Eastern and Central European Decommissioning (ECED) - 2019

THE GRADED APPROACH IN THE MANAGEMENT OF DECOMMISSIONING WASTE IN FRANCE

Nicolas Solente - Andra

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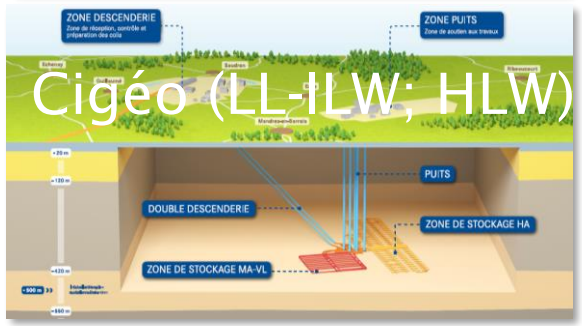
Implementation of a Graded Approach in Radioactive Waste Management in France



Current situation in France:

- Disposal of VLLW and short-lived LLW in Andra's surface facilities.
- Cigéo project for long-lived ILW and HLW.

Building a global approach of the management of all radwastes (and materials if reclassified into waste):

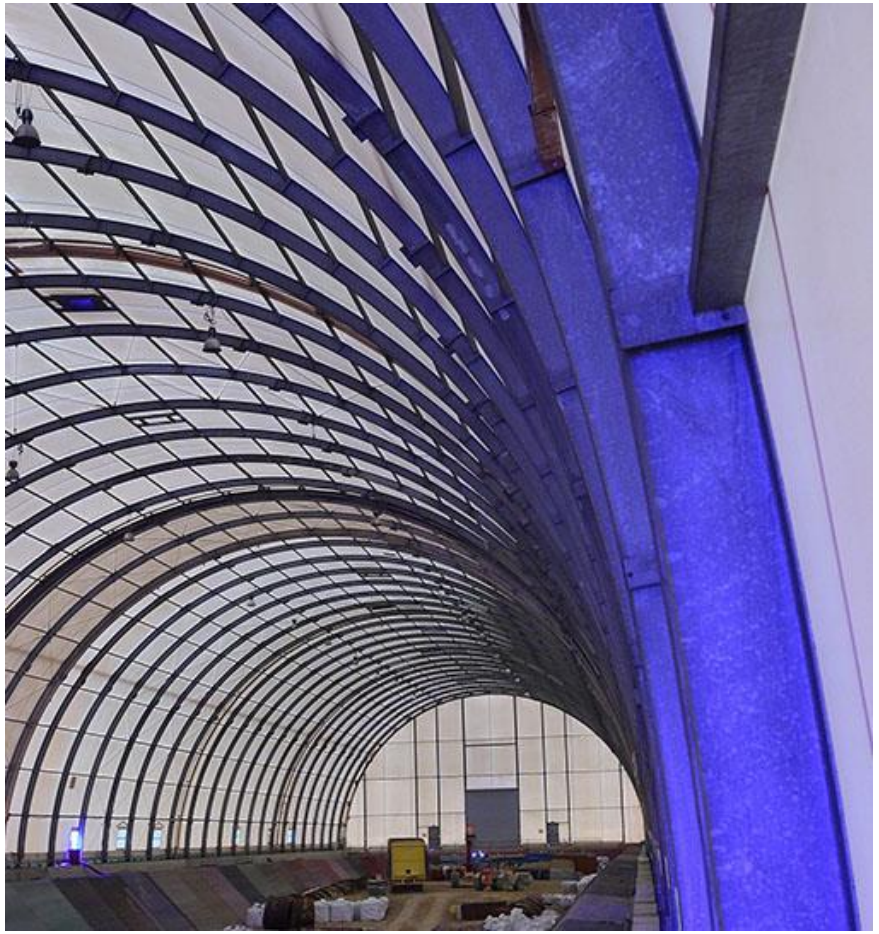
- Exhaustive with respect to waste inventory,
- Coherent with regard to safety and best environmental practice,
- Proportioned to waste harmfulness.

Harmfulness indicators are being elaborated in France to support Waste management strategy

Taking into account:

- Activity level
- Radioactive decay
- Radiotoxicity
- RN mobility
- Non radioactive harmfulness (on Man and the Environnent)

LL-LLW: Distribution of non radiological harmfulness with regard to conventional waste regulation
(Additional types of waste considered since 2016 are not taken into account)

