

6th Review Meeting of the Joint Convention

BELGIUM

Country Group 4

Tuesday 22nd, May 2018

Speakers

F. Hardeman

Federal Agency for Nuclear Control (FANC)
General Manager

P. Lalieux

ONDRAF/NIRAS
Manager, Long term RW management

Presentation outline

Content of the presentation :

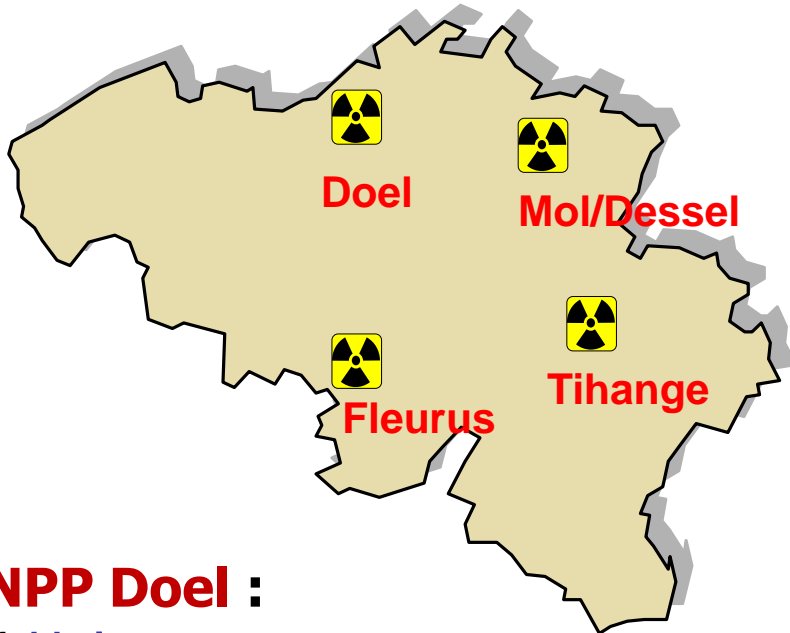
- Part 1: **FANC**
 - Basic information from the National Report
 - Developments between 2015-2018:
 - Developments since the last RM
 - Measures taken to address Suggestion & Challenges
 - Questions on the national report
 - Measures to improve safety and challenges
 - Areas of good performance

- Part 2: **ONDRAF/NIRAS**

1. Basic Information

- Belgian Nuclear Sites
- Spent fuel & radioactive waste
- Legislative and Regulatory Framework
- The Safety Authority and the Waste Management Agency
- Licensing Process
- Surveillance of Nuclear installations
- Emergency Preparedness and Response

Belgian Nuclear Sites



NPP Doel :

4 Units +
"SCG" central SF dry storage

NPP Tihange :

3 Units +
"DE" central SF wet storage

Mol/Dessel :

Belgoprocess (BP) site 1 & 2
SCK•CEN : 2 operational research
reactors (BR1 & BR2)

Under decommissioning :

FBFC UO2 fuel fab. facility
BR3 research reactor
Eurochemic reprocessing facility
Belgonucleaire MOX fuel Fab. Facility

Fleurus :

IRE : Radio-isotopes production
(for medical purposes)

Under decommissioning :

Best Medical Belgium

Spent fuel and radioactive waste

Located at several sites:

- Belgoprocess site 1 in Dessel and site 2 in Mol
- Tihange and Doel nuclear power plants sites
- Umicore site in Olen
- Institut des Radioéléments (IRE in Fleurus)
- Universities, hospitals, research centres, laboratories.

Policies

Spent fuel

- Part of spent fuel was reprocessed (La Hague). Pu → Mox, U recycled, vitrified HLW back to Belgium and stored temporarily
- Reprocessing suspended since 1993.
- Disposal and reprocessing remain two options.
- At present time:
 - Dry storage (in transport containers) at Doel
 - Wet storage (bunkerized building) at Tihange
 - SF of BR3 & THETIS RRs :
Dry storage at Belgoprocess

Radioactive waste management

- Activities of ONDRAF/NIRAS related to RW management
 - ✓ Processing (BP)
 - ✓ Conditioning (BP)
 - ✓ Intermediate storage (BP)
 - ✓ Qualification of processes and installations for treatment and conditioning of RW
- Research (SCK•CEN, ...)
- License application by ONDRAF/NIRAS for a **surface disposal facility at Dessel for LILW-SL Waste ("cAt")**

Hospital waste

Solid Waste :

- Dilution or mixing prohibited
- Short-lived isotopes ($T_{1/2} < 6m$): mandatory storage to “nearly complete decay”, i.e. at least $10 \times T_{1/2}$
- Clearance levels (annex IB of GRR-2001)
- Others : ONDRAF/NIRAS

Liquid waste :

- Dilution prohibited
- In practice, almost always decay storage
- Discharge Limits in table H1 of GRR-2001
- Others: ONDRAF/NIRAS

Legislative and Regulatory Framework

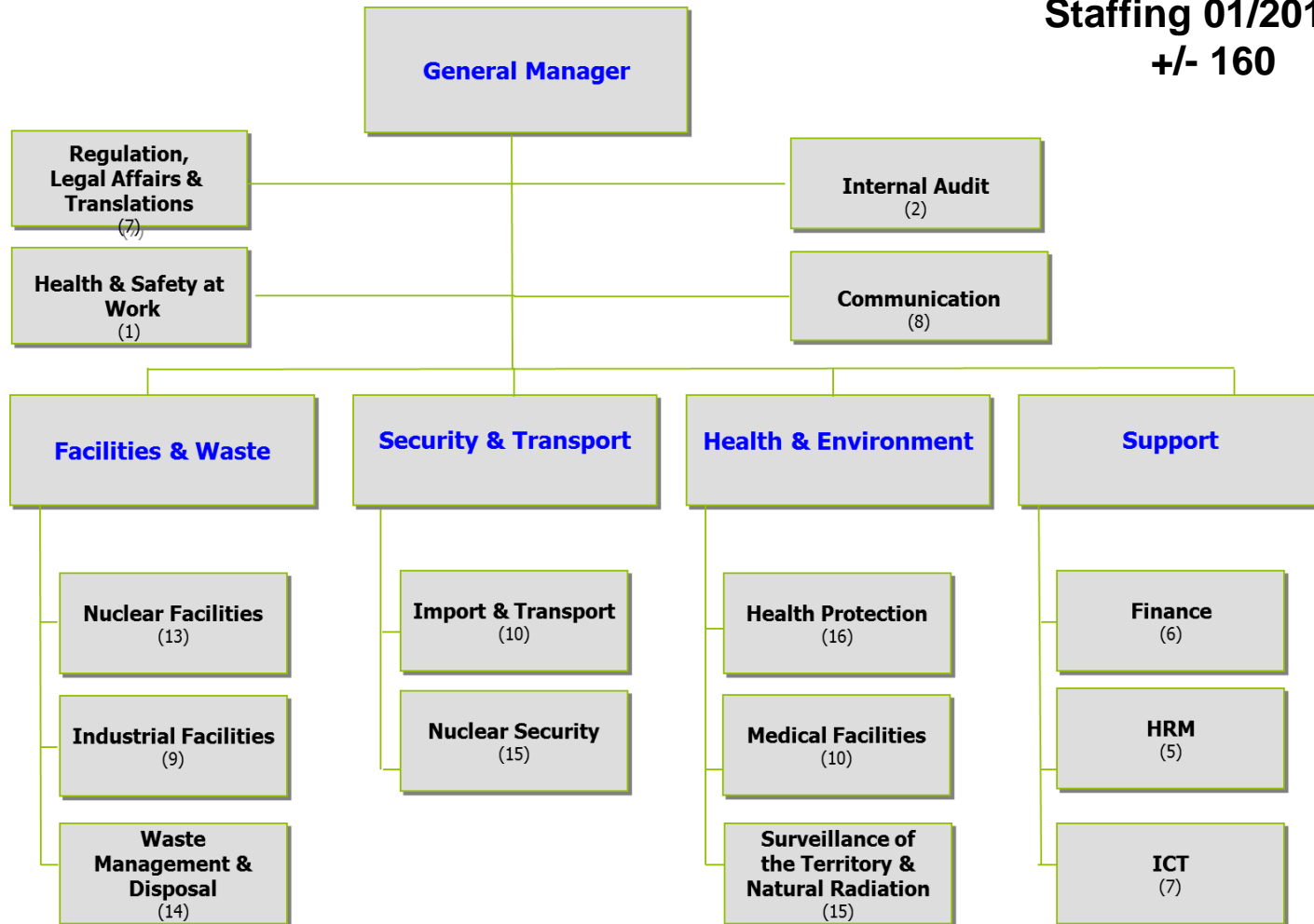
- The Law of 15 April 1994
Creation of the Federal Agency for Nuclear Control (FANC)
- The Royal Decree of 20 July 2001 (“GRR-2001”)
on the protection of the workers, the public and the environment against the dangers of ionizing radiation
- The Royal Decree of 30 November 2011 (SRNI)
on the Safety Requirements for Nuclear Installations
- The [Royal Decree of 1st March 2018](#) establishing the nuclear and radiological emergency plan for the Belgian territory

