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Decommissioning of Belgonucleaire MOX plant

Content

- Regulatory framework
- Strategy
- Status of the project
- Role of Bel V
- Conclusions

Belgian Nuclear landscape

General information (1/2)

- BN = Plant dedicated to MOX fuel fabrication

- Fabrication of MOX took place in 2 buildings (total ≈ 5000 m^2) housing about 170 glove boxes

General information (2/2)

- Total production during 20 years (1986 – 2006): 660 tons of MOX ~ 40 tons Pu
- December 2005: Decision to shut-down the plant (shrinkage of the MOX market)
- April 2006: Application for decommissioning licence
- August 2006: Plant definitively shut-down
- February 2008: Decommissioning licence is granted

Regulatory Framework (1/6)
Main actors

FANC

- Created in 1994 as RB and became operational in 2001

- Licensing
- Implement and enforce regulations
- Emergency plan
- Information of the public

Bel V

- Created in 2008 as FANC subsidiary

- Inspections
- Review and assessment

ONDRAF / NIRAS

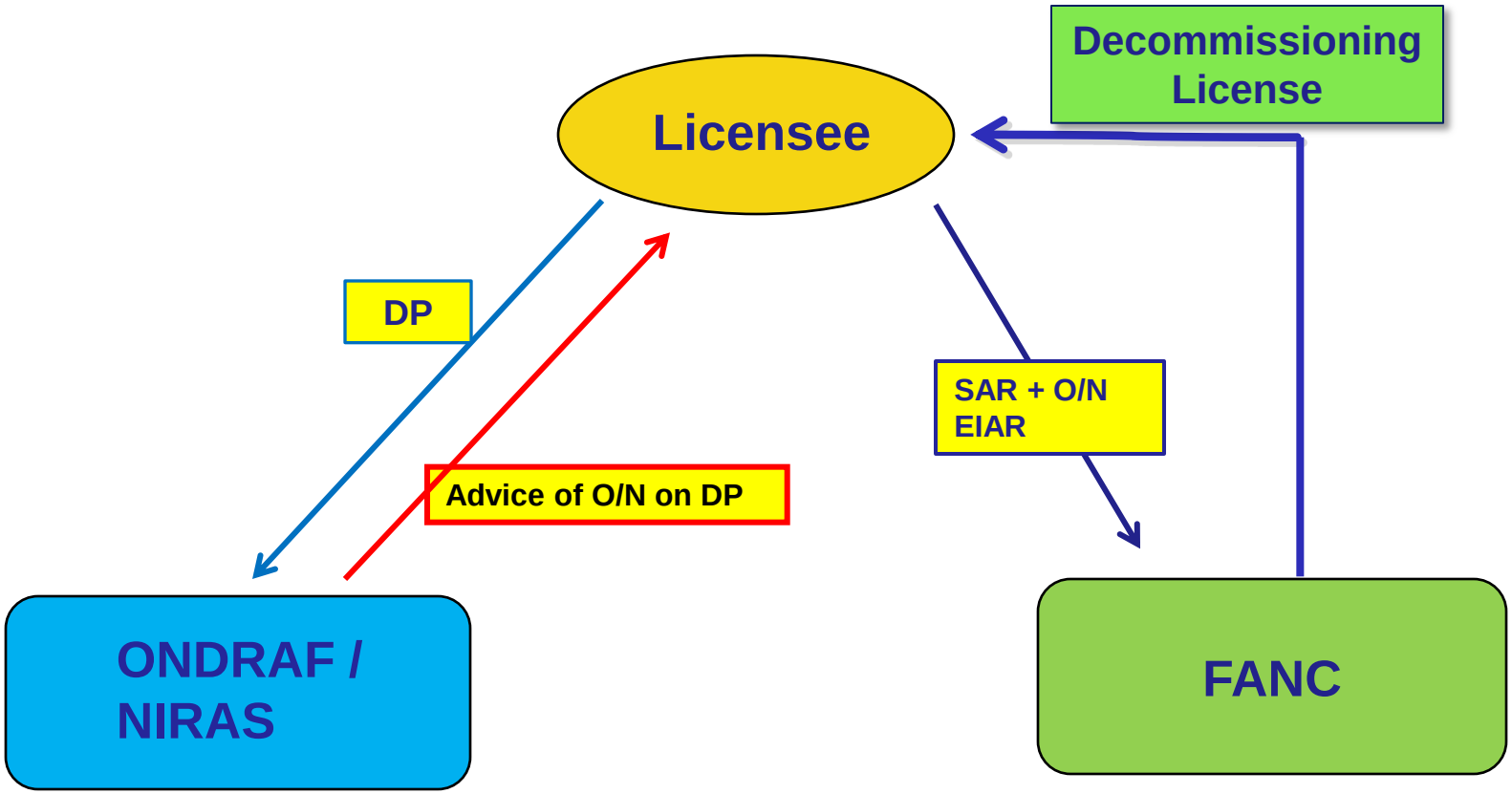
- Created in 1981 as responsible for waste management on Belgian territory, became operational in 1984