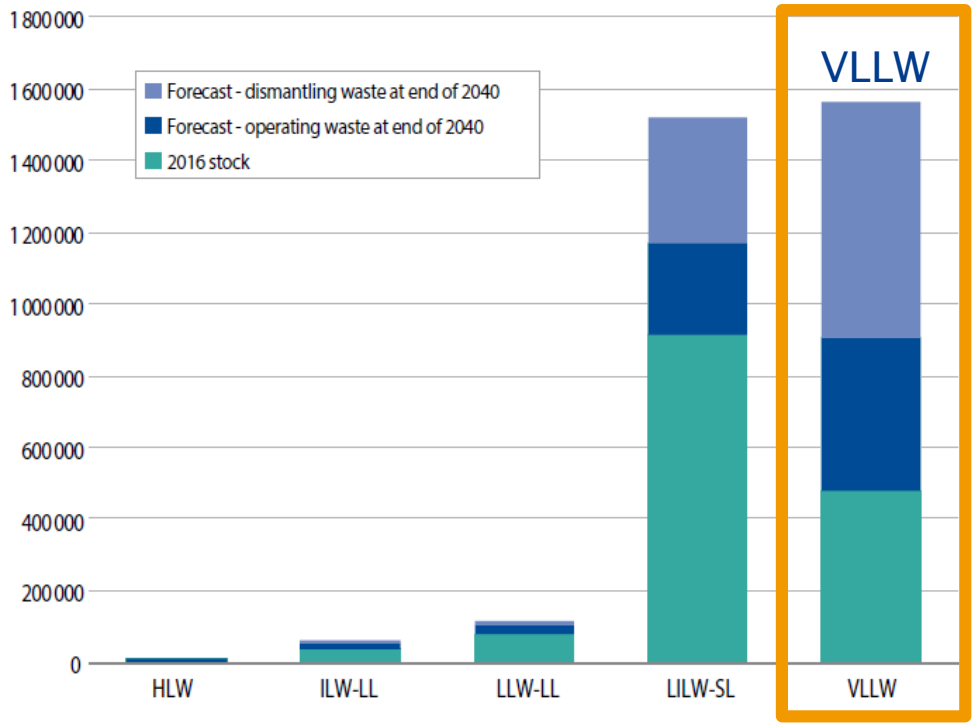


Very Low-Level waste
VLLW

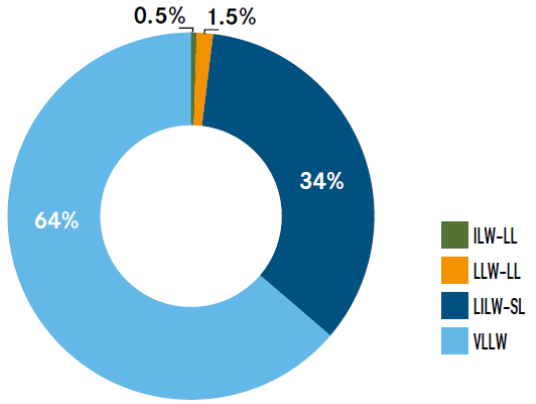
A significant part of decommisioning waste

Inventory of the decommissioning wastes to be disposed of in 2040

PROJECTED QUANTITIES OF WASTE AT THE END OF 2040 FOR SCENARIO SR1



PRODUCTION OF DISMANTLING WASTE FROM 2017 TO END OF 2040



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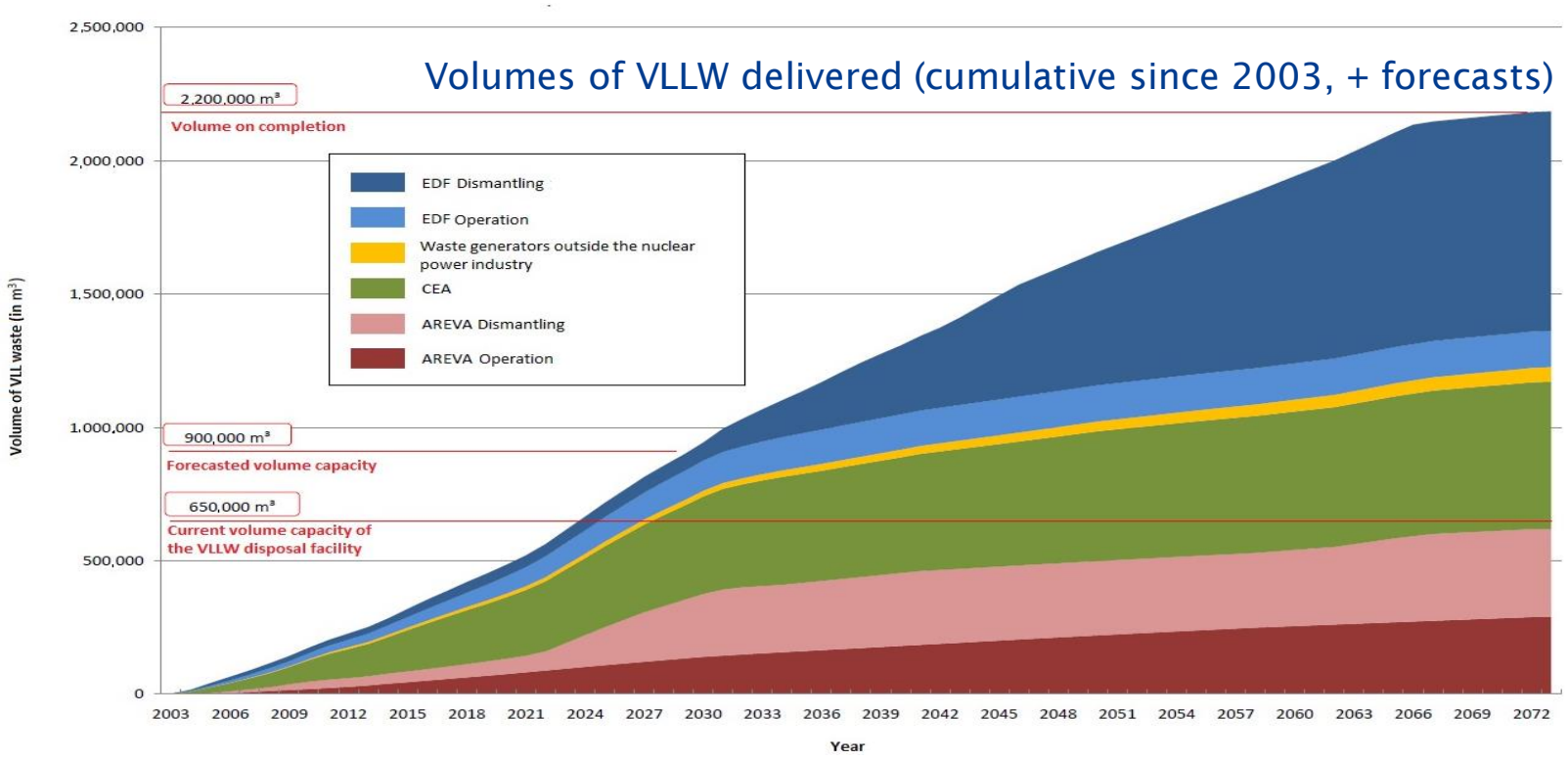
A saturation of regulatory capacity by 2025 … which could be postponed to 2030