The Belgian Regulatory Body : FANC / Bel V

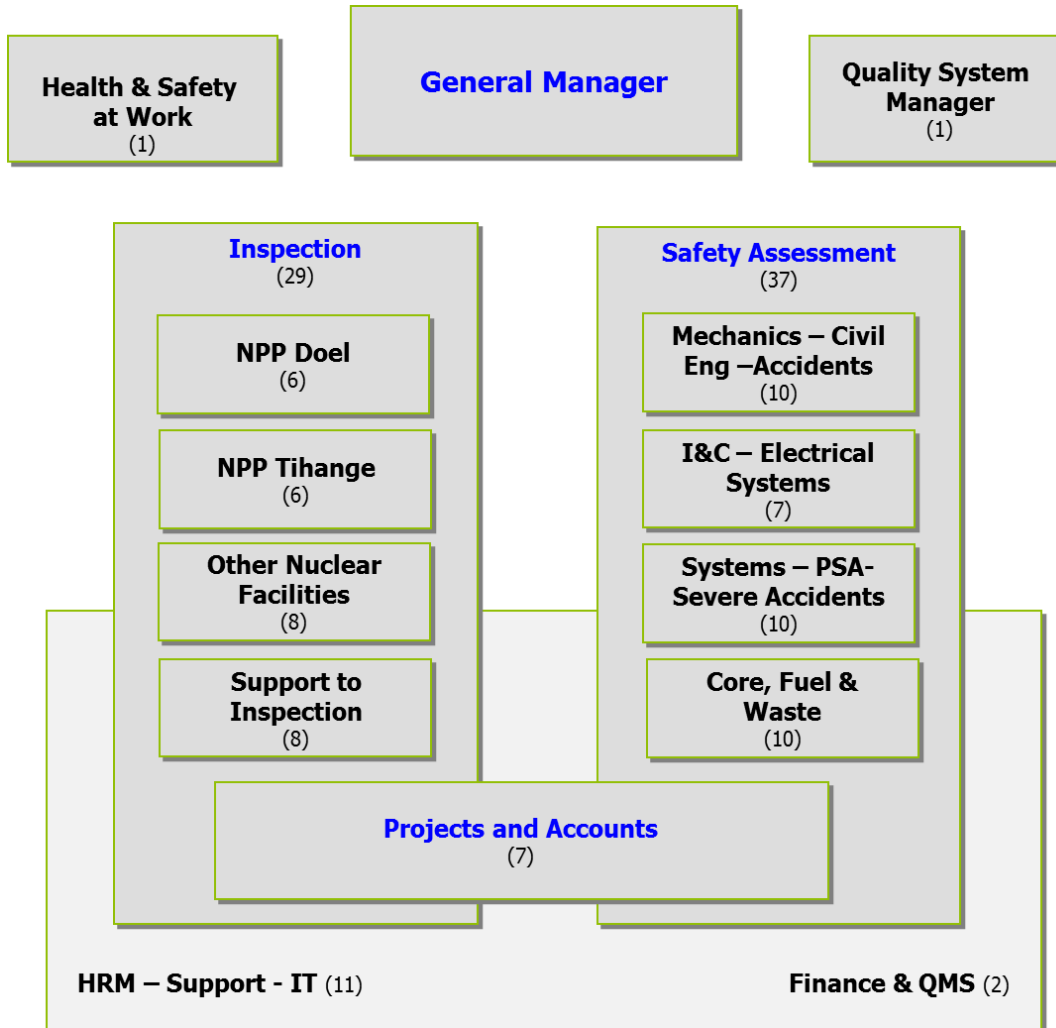
- The **FANC** (the Safety authority):
 - Issues **License** proposals to the King (Government)
 - Performs **inspections** : FANC inspections focused on specific thematic subjects and/or groups (type) of facilities, more transverse
 - Has **enforcement** power: FANC supported by Bel V, on (citizen) complaints, can close a facility, impose corrective actions, penalties, ...
 - Makes **regulation proposals**
 - Is in charge of public **communication**
- **Bel V** is the **technical subsidiary body** of the FANC:
 - **Safety Assessments**
 - **Conformity checks of** new (licensed) installations or modifications
 - **Inspections** : written reports sent to the FANC