- 1991: O/N is legally involved in decommissioning = evaluation of DP
- 1997: Responsible to conduct inventory of the radioactive waste in Belgium (updated every 5 years)
- 2001: O/N advise FANC on DP for granting decommissioning license

Regulatory Framework (2/6)
Main Regulations

- RD (30/03/1981)
  - Article 5: Information related to decommissioning must be sent to O/N at least 3 years before definitive cessation of activity.
- Law (11/01/1991)
  - O/N is involved in the field of decommissioning through the assessment of the DP
- RD (20/07/2001)
  - Article 17.1: In case of cessation of a licensed activity the operator informs FANC and O/N without delay of his intention to stop his activity
  - Article 17.2: Dismantling of a facility has to be granted by a decommissioning license

Regulatory Framework (3/6)
Licensing process



Regulatory Framework (4/6)
Decommissioning Plan

- DP must include the following main topics:
    1. Brief description of the plant to be dismantled (physical and radiological inventories)
    2. Discussion about possible decommissioning strategies envisaged, → selected strategy is analysed in greater depth
    3. Description of the decontamination and dismantling techniques to be used,
    4. Forecasting and assessment of resulting decommissioning waste
    5. Planning of decommissioning
    6. Decommissioning cost evaluation and description of funding mechanisms

Regulatory Framework (5/6)
Application for decommissioning license

- Decommissioning license application is introduced to the FANC. It contains:

1. General information of the plant to be decommissioned
2. Specific information: Planning, Organisation, Strategy, Methods of decontamination and dismantling, Qualification of the methods
3. Information on material and radioactive waste: waste management, clearance, methods of radiological characterization, destination of the radioactive waste

Regulatory Framework (6/6)
Application for decommissioning license (cont.)

4. Future destination of the site
5. Safety provisions: Radiation safety, Risk analysis, Emergency plan
6. Environmental Impact Assessment Report
7. Advice of O/N on DP

Decommissioning license
Associated Conditions

- The licensee is the only responsible for safety
- Modifications, which could impact the safety, must be approved by Bel V
- New cutting or decommissioning techniques must be approved by Bel V on basis of safety assessment
- Any free release of radioactive material must be approved by Bel V
- The licensee must send an annual progress report to the FANC
- At the end of the decommissioning, the licensee must send to the FANC a final report, including the final radiological status of the site.

Strategy (1/2)
Immediate dismantling

- BN has opted for immediate dismantling

1. Plant knowledge still fresh in memories
2. Immediate decrease of the contamination risk
3. No interim maintenance and surveillance cost
4. Avoid risk of gradual deterioration of structures and equipment
5. No benefit to defer decommissioning in order to take advantage of the decay of radionuclides ➔ Build-up of Am-241 from decay of Pu-241.

Strategy (2/2)
Main options

- Main options:

1. Reusable fissile material sent back to their owner
2. In-situ disassembling of the GB
3. Selection of proven dismantling techniques
4. Regular transfer of waste to Belgoprocess = final conditioning plant of radioactive waste ➔ taking advantage of the proximity of BP from BN (less than 1 km)

Preparation phase (1/3)
Contracting organization

- March 2008: BN examined possibility to contract dismantling at fixed price: Not possible owing to excessive safety margins
- End 2008 decision: BN takes lead of integrated organisation and specialized contractors
  - Studsvik (experience with dismantling of a fuel fabrication plant in Germany)
  - Consortium Belgoprocess & SCK•CEN
  - Tecnubel
- BN defines the safety rules to be applied for all decommissioning operations.

