Radwaste Crisis in Belgium

European Parliament, Feb.5th 2020

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Radwaste Crisis in Belgium

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Waste inventory and planned till closure NPPs (2025)

	31 Dec. 2017	Total (in National Report of Belgium)	Total (Greenpeace estimation)
Category B (MLW) Excl. Umicore (*)	-	10,900m3	10,400 – 11,100m3
Category C (SNF) Only from NPPs	4322tHM (incl. 66 MOX)	3800tHM (no MOX)	4,800tHM (****) (incl. 66 MOX)
Category C (VHLW) Only from NPPs	70m3 (**)	250m3 (***)	70m3 (**)

(*) This excludes Umicore alfa-contaminated radium-226 waste in Olen of 55,000 – 275,000m3 of Cat.B waste
(**) 70m3 VHLW from 672tHM spent UOX
(***) 250m3 VHLW from 1672tHM spent fuel, incl. 66tHM spent MOX
(****) 3800+1000tHM

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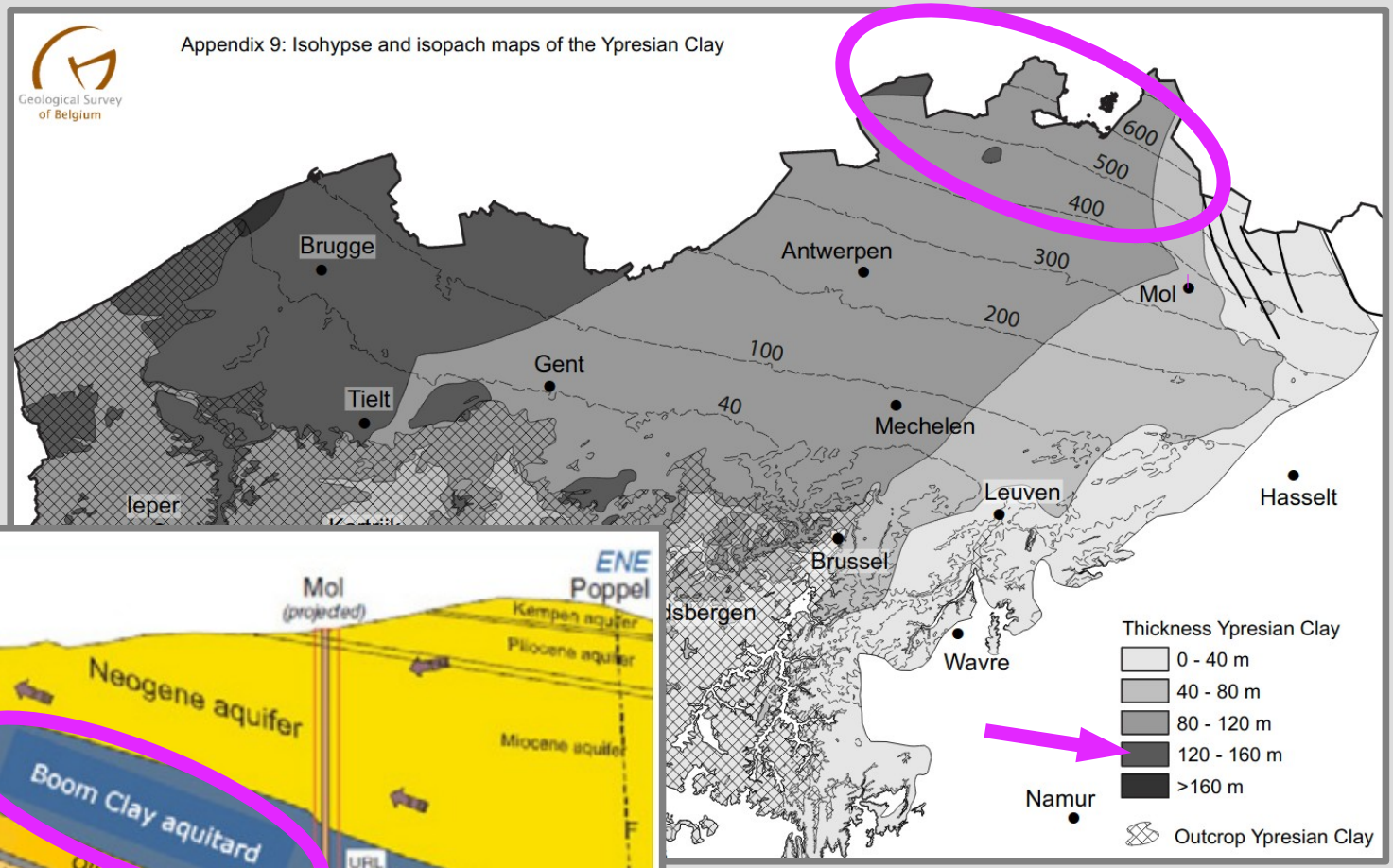
Uncertainty on future reprocessing