The FANC

Staffing 01/2018 :
+/- 160

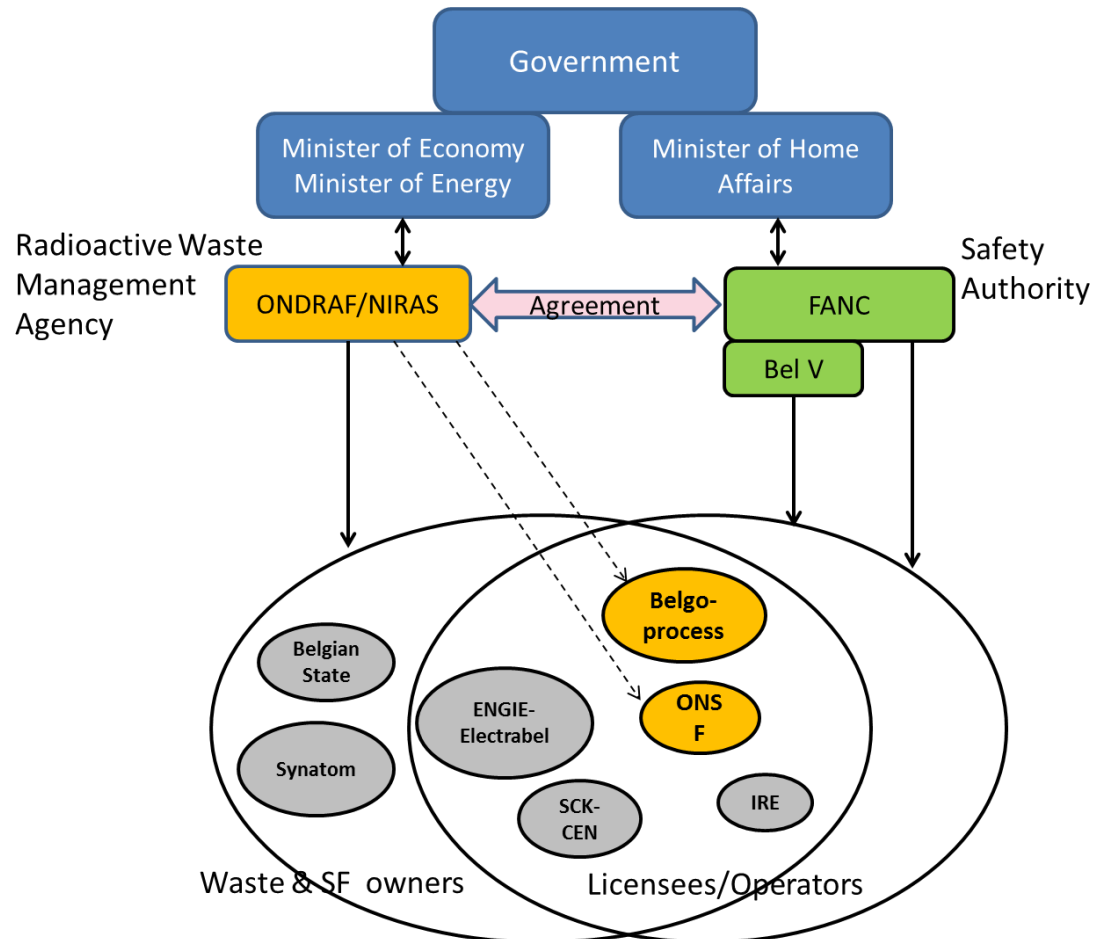


Bel V



**Staffing 01/2018 :
+/- 90**

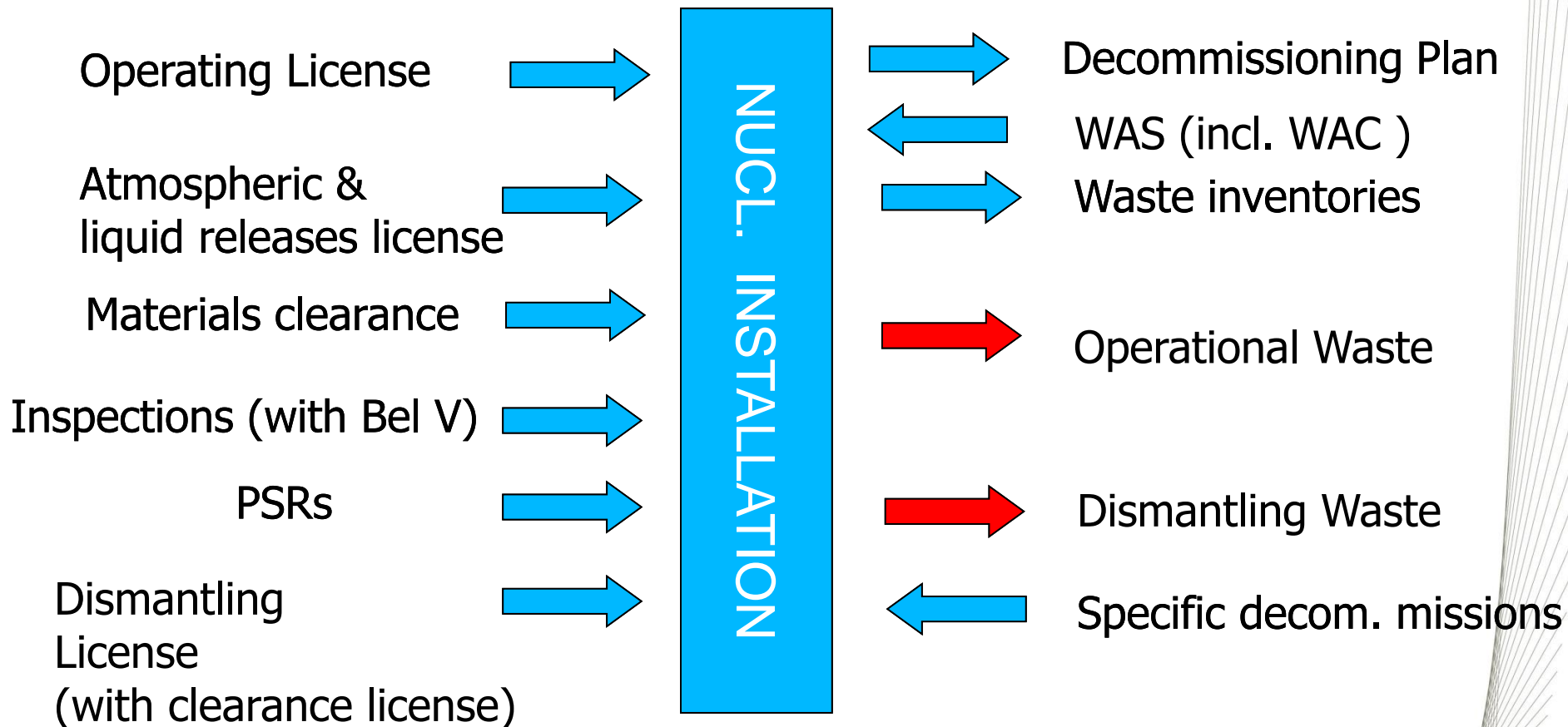
Organisational structure : the Safety Authority and the Waste Management Agency



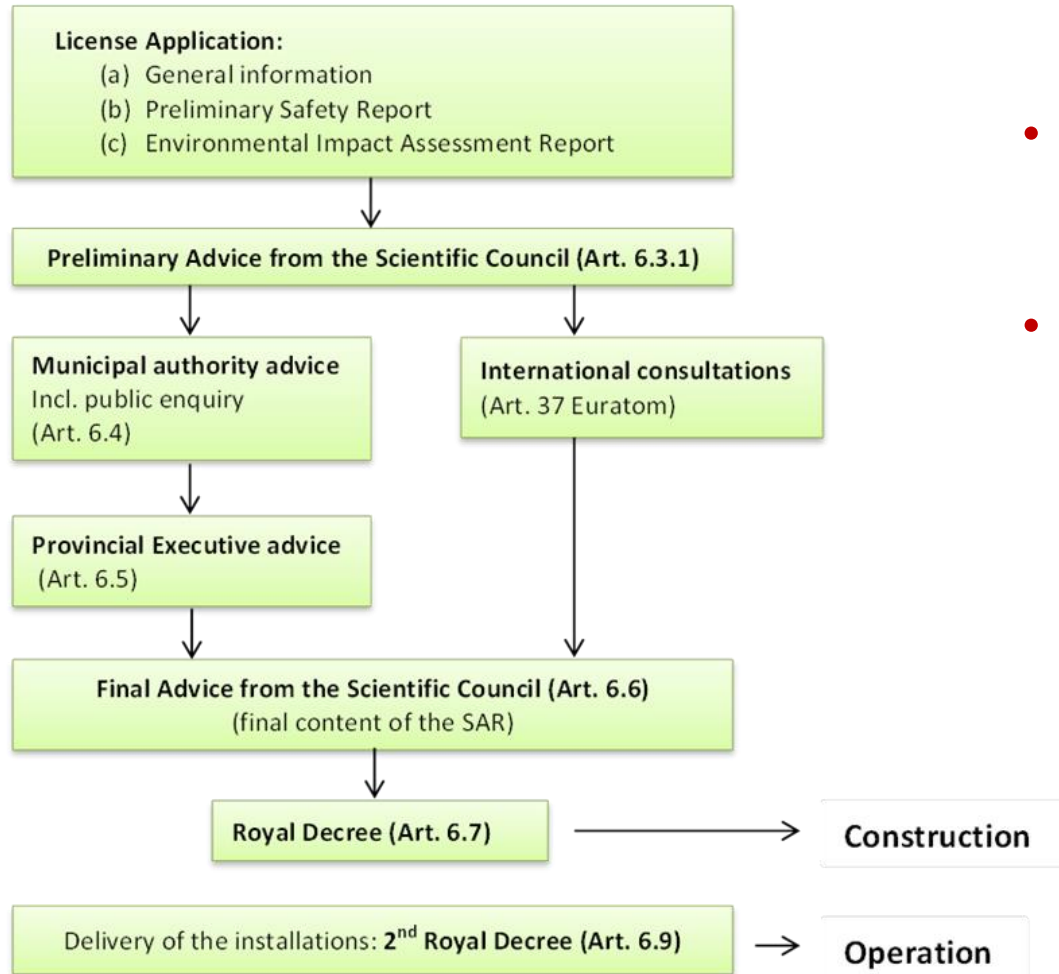
Interactions FANC - Licensee - ONDRAF/NIRAS