Preparation phase (2/3)
Planning

- 2006: Permanent shut-down
  - Objective = Set the facility in a safe state
- 2007 – 2009: Post-operational phase
  - Radiological survey
  - Selection and validation of techniques and methods
- 2009 – 2013: Decommissioning phase
  - Dismantling of the glove-boxes
- 2014: Release of building and site

Preparation phase (3/3)
Survey and Inventory

- Radiological survey performed in 2009:
  - Smear tests
  - Scratch samples
  - Full material samples
- Main results of the survey:
  - Infrastructures (ventilation, electricity, platforms, ...= 1300 tons)
    - 90 % free release
    - 10 % lightly contaminated waste
  - Glove boxes (180 tons):
    - contaminated with Pu

Waste Management

- Major fraction of the waste can be released according clearance levels (Annex IB from RD of July 20, 2001)
- Preparing waste for transfer to BP in accordance with the acceptance criteria set by O/N
- Reducing total waste volume to be stored:

  Stainless steel is melted in Studsvik facility
  Remaining radioactive waste (10 – 5% volume) is sent back to Belgonucleaire.

Radiation Safety & ALARA

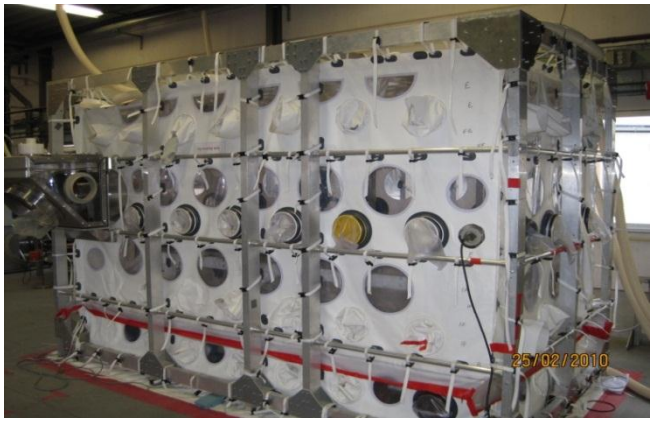
- Compliance with regulatory limits and with ALARA principles:

1. Yearly individual dose constraint of 12 mSv
2. Objective on collective dose defined for the overall decommissioning of the glove boxes = 1500-2000 man.mSv

Status of the BN dismantling project

Decommissioning activities (1/2)

- **2009** : <u>Preparation</u> :
  - Selection of contractors
  - Training and qualification of operators in box school



Status of the BN dismantling project
Decommissioning activities (2/2)

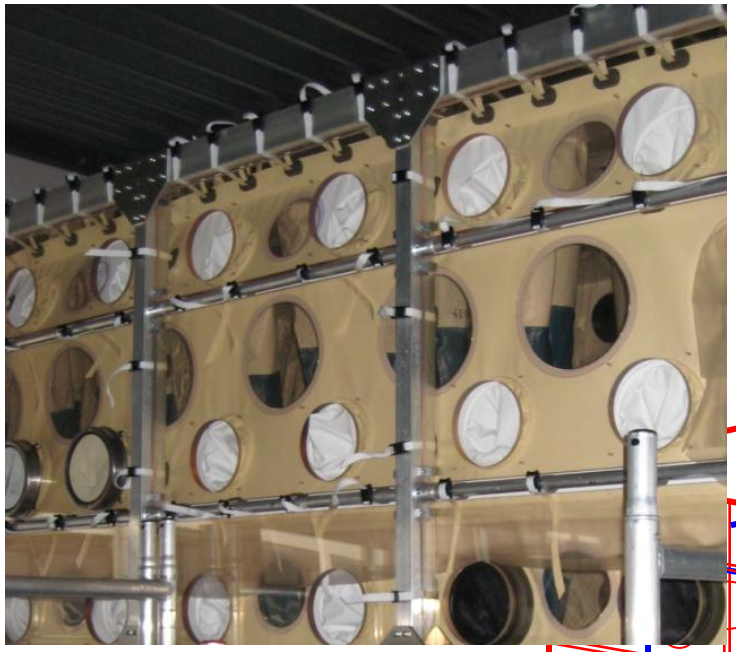
2010-2012 : Dismantling

- Step I :
  reduction of source term (by emptying GB).
- Step II :
  separation of GB from the fabrication line.
- Step III :
  cutting of the GB in a tent.