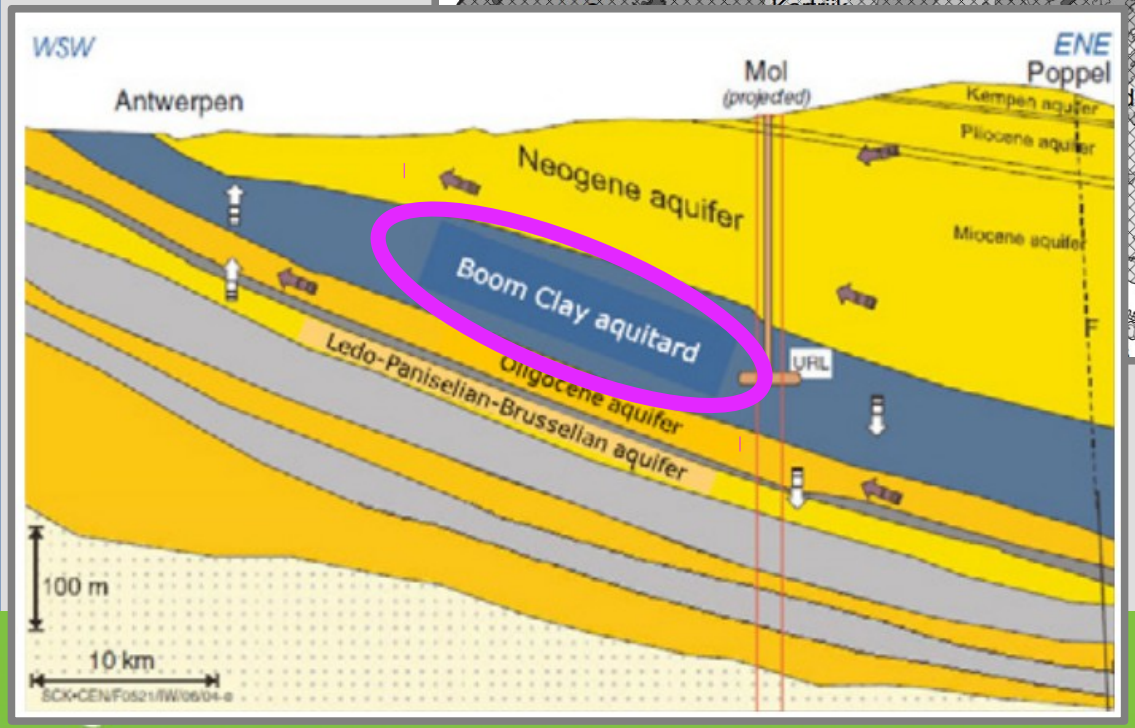
Estimated planned conditioned waste (BE 2nd national report of Aug.2018 p.15):

- "*a total of 1000tHM SNF will still be reprocessed (incl. 66tHM MOX spent fuel) in addition to the 672tHM UOX that have already been reprocessed*"

- BE decided to stop reprocessing in 1998
- SNF from wet storage in Tihange would be used
- Anyway both spent UOX and MOX
- Uncertainty on feasibility of geological storage of spent MOX?
- How to dispose PuO2 & RepU ?

From Boom clay (220m) to Ypresian clay (>400m)





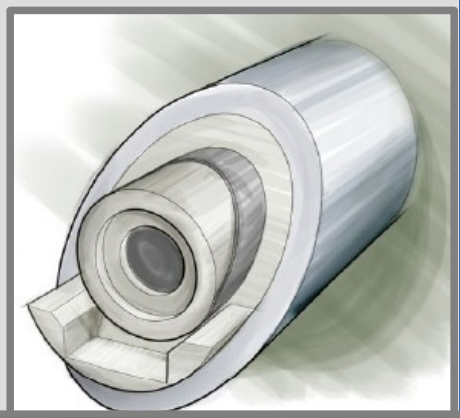
Technical problems and uncertainties With clay concept (some highlights)

Greenpeace report, 2019

THE GLOBAL CRISIS OF NUCLEAR WASTE

A REPORT COMMISSIONED BY GP FRANCE

1. The waste packages:
   - Bitumised waste: underground hydrogen production, swelling, explosion or fire risk and chemical reactions
   - Pu & U-235 : risk of criticality accident
2. infrastructure
   - Ventilation during operational phase
   - Vertical shaft: risk to drop container
   - Maneuver large supercontainers
   - Waste not retrievable after operational phase
3. Host rock: clay
   - Tunneling activity disturbs integrity over about 40m
   - Clay layer too thin & not homogeneous
   - Aquifer just above clay layer
   - Sensitivity of clay for high temperature HLW