FANC

ONDRAF/NIRAS



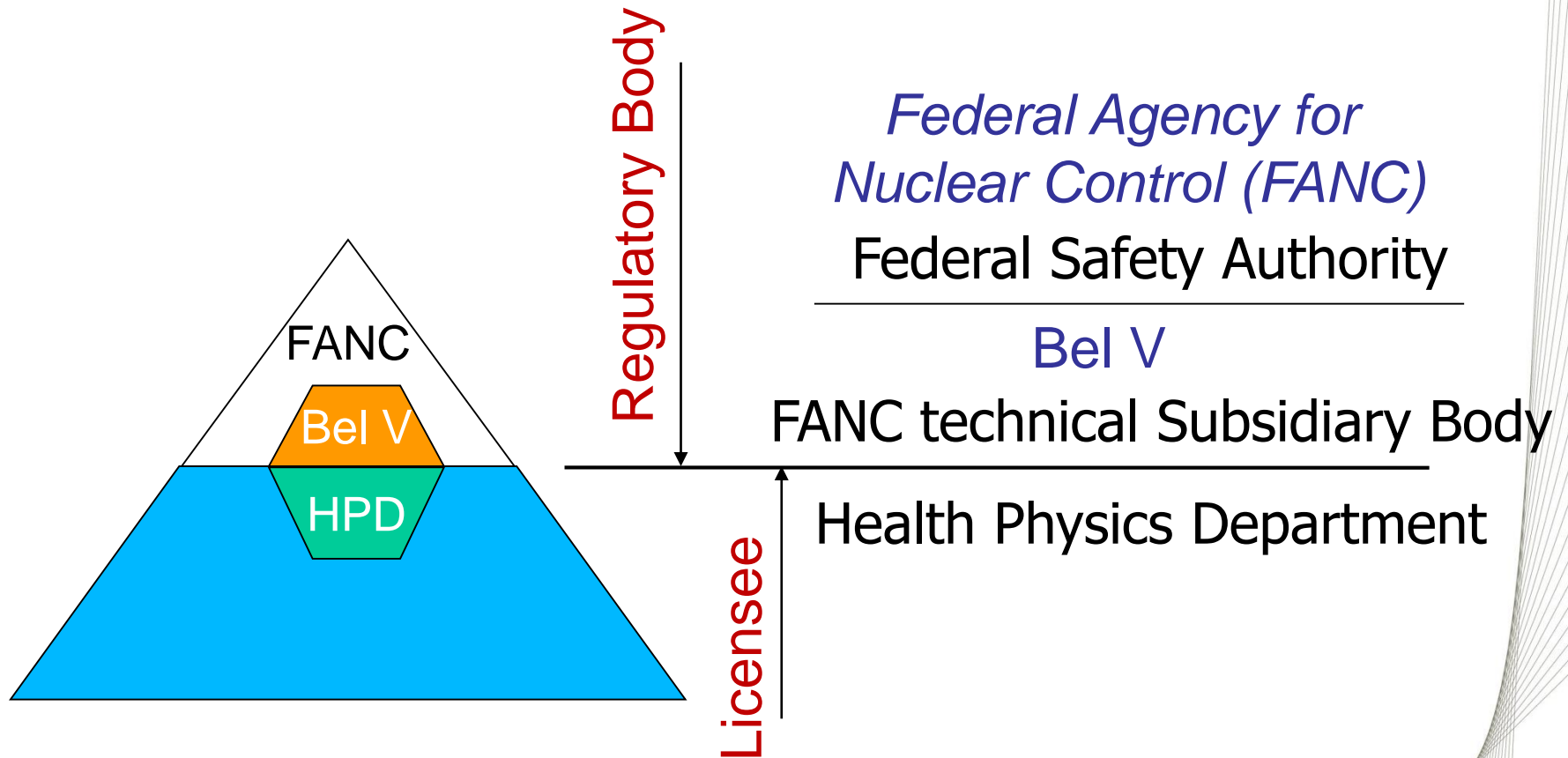
Licensing process of Nuclear Facilities (GRR-2001)



- Same process for the dismantling license
- Advice of ONDRAF/NIRAS required in the dismantling license application file

Proposed licensing system for disposal facilities similar but with a phased approach (multiple confirmation decrees) and consideration of long timeframes

Surveillance of Nuclear Facilities : 3 levels

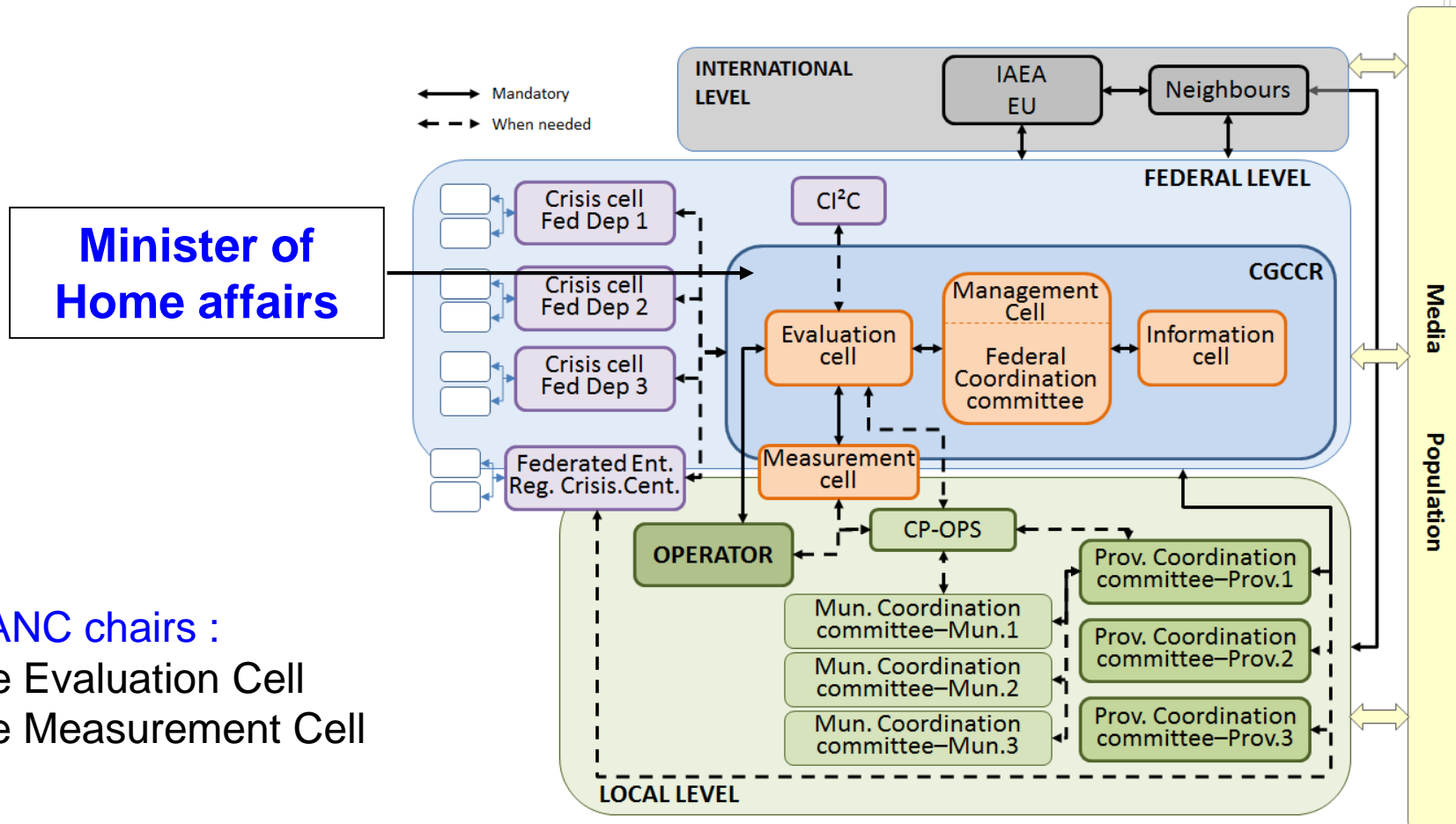


Explicit prime responsibility of the Licensee : Law of 7 May 2017

How does it work practically

- An internal **Health Physics Department** must be set up by the Licensee (art 23 of GRR-2001). The HPD head is a recognized expert.
- **Inspections on site** performed by **Bel V** + some by/with **FANC**
- Inspection reports sent to FANC. Regular meetings on relevant issues, including experience feed-back
- **Contact Commissions** with operator on regular basis lead to effective interactions.