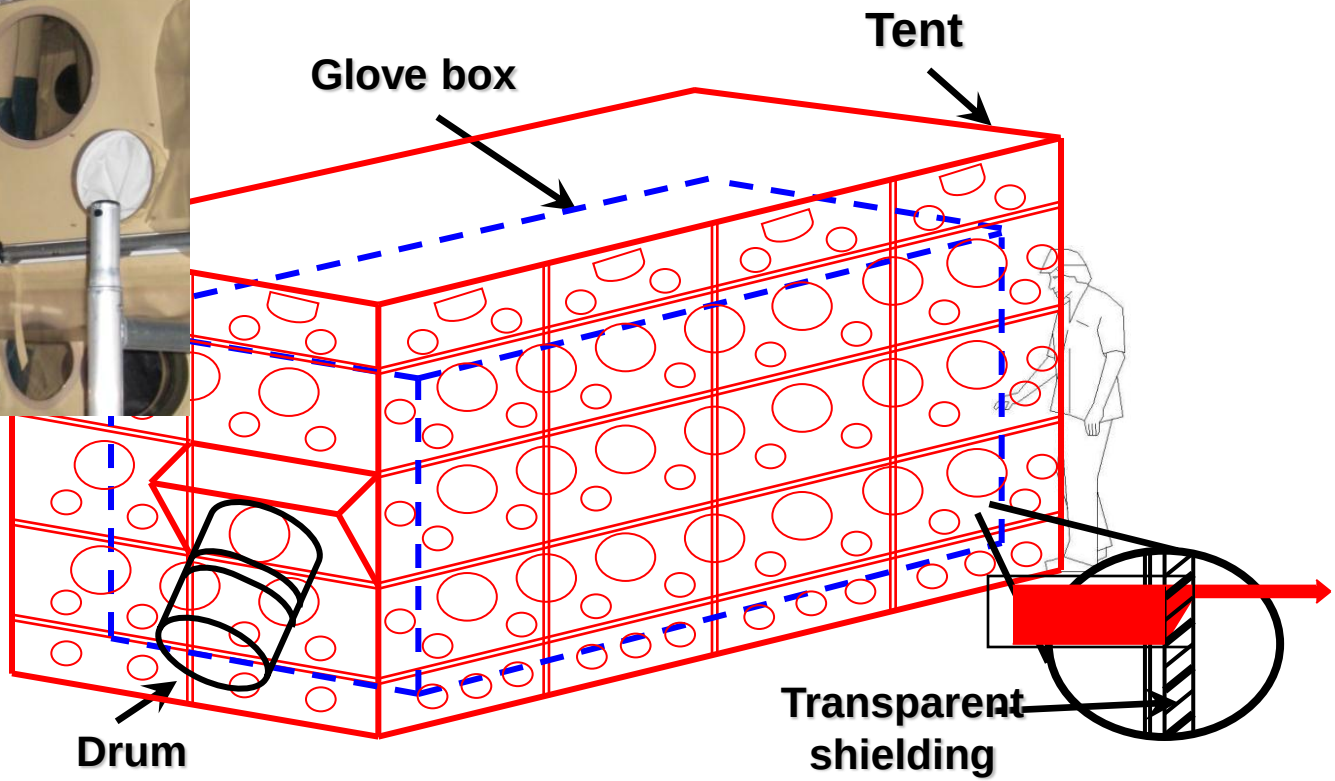
- 2010-2011 : Step I
- 2012 : Step II + III

Status of the BN dismantling project

Occupational exposure and contamination (1/2)



- Shielding from the source term :
  “ Customised Lead glass”



Status of the BN dismantling project

Occupational exposure and contamination (2/2)

- Use of PPE :
  - Contamination protection : Respiratory Mask
  - Exposure protection : Lead apron and lead charged gloves

