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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
- Conclusion

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 Belgonucleaire (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)

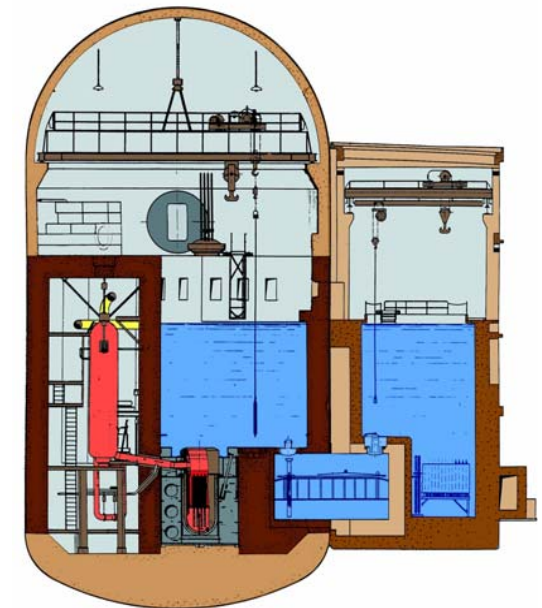
Plant status :

Core defuelling -> 7 CASTOR casks at Belgoprocess.

Core internals, SG, RPV: dismantled and cut.

Decontamination of neutron shield tank.

Start of decommissioning : 1989



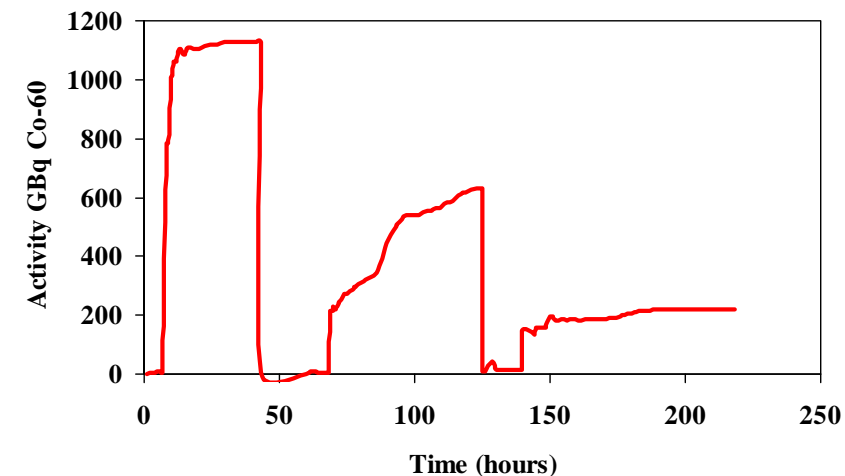
D&D projects in Belgium

- 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
- α -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. '