Emergency Preparedness



Minister of Home affairs

The FANC chairs :

- The Evaluation Cell
- The Measurement Cell

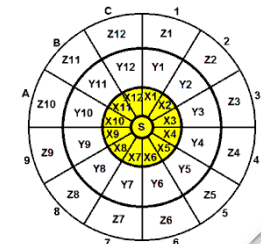
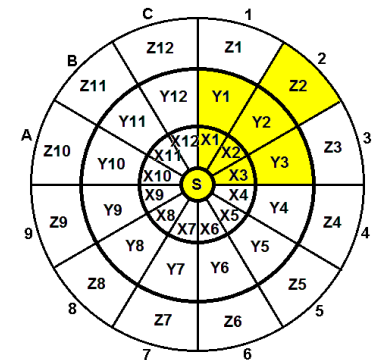
The FANC has its own Internal Crisis Centre (CI²C)

Emergency Preparedness :

Emergency Plan of 1st March 2018

Major changes (1)

- Classification of Emergencies (in accordance with IAEA classification) :
 - Alert (replacing N0):
 - *significant event*
 - Facility emergency (replacing N1) :
 - *Actions taken on-site*
 - Site area emergency: (replacing N1, N2):
 - *Activation of off-site response plan*
 - General emergency: (replacing N2, N3)
 - *Activation of the off-site response plan and sheltering in the circle part of "keyhole" (S) and other protective actions (population/food chain) outside (S)*
 - General emergency reflex mode (replacing NR)
 - *Immediate protective actions in the PAZ : Alert, sheltering, listening to the media waiting for the mobilisation/gathering of local and federal emergency committees*



Emergency Preparedness :

Emergency Plan of 1st March 2018

Major changes (2)

- More focus on transition and post-accident phases

- Plan not limited to the Urgent & Early phases

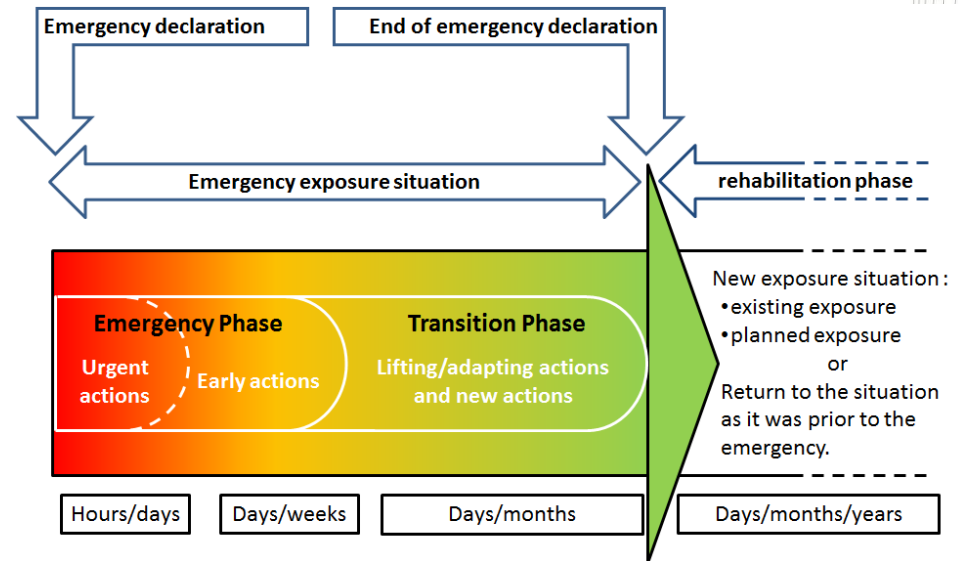
- Preparedness zones

- Emergency planning zones

- Detailed preparation of the protective actions
- Evacuation: 10km
Sheltering & Iodine Thyroid Blocking (ITB): 20km

- Emergency extension zones

- General strategy to extend protective actions outside the associated EPZ
- Evacuation: up to 20km
Sheltering & ITB: up to 100km



2. Developments since the last RM & Measures taken to address Suggestion & Challenges

Content

- Spent Fuel Storage Facilities & Spent Fuel status
- Update of legal framework
- Task Force FANC-ONDRAF/NIRAS
- Licensing of cAt surface disposal facility
- IRRS follow-up mission
- Stress Tests actions plans status
- Regulatory guidance on decommissioning
- Questions raised on the National Report

Suggestion : Increase Spent Fuel storage capacity

- A solution for additional interim spent fuel storage at both sites in Doel and Tihange has been developed.
- Main characteristics are :
 - Dry storage in “**dual purpose casks**” (with similarities with existing facility at Doel)
 - The facility meets the recent FANC/Bel-V guidance
- Project currently passes through a pre-licensing phase.
- Submission of the Licence application will be the next phase.

Spent fuel status

- *Status of Spent Fuel: Disposal or Reprocessing*
 - To be part of a future policy decision, on the basis of the owner's proposal
 - No status currently proposed by the owner

Update of legal Framework

- Update of legal Framework:
 - The Law of June 28th, 2015 allowed 10 years of LTO for Doel 1 & 2 (same as for Tihange 1 in 2012)
 - Legal shutdown dates :

Doel 1	15 nd February 2025
Doel 2	1 st December 2025
Doel 3	1 st October 2022
Doel 4	1 st July 2025
Tihange 1	1 st October 2025
Tihange 2	1 st February 2023
Tihange 3	1 st September 2025

Update of legal Framework : recently approved proposals

- Royal decree *on the decommissioning of Nuclear installations* :
 - Signed by the King on August 15th ,2015
- Proposal of royal decree *aiming to avoid situations which can give rise to possible liabilities of radioactive waste or of installations to be dismantled*':
 - Approved by the Council of Ministers (14 Dec. 2017) & by the Council of State (25 Jan. 2018) : to be signed shortly by the King
- Proposal of royal decree *on the safety of facilities for storage of spent fuel and radioactive waste*
 - Approved by the Council of Ministers (14 Dec. 2017) & by the Council of State (25 Jan. 2018) : to be signed shortly by the King

The Task Force FANC – ONDRAF/NIRAS

- Created by decision of [council of ministers of 18/11/2016](#)
- Composed of directions of FANC and ONDRAF/NIRAS and government commissioners of both FANC and ONDRAF/NIRAS
- Objective: formulate answer to recommendation 7 of IRRS mission (2013):

« The Government should review the current allocation of roles and responsibilities of ONDRAF/NIRAS and the regulatory body to ensure separation of roles and responsibilities of both organisations so that the decisions of the regulatory body are not unduly influenced by prior governmental and ONDRAF/NIRAS decisions. »

Conclusions of Task Force report

- Need for modification or additional regulations for:
 - Waste acceptance system
 - Transfer of waste to ONDRAF
 - National Policy on waste disposal
 - Intervention of and remediation of contaminated sites
- July 2017 decision of council of ministers: ONDRAF and FANC should develop proposals
- April 2018 proposal to government of co-ordinated proposals of modification of law for ONDRAF system of acceptation of waste and oversight by FANC

Licensing of cAt surface disposal facility

- License submission in January 2013.
- Review of the safety case by regulatory body led to 324 issues raised (and now solved)
 - Optimisation Process
 - Radiological limits of the repository
 - Long term safety assessment scenarios
 - Operational risk analysis
- Updated safety case expected by the end of the year

IRRS Follow-Up - December 2017

Category	Recommendations	Suggestions	Good Practices
2013 Mission	31	24	6
Closed	17	12	
Closed on Progress Made & Confidence	12	10	
Remain Open	2	2	
New Findings 2017		3	2

IRRS Follow-Up - December 2017: General Remarks (Review Team)

- FANC & Bel V (the Regulatory Body) have made **significant progress** in addressing the findings of 2013 IRRS mission and demonstrated a strong commitment to implementing relevant IAEA safety standards.
- The RB is a **credible, independent body, and is actively considering its future regulatory challenges.**
- The RB should **continue** to seek to improve its effectiveness through focus on **closing the few remaining, and new, IRRS findings**