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No approved reference scenario for HLW-ILW

2011: ONDRAF proposes its waste plan for dumping in “Boom clay”
=> SEA public consultation: 3000 objections
2015: AFCN (regulator): “*not yet possible to choose for clay*”
=>Belgian government demands ONDRAF to look at deep-geological options
2020: new SEA to be organised (no timing yet known)

No approved reference scenario for HLW-ILW

2015: AFCN (regulator): "*not yet possible to choose for clay*"

processus d'optimisation de la protection. A ce jour, aucune analyse de sûreté n'a été présentée pour avis à l'AFCN démontrant que les formations d'argile peu indurées dans leur contexte géologique présentent des performances de confinement et d'isolation suffisantes. De plus, la solution de gestion à long terme préconisée par l'ONDRAF ne résulte pas d'un processus d'optimisation de la protection.

confinement et d'isolation du système de stockage. L'aspect isolation n'est en effet pas suffisamment abordé dans le Plan Déchets notamment concernant la présence de réserves d'eau souterraine exploitables (couches aquifères) contiguës à la

AFCN

AFCN, May 7th 2015 nucléaire

"*as of today, no safety analysis has been presented to AFCN demonstrating that soft clay formations...offer sufficient performances for confinement and isolation...*"

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No approved plan: EU infringement procedure

Infringement procedure / Member State	Non-communication of final transposing measures relating to Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste	Failure to communicate and/or notify all the transposition measures for Council Directive 2011/70/Euratom on safe management of spent fuel and radioactive waste	Failure to notify the national programme for the implementation of a spent fuel and radioactive waste management policy	Failure to correctly transpose certain requirements of Directive 2011/70/Euratom	Failure to adopt a national programme compliant with the requirements of Directive 2011/70/Euratom	Failure to comply with the requirements of the Radioactive Waste Directive 2011/70/Euratom
Start of procedure	*20. Nov 2013*		*28. Apr 2016*	*17 May 2018,07 Jun 2018*	*17 May 2018*	*24 January 2019*
Belgium	20132224; closed 16 Dec 2014		20162026, closed 17 Nov 2016		20182013, formal notice, reasoned opinion on 27 Nov 2019	

Nuclear waste management in the EU:
Implementation of Directive 2011/70/EURATOM
Joint Project Assessment Report

Joint Project, 27 Nov. 2019

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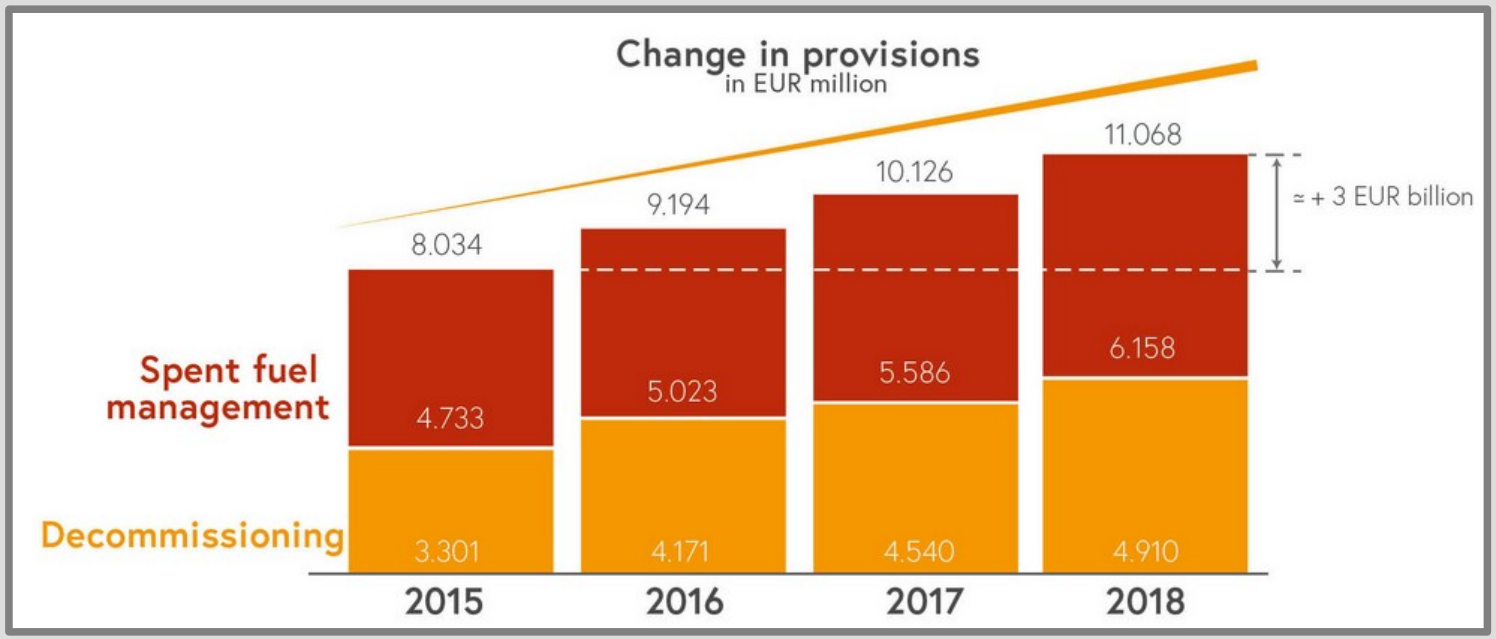
Financing: “Synatom Funds”



