot decommissioning of 2 small storage buildings
    - automation of concrete decontamination
    - decontamination of metal components
  - general objective: free release and demolition of the building
  - general strategy:
    - removal and decontamination of equipment of each cell, decontamination of cell walls, ceilings and floors
    - unconditional release of remaining structures
    - demolition in phases
D&D projects in Belgium

- Eurochemic reprocessing plant at Belgoprocess (3)
  - decommissioning on an industrial scale
  - challenge of unconditional release of large amount of concrete material after demolition of the building
    - installation for concrete crushing and sampling
    - during crushing operations, metal parts are taken
D&D projects in Belgium

- MOX-plant at Belgonucleaire (1)

Two one-floor process buildings (~5000 m²)

> 35 tons Pu dry-processed into MOX fuel (1986-2006)

Some figures:

- 170 glove boxes (165 tons, 550 m³)
- 1200 tons infrastructure

Plant status:

- Shutdown, safe standby.
- Dismantling license granted.
- Contracting.

Start of decommissioning: early 2009
D&D projects in Belgium

- MOX-plant at Belgonucleaire (2)

Overall Decommissioning Strategy:

- Glove boxes: in-situ cold cutting in glove tent
  - non-conditioned waste packaging (A3X drums)
  - off-site conditioning by NIRAS/Belgoprocess

- Infrastructure:
  - Free release: steel melting, shredding,...

- Building:
  - Free release after wall shaving

Expected waste: ~400 ton

Expected free release: ~1000 ton
D&D projects in Belgium

- MOX-plant at Belgonucleaire (3)

Glove box decommissioning strategy:

Disposable ‘glove tent’:

Cutting technique: nibbling or sawing

NO FLAME – NO SPARK

**Advantages:**

- In situ cold cutting (safety!)
- Parallel processing (short timing)
- Appropriate radiation protection (Kiowa glass)
- Containment protection
- Acceptable secondary waste
Licensing approach for decommissioning

- Regulatory aspects in Belgium
  - AFCN/FANC: protection of public & environment against the danger of ionizing radiation
  - ONDRAF/NIRAS: management of RW & coordination of D&D projects in Belgium

- Application for decommissioning (since 2001)
  - application file to FANC/Bel V (AVN) & NIRAS (PSAR + EIAR)
  - decommissioning plan to NIRAS
  - public enquiry and advice: local authorities, European Commission (Euratom art 37), scientific council
Licensing approach for decommissioning

- TSO safety aspects
  - safety evaluation on basis of PSAR
  - compliance with the provisions of the decommissioning license
  - approval for every safety significant step
  - approval for measurement protocols (specific clearance methodology)
TSO activities – D&D

- TSO experts involved in control activities of nuclear installations
- In the past: D&D were treated and analysed by operators and TSO through progressive modifications of installation
- Presently: D&D activities are formally the subject of a new licence
- Systematic analysis by TSO of multiple aspects of D&D projects
  - Evaluation of a global safety case for decommissioning
  - Management of modifications with respect to global safety case
  - Definition of decom phases important for safety (hold-points)
  - Periodical reporting, return of experience, ...
TSO activities – BR3

- TSO activities
  - mainly follow-up of progressive modifications of the installation
    - special attention: dismantling operation in test phase (case-by-case)
    - decontamination operations (procedures & MEDOC process)
    - dismantling operations (procedures)
    - clearance procedures
  - since 2001 – 2002: formal authorization of dismantling
    - 2002 evaluation of decom license file
TSO activities – Eurochemic

- TSO activities
  - special attention:
    - high dose rates due to remaining liquids from former reprocessing activities
    - $\alpha$-contamination on equipment & building surfaces (reprocessing plant)
    - in-depth penetration of contamination
    - pipe penetrations between cells (structure stability)
    - demolition in subsequent phases
  - initially: follow-up of progressive modifications of installation
    - placing the plant in stand-by conditions
    - dismantling of the main plant components
    - alternation of dismantling of units and adaptation of ventilation
    - isolation of Eurochemic building from adjacent buildings
TSO activities – Eurochemic

- TSO activities
  - since 2001 - 2002: formal authorization of dismantling
    - remaining D&D activities: decontamination operations for clearance + strategy & techniques for “controlled“ demolition
    - evaluation of decom safety case
    - decommissioning phases important safety (hold-points)
      - start of evacuation of equipments
      - beginning of demolition works
      - clearance of site
    - clearance procedures
TSO activities – MOX-plant

- TSO activities
  - special attention:
    - closing facility
    - mainly dismantling of glove boxes (clearance limited)
  - formal authorization of dismantling
    - evaluation of the decom safety case
    - implementation of safety measures and procedures
      - new building configuration
      - ventilation
      - fire
      - air-monitoring (α-contamination)
    - personnel and organisation
International activities

- WENRA-WGWD
  - since 2002: participation in Working Group on Waste and Decommissioning
  - WGWD published in March 2007 a document entitled « Decommissioning safety reference levels report »
  - basis: IAEA safety standards + more specific requirements

- EC projects
  - activities of transfer of Western European methodology and practices to Eastern European countries in the field of nuclear safety

- R&D
  - IAEA project DeSa (in the future: follow-up FaSa)
Conclusion

- Evolution in TSO involvement for decommissioning
  - in the past: progressive modification of installations
    - interaction with operator for each important operation for safety (case by case)
  - presently: structured follow-up and interactions
    - decommissioning as a fully-fledged project with explicit interactions with TSO
    - decom safety case: global safety approach
    - preliminary definition of decommissioning phases important for safety (and hold-points)
    - periodical reporting, integration of return of experience
    - clearance aspects
Conclusion

- Strengthening TSO capacities by taking part in
  - international projects
  - working groups
  - R&D projects
Appendices
TSO evaluation of decom Safety Case - Eurochemic

- objectives of dismantling project
- planning of dismantling project
- description of dismantling operations
  - applicability of pilot dismantling tests (buildings 6A/6B)
    - in-depth penetration of contamination
    - lack of historical data
    - pipe penetrations between cells (structure stability)
  - management of dismantling waste (clearance, waste, inventory)
  - equipment (ventilation, surveillance, safety measures, atmospheric release, RP environment, accidents, QA, ALARA)
- final destination of buildings
Directive 96/29 in the Belgium legislation - clearance

- **Annex 1B:**
  - ‘Set of Clearance level’ ~ CL in RP 122’

- **Art. 35:**
  - Concentration Activity Level < CL (1B)
  - Measurement procedures conform to the Agency directives or approved by the Agency (and by TSO)
  - (1st of March, list of released material to ONDRAF and Agency)

- **Art. 18**
  - Solid waste from nuclear installation of class 1, 2 or 3 or natural sources under art 9 that does NOT satisfy CL (given in annex 1B) request an authorization by the agency.'