Stress Tests Actions Plans : Status on Dec. 31st, 2017

- **Nuclear Power Plants** (including desactivation pools and on site SF storage & waste treatment facilities)
 - On March 1st 2018, **one** action (of 365) still in progress: New site Emergency centre at Tihange (2019)

Status & Description published on 09/03/2018 - in English:

<https://afcn.fgov.be/fr/system/files/best-2017-final.pdf>

Stress Tests Actions Plans : Status on Dec. 31st, 2017

- Other Nuclear Facilities (BP, SCK/CEN, IRE)
 - IRE: 53 (of 68) actions closed
 - Remaining actions on tornadoes & earthquakes (2018)
 - BP : 50 (of 63) actions closed
 - Remaining actions on fire protection & earthquakes (2018)
 - SCK/CEN : 38 (of 42) actions closed
 - Remaining actions on Diesel UPS for BR2 (2019) & On site emergency centre (2018)

Status & Description published on 09/03/2018 - in French:

<https://afcn.fgov.be/fr/system/files/besta-2018-fr-final.pdf>

Regulatory Guidance on Decommissioning

- Focus on decommissioning activities has lower priority due to the amendment of the Nuclear Energy Phase-out Law (LTO)
- Position papers:
 - Release of site
 - Clearance of building
 - Regulatory Phases after final shutdown
 - Free release of objects (under development)
 - Waste management (under development)
 - Detailed content of safety case (under development)

Questions and Answers raised on National Report

- Belgium received 70 Questions and Comments
- Main topics have been discussed in this presentation (e.g. Emergency Planning, cAt licensing)

3. Measures to improve safety and challenges : Regulatory Body side

Measures to improve safety and challenges : Regulatory Body side

- **Continue and finalize current activities:**
- Improvement of the **Regulatory Framework:**
 - Finalization of EU BSS transposition, incl. **Health Physics Organisation**
 - Licensing regime of Disposal facilities
 - Safety of Disposal facilities

Measures to improve safety and challenges : Regulatory Body side

- **Licensing of**
 - Surface disposal Facility
 - New on-site Spent Fuel Storage
 - ASR-affected waste drums management facility
- Continue « **Task Force** » efforts with elaboration of regulation proposals
- **Challenge** : Prepare final shutdown and decommissioning of NPPs (2022-2025)

4. Areas of good performance

Areas of good performance

- Re-inforced collaboration FANC-ONDRAF/NIRAS :
 - New **regulatory Framework** to avoid liabilities of RW or installations to be dismantled:
 - Transfer of licenses, waste and dismantling files as part of license application with (systematic) advice of O/N, surveillance of filling rate of waste storage installations,...

Areas of good performance (2)

- Re-inforced collaboration FANC-ONDRAF/NIRAS :
 - « **Task Force** » to prepare regulation proposals
 - **FANC review of Waste Acceptance System** in view of the new cAt disposal facility: responsibilities, processes, documents, combined inspections with O/N

Type of Liability	Current practices/ Facilities	Long-term management policy	Funding of Liabilities	Planned Facilities
Spent Fuel	<ul style="list-style-type: none"> - On-site wet or dry storage of SF from NPPs - Storage or reprocessing of SF from research reactors 	Long term management policy still to be defined: disposal of waste from reprocessing or direct disposal	NPP operators contribute to the fund managed by SYNATOM;	<p>Extension of storage facilities on NPP sites</p> <p>Geological disposal still to be confirmed by policy decision. (disposal and pre-disposal facilities to be decided)</p>
Nuclear fuel cycle waste	Centralised storage at Belgoprocess site of all SL-LILW, LL-LILW and HLW transferred to ONDRAF/NIRAS	SL-LILW : Near surface disposal LL-LILW and HLW: policy still to be defined	<p>Producer pays, contribution to ONDRAF/NIRAS long-term fund;</p> <p>Insolvency funds</p> <p>Various funds for historical liabilities fed by state</p>	<p>Surface Disposal for SL-LILW at Dessel, including the disposal facility and other facilities for waste packaging for disposal. (Gov. Decision taken in 2006, license application in 2013)</p> <p>Storage building for the ASR non-conform waste at Belgoprocess</p> <p>Geological disposal of LL-LILW and HLW still to be confirmed by policy decision. (disposal and pre-disposal facilities to be decided)</p>
Non-power reactors waste	Centralised storage at Belgoprocess site of all SL-LILW, LL-LILW and HLW transferred to ONDRAF/NIRAS Radium waste storage at Umicore/OLEN	SL-LILW: near surface disposal LL-LILW: policy still to be defined Radium waste : policy still to be defined	<p>Producer pays, contribution to ONDRAF/NIRAS long-term fund;;</p> <p>Insolvency fund;</p> <p>Radium waste: Producer pays</p>	Idem

Type of Liability	Current practices/ Facilities	Long-term management policy	Funding of Liabilities	Planned Facilities
Decommissioning Liabilities	<p>Present projects : BR3 Research Reactor; Eurochemic reprocessing plant SCK•CEN waste department; Belgonucleaire MOX fabrication plant and FBFC fuel fabrication plant;</p> <p>Radio-element production facility ex- "Best Medical Belgium"</p>	<p>Responsibility of operator; approval of decommissioning plan by ONDRAF/NIRAS</p> <p>SL-LILW: near surface disposal</p> <p>LL-LILW policy still to be defined</p>	<p>NPP operators contribute to the fund managed by SYNATOM; various funds for historical liabilities fed by state;</p> <p>Transfer of financial means to ONDRAF/NIRAS (waste funds managed by ONDRAF/NIRAS) when waste is transferred to ONDRAF/NIRAS</p>	Idem
Disused Sources	Sealed Return to supplier, decay storage or transfer to ONDRAF/NIRAS	Implementation of EU directive, recovery of orphan sources	If no return, holder has to set up financial guarantee	idem

End of Part 1

Thank You for Your Attention



ONDRAF/NIRAS

The management of radioactive waste in Belgium

**Sixth Review Meeting of the
contracting parties to the Joint
Convention**

Vienna 21 May – 1 June 2018

**Philippe Lalieux
Director Long-term Management
NIRAS/ONDRAF**



Outline

- **Summary of basic information**
- **Developments between 2015 – 2018**
 - Significant developments
 - Action on measures to improve safety and challenges from last Review Meeting
- **Current measures to improve safety and challenges**
- **Areas of good performance (see FANC presentation)**

Summary of basic information

What does ONDRAF/NIRAS do?

ONDRAF/NIRAS (= Belgian Agency for Radioactive Waste and Enriched Fissile Materials)

- Created by the law of August 8, 1980
- Supervising authority: Ministers for Economic Affairs and Energy



Our vision



Nuclear waste quantities

For the current nuclear programme – expectations by 2075
(3 NPPs 50 years lifetime and 4 NPPs 40 years lifetime)

- **Low-level waste – category A waste**
 - Conditioned in concrete boxes for surface disposal
 - Waste volume for **disposal** ~ 55 000 m³
- **Intermediate-level waste – category B waste**
 - **Storage volume**
 - Between 11.000 m³ (full reprocessing) and 10.500 m³ (10 % reprocessing)
- **High-level waste – category C waste**
 - **Storage volume**
 - Between 600 m³ (full reprocessing) and 4500 m³ (10% reprocessing)

Developments since last Review Meeting
&
measures taken to address suggestions and challenges

National Programme

- National Programme established as required by EC Directive 2011/70/Euratom
- Covers the management of all categories of radioactive waste in Belgium
- Status of situation in 2015 in terms of national policies and implementation of policies
- Established by National Committee for the National programme (Ministry Economy/Energy, ONDRAF/NIRAS and Synatom, with the opinion of the FANC)
- Approved by Federal Council of Ministers – Ministerial Decree October 2016
- Publically available
- Update to be decided in relation to
 - Policy decisions
 - Progress made with implementation
- National Report 2018 in preparation

Existing national policies as in National Programme 2015

- Decay of very short-lived waste and clearance of decayed waste
- Centralised short- and medium-term management of LLW, ILW and HLW at the Belgoprocess site of ONDRAF/NIRAS (Mol & Dessel)
- Long-term management of LLW in a surface disposal facility in Dessel
- On site storage (Doel & Tihange) of spent fuel from the NPPs followed by reprocessing or direct disposal
- Specific policies for the spent fuel from the various research reactors (reprocessing or storage or transfer to ONDRAF/NIRAS as radioactive waste)