- Dosimetry :
  - Gamma dose
  - Neutron dose
  - Extremity dose

  In case of contamination :
  excreta measurements and dose calculation

Status of the BN dismantling project
Fire hazards

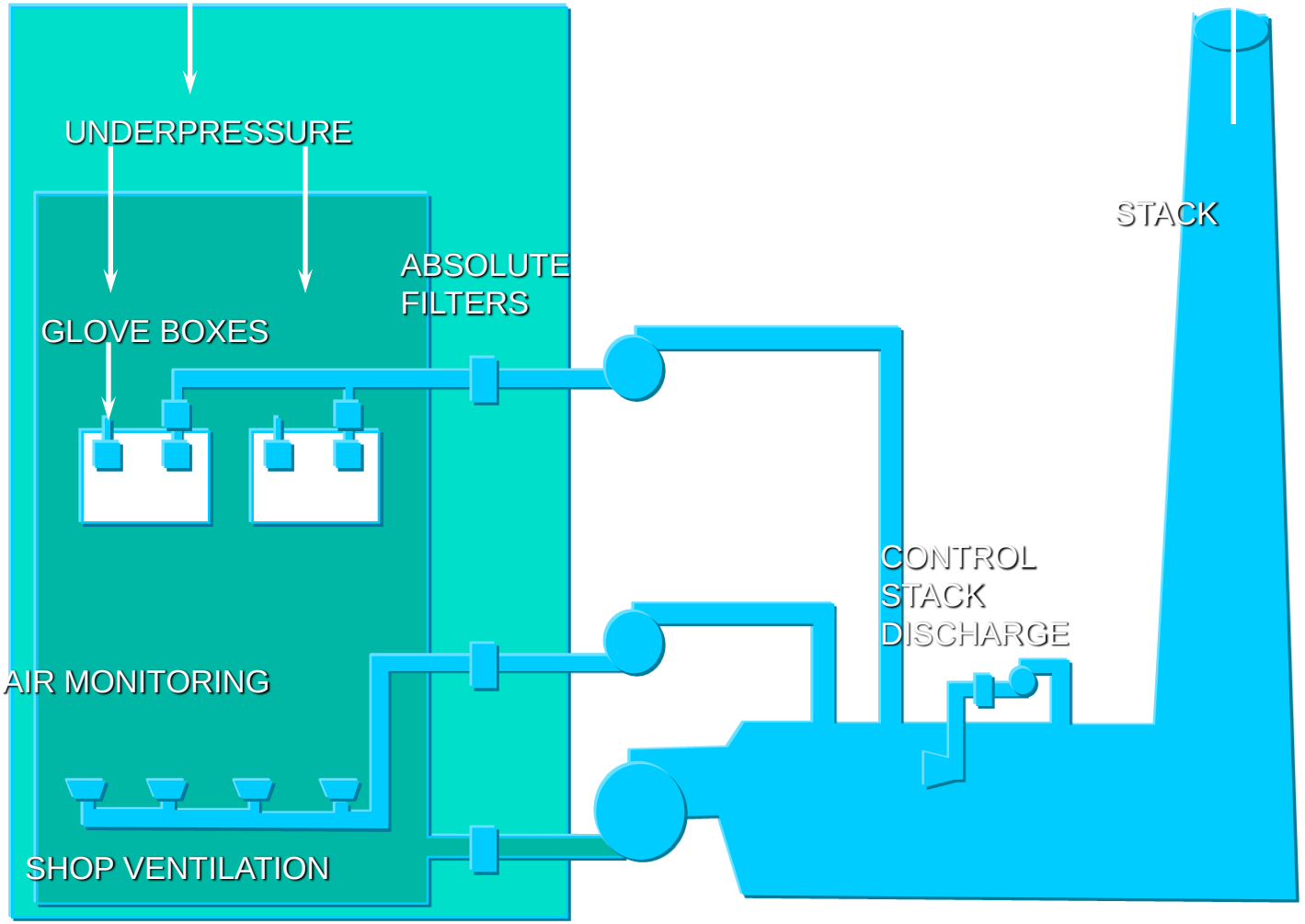
- Cold cutting techniques in tent : *no spark, no flame*.