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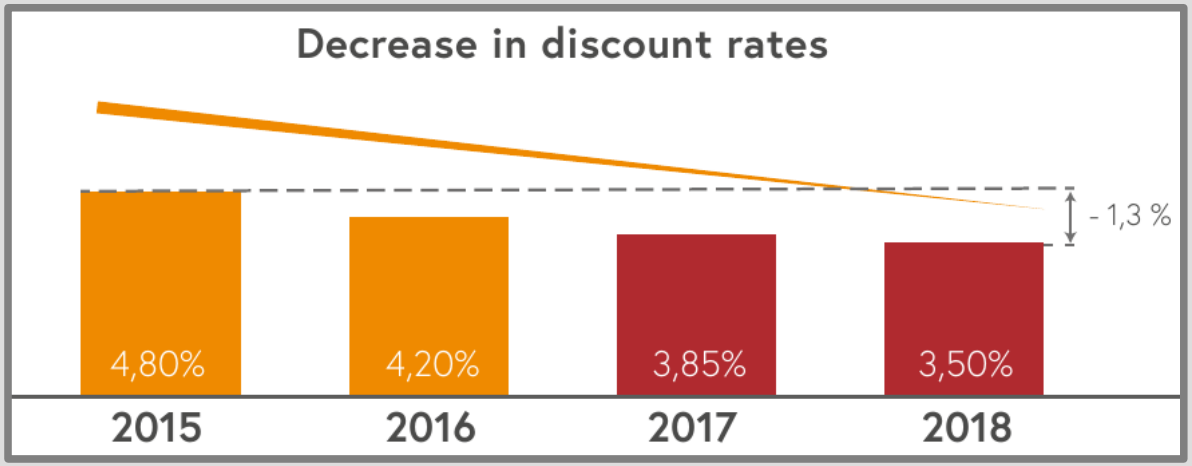

Source: Synatom, 2019

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“Synatom Funds” : Key problems and Missing money

- High uncertainty on cost: increase costs from 3.2bn€ (2011) to 8-10.7bn€ (2018) (NIRAS, indicative, an official figure in 2020)
- Risks for availability of fund: 75% borrowed to Engie
- BE provisions relatively low: 1.6€bn/GWe compared to 4.0 in NL and 4.6 in DE (decomiss. + waste)
- Incentive for Engie to extend lifetime of 2 reactors, even if not economical: delay start of investments, increase fund not through capitalisation but through (too high expected) interest rates

“Synatom Funds” : Key problems and Missing money

Compared to the previous ONDRAF estimate made in 2011, it must be noted that :

1. the new amounts put forward have **more than doubled or even almost tripled.** ONDRAF is now estimating a total amount of between €8 and €10.7 billion. The reasons given are mainly related to a reassessment of the landfill criteria and a change in architecture.

2. the schedule has been radically revised by ONDRAF and extended by nearly **30 years** to take us to closure of the depot in 2130... or in more than a century.

Synatom
Excellence in nuclear fuel cycle management

Source: Synatom Annual Report 2018

The impact of these two factors is **ambivalent** in terms of the establishment of provisions related to spent fuel management. In fact, it would appear that an increase in costs of this magnitude will cause the amounts to be provisioned today to skyrocket. However, this is not the case because the impact of the increase is mitigated by extending the provisioning period by at least 25 years, and consequently by the interest accrued during this additional period.

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Conclusions:

- No approved plan for ILW-HLW
- Uncertainty on location and host rock
- After 30 years of research in “Boom clay” (Hades, 220m depth), this host rock is not a candidate any more
- “Ypresian clay” is considered at >400m but no experience yet, different conditions
- Uncertainty on costs, increase of 5-7bn€ (indic.), new estimation later this year
- Major technical problems of waste: bitumen, expansion, hydrogen, fissile material
- PLEX back on the agenda: Doel4 & Tihange3 for up to 20 years : closure 2025 → 2045

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