Management of non-conform waste from NPPs

- 2012: discovery of gel formation on waste drums during routine inspections in storage buildings
- Neither air nor surface contamination observed in the storage building
- The drums were conditioned at the Doel NPP
 - Cemented sludges waste – mainly affected
 - Exchange resins waste
 - Filter waste
- Gel formation due to Alkali Silica Reaction (ASR)
- Potentially 10000 waste drums affected



Patches of gel < 50%



Patches of gel > 50%



Much gel



Management of non-conform waste from NPPs

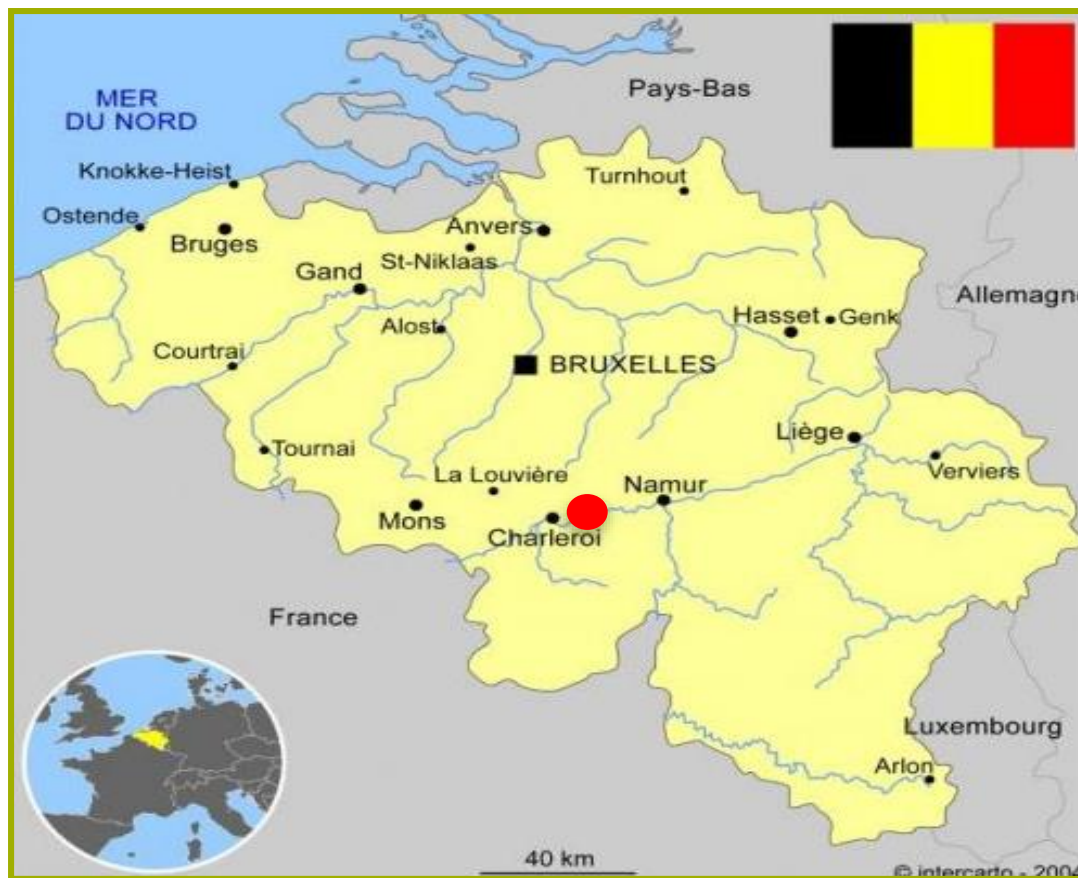
- ONDRAF/NIRAS has established a road map to deal with this important non-conformity problem
 - Alkali – silica reaction in concrete matrix
- Road map covers seven themes, covering waste package inspections, RD&D, operational and long-term safety, waste acceptance system, ...
- Withdrawal of qualification for waste processing of affected waste types at the NPPs of Doel and Tihange
- Follow-up of action plan with the FANC
- In progress: a dedicated storage facility for this non-conform waste – design review phase in interaction with the FANC is ongoing

Progress on decommissioning programmes

ONDRAF/NIRAS Fleurus site

History

The company "Best Medical Belgium SA" (BMB) located at Fleurus (Belgium) produced radioisotopes for medical applications and industrial radiography, and was declared bankrupt on May 14th, 2012.

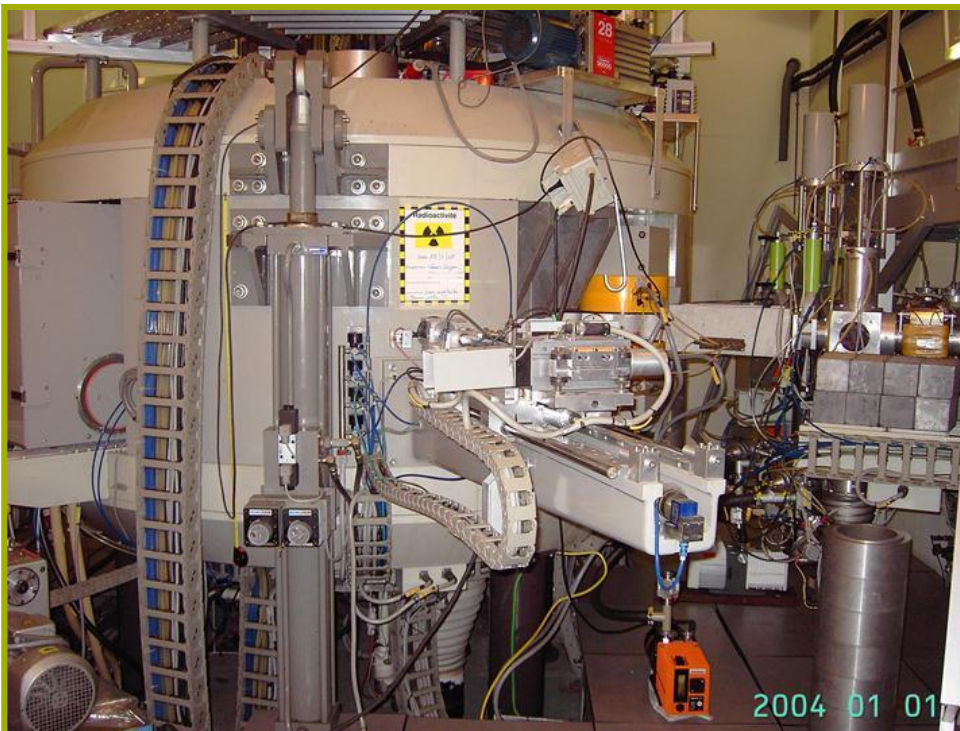


Facilities

The ex-BMB facilities are located in 7 buildings.

The facilities include:

- 2 cyclotrons + irradiation vaults
- 24 shielded hot cells
- 15 glove boxes



Operation by ONDRAF/NIRAS

ONDRAF/NIRAS's legal assignment is to carry out the decommissioning program and the decommissioning operations of the contaminated facilities belonging to radioactive waste producers in case of failure.