Nibbler

Bandsaw

Status of the BN dismantling project

Confinement and atmospheric release

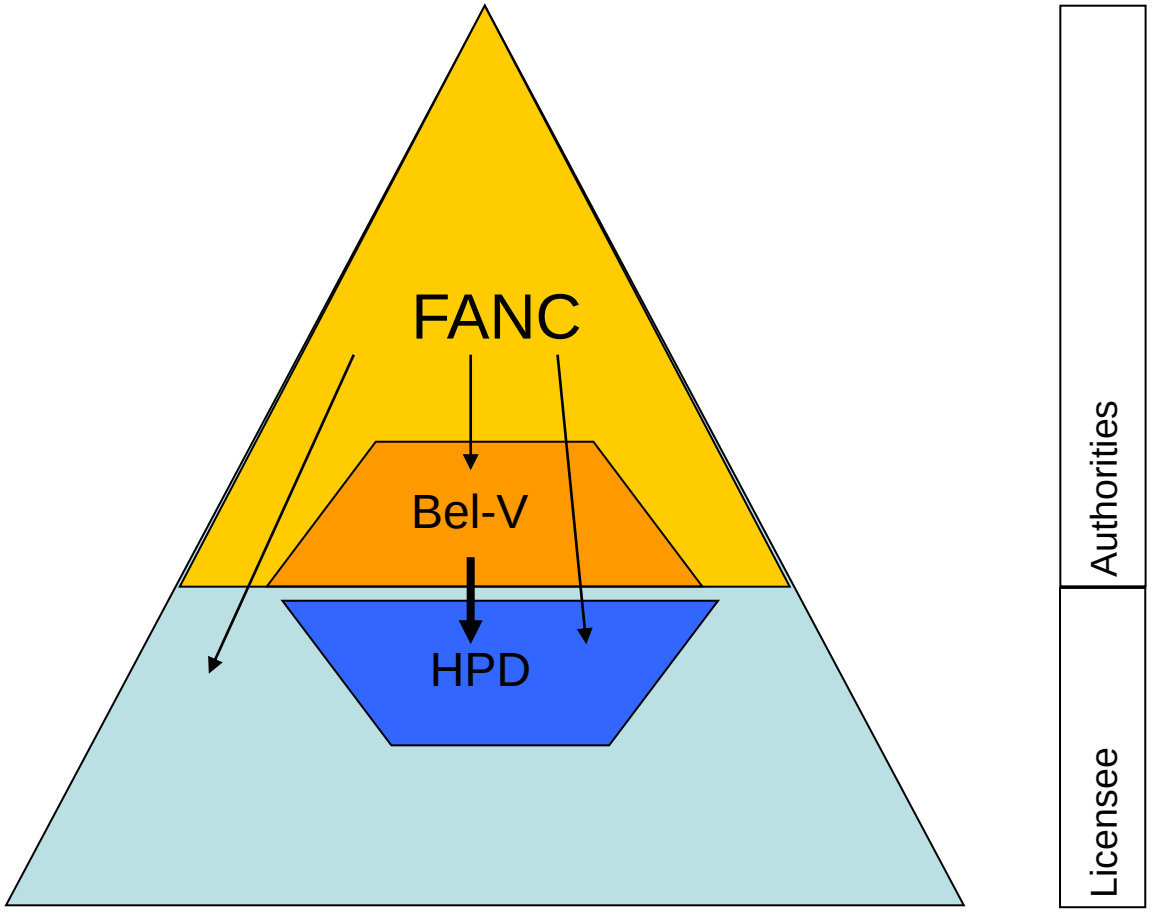


Status of the BN dismantling project
Waste disposal and clearance

- Waste Production : Drums for evacuation to treatment facility (BP)
- Waste Reduction : Evacuation of steel for off-site melting
- Waste Clearance : Marinelli measurement

Role of Bel V (1/3)

- Relation Health Physics Department - Bel V - FANC



Role of Bel V (2/3)

- Inspection programme * :
  - Periodic on-site visit (~ 3 weeks) :
    follow up of dismantling activities, incidents.
  - Topical inspections (2009-2012) :
    - fire protection,
    - emergency planning,
    - subcontracting,
    - radiation protection,
    - ventilation system,
    - modifications files
    - management (yearly, in collaboration with FANC).

* *based on RD of 20/07/2001 and decommissioning license conditions*.

Role of Bel V (3/3)

- Specific tasks (stipulated in decommissioning license) :
  - *Ongoing* :
    - Approval of new dismantling techniques
    - Approval of clearance methodology and clearance files
    - Approval of changes in the organisation (with FANC)
  - *Still to come* :
    - Approval of the final radiological status

Conclusions

- Since 2009, dismantling of BN MOX facility is proceeding without major difficulties or incidents.
- Keys to success :
  - Detailed preparation
  - Use of proven and qualified techniques
  - Substantial Training of personnel
  - Detailed bookkeeping of incidents (during operation and dismantling)
  - Drive for continuous improvement based on lessons learned.
- Regular presence on-site from Bel V and open discussions and transparency from operator to regulatory body enhance the safety of the decommissioning.