In October 2012, ONDRAF/NIRAS became nuclear operator of these installations to carry out clean-up and decommissioning

Immediate clean-up



Operation by ONDRAF/NIRAS

- End 2017: start working in the 2 workshops dedicated for cutting, sorting, decontaminating and measuring radioactive materials
- 2018: new facility for temporary storage of radioactive wastes
- May 2018: Final Decommissioning Plan submitted to ONDRAF
- Clean-up activities of all the buildings: up to the end of 2019
- D&D of central cyclotron building : up to 2026
 - The only building that will be completely demolished

Progress on decommissioning programmes

other sites

Decommissioning programmes

- **Belgonucleaire**
 - Former MOX production facility (ended 2006)
 - Decommissioning well advanced : objective of unconditional release of site by 2018
- **FBFC International**
 - Former U-fuel production and MOX assembly facility (ended 2010)
 - Objective of unconditional site release by 2019
- **Thetis reactor (University of Ghent)**
 - Research reactor shut down in 2003
 - Dismantling works completed in 2015
 - Declassified in December 2015

Decommissioning programmes

- **BR3 research reactor at SCK•CEN**
 - End of decommissioning planned by 2020
 - All main components already removed
- **Belgoprocess site**
 - Eurochemic pilot reprocessing plant – completed Dismantling & Decommissioning
 - Less than 5% of produced decommissioning materials to be managed as radioactive waste
 - Decommissioning of Evence-Coppée incinerator mid 2015

Waste acceptance system

- Operational waste acceptance system
ONDRAF/NIRAS
 - From waste generation till storage
 - Waste acceptance criteria defined by ONDRAF/NIRAS
 - Qualification of waste management facilities by ONDRAF/NIRAS (incl. radiological waste characterisation tools and equipments)
- Extension of system to (operational) disposal facility – surface disposal facility for LLW
- Intensive interactions with the FANC (see first presentation)
- Disposal license will define radiological and physico-chemical limits for LLW acceptance in surface disposal facility

Inventory of nuclear liabilities

- Draw up a register of the localisation and the state of all nuclear sites and all sites containing radioactive materials – legal task ONDRAF/NIRAS since 1997
- Estimate the costs of their dismantling and remediation
- Evaluate the existence and **adequacy** of the provisions for financing these future or current operations
 - **Sufficiency**
 - **Availability**
- Update this inventory on a five-yearly basis
- Fourth inventory report 2013 -2017
 - Published beginning of 2018
 - Report to the supervising Ministers (Economy & Energy)

Inventory of nuclear liabilities

- **Estimated total management cost increased from 12087 M€₂₀₁₅ (report 2012) to 15107 M€₂₀₁₅ (report 2017)- main reasons:**
 - Increase of estimated NPPs decommissioning cost
 - Increase of spent fuel quantities to be managed
 - Increase of general cost of radioactive waste management
 - Diverse others cost increases
- **Sufficiency and availability of provisions**
 - No significant evolution with previous assessments
 - Remains high but with some remaining key uncertainties (e.g. long-term management cost of HLW and ILW)

**Challenges identified at the 5th
Review Meeting
of relevance for ONDRAF/NIRAS**

Challenge 3 - approval and implementation of policy for the long-term management of high-level and long-lived waste

- National Policies for the management of radioactive waste to be established by Royal Decree deliberated in the Council of Ministers, on the basis of a proposal by ONDRAF/NIRAS and after taking the opinion of the FANC (transposition law of Directive 2011/70/Euratom)
- Proposal for stepwise long-term management policy for ILW & HLW by ONDRAF/NIRAS in February 2018
 - First step = geological disposal on the Belgian territory
 - Next step = establishment of a decision making process with all stakeholders
 - Final step = site chosen
 - Formal prelicensing process with FANC during all policy steps

Challenge 4 - development of a policy proposal for radium-bearing waste

- ONDRAF/NIRAS will establish a policy proposal for radium-bearing waste after a policy decision for ILW and HLW
- **Scope** : covering radium-bearing waste (historical radium production activities in Olen) and NORM waste fraction to be managed as radioactive waste
 - Large uncertainty on volumes to be managed → to be reduced
- Common action by the FANC & ONDRAF/NIRAS to better define scope and long-term management options
 - Inventory of all Radium & NORM sites and total waste volumes – radioactive and non-radioactive waste (end 2017)
 - Preliminary identification of fractions to be (potentially) managed as radioactive waste (second half 2018)
 - From 10^7 m³ to 10^4 m³ (orders of magnitude)

Challenge 4 - development of policy proposal for radium-bearing waste

- Common position FANC - ONDRAF/NIRAS will be published
- Basis for ONDRAF/NIRAS' policy proposal
 - Definition of the source term to be managed
 - Assessment of the management options from safety and environmental impact point of view - Strategic Environmental Assessment procedure incl. public participation
 - Policy proposal to the federal government
- Timing to be decided
- In the mean time: assessment by FANC of safety of storage facilities for radium-bearing waste in Olen
 - Check for potential safety issues

Challenge n°5: decommissioning financing – liability for IRE decommissioning

- The financial responsibilities are with the Belgian State
- The conventional agreement to cover this responsibility is in a final stage of approval

Challenge n°7: consequences of Nuclear Energy Phase-out on the waste management chain

- Financing mechanisms: Royal Decree of April 25, 2014 modifies the financing system for long-term management
 - Takes into account nuclear operators stopping their activities
 - Tariff increases apply to both already produced waste and future waste arisings
- Decommissioning programmes and management of large quantities of decommissioning waste
 - Priority to make operational a complete management chain
 - waste containers for transport and disposal
 - operational surface disposal facility in due time

Challenge n°7: consequences of Nuclear Energy Phase-out on the waste management chain

- Interactions with utilities for calendars of waste generation and waste arisings
 - ILW – central parts of reactor building (period till approx. 2035)
 - LLW – large volumes of concrete (period till approx. 2045)

Current measures to improve safety and challenges

Extension of waste acceptance system to disposal

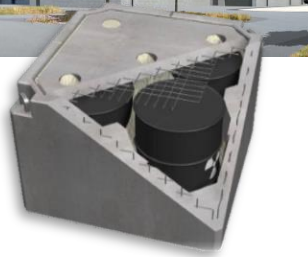
- Revision and issuing as Royal Decree of the General Rules for the Waste Acceptance Criteria with a binding opinion by the FANC
- Improvement of waste acceptance system on the basis of past REX exercises and FANC assessment results
- Definition of waste acceptance criteria for disposal integrating the disposal license requirements
 - Covering non-conditioned waste, conditioned waste and disposal waste (in concrete disposal container)
 - Covering bulk waste from decommissioning

Surface disposal - multi-barrier system

Storage building



Installation for the production of monoliths (IPM)



Disposal modules




Caisson plant



Multi-layer cover

Preparation and implementation of surface disposal

- Start construction of caisson (concrete containers) production facility (operation 2021)
- Start construction of Monolith production facility (operation 2021)
- Surface disposal facility (operation 2023)

Storage capacity at Belgoprocess site

- Assessment and follow-up of expected waste arisings in close interaction with waste producers
- Plans for increasing storage capacity
 - Non conform waste
 - Monolith production facility with buffer storage
- Timely construction and operation of surface disposal facility is key factor

Long term management of Radium-bearing waste

- Preparatory work in interaction with FANC ongoing – see above

Continuation of decommissioning works at ONDRAF/NIRAS Fleurus site

Management of non-conform waste from NPPs

- Main themes
 - a major inspection program
 - research and development
 - operational safety of interim storage
 - long term safety, i.e. impact on final disposal
 - impact on the Waste Acceptance System
 - impact on treatment and conditioning processes
 - financial aspects

Management of non-conform waste from NPPs

- Specific actions
 - Dedicated storage facility at Belgoprocess site
 - Design review ongoing
 - License application 2019
 - Operational target = 2023
 - RD&D plan for definition of long-term management options
 - Surface disposal when ASR can be excluded
 - Surface disposal with design modifications when ASR is limited
 - Surface or geological disposal when it can be demonstrated that ASR gel does not negatively affect main disposal barriers
 - Waste reconditioning

Preliminary assessment of disposability of waste

- **Production of disposal-conform waste in the future**
- **Demonstration of conformity for existing waste**
 - Physical non-conformities and missing information
 - How can non-conformities be dealt with in a systematic manner?
 - Non-destructive and destructive testing
 - Design modifications
 - Waste reconditioning
 - Reduction of conservative assumptions in disposal safety case (RD&D)

LLW

ILW & HLW

Radium-bearing waste & NORM waste

Policy decisions
January 1998 and
June 2006

Waste Plan & SEA 2011
Policy proposal 2018

Waste Plan & SEA
Policy proposal

Policy decision(s)

Policy decision(s)

Integrated
preliminary designs

Integrated
preliminary designs

Integrated
preliminary designs

License application
January 2013

License application

License applications

Licensing &
construction and
operation

Licensing &
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