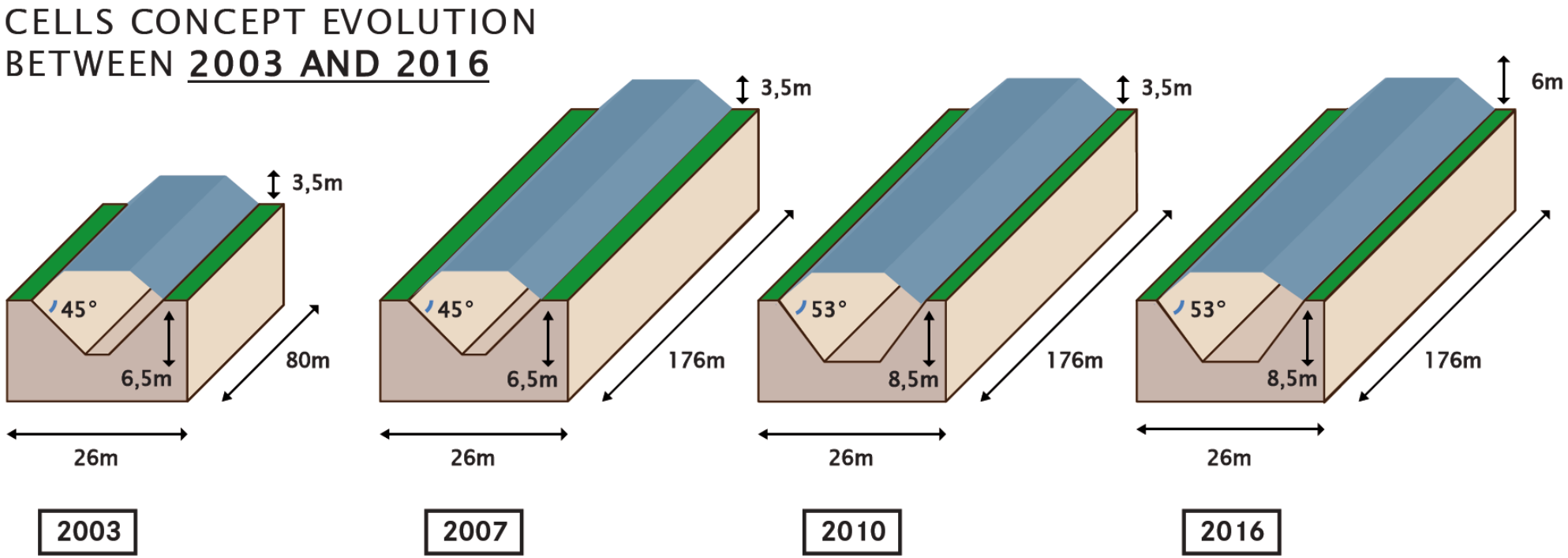


… provided an extension of the currently authorized capacity to ≈ 900 000 m³, within the current available area

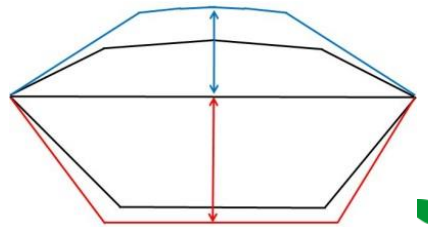
The CIRES VLLW facility

- Commissioned August 14th 2003
- Area : Total: 43 ha; disposal area: 28,5 ha
- Licensed disposal capacity : 650,000 m3
- >50% of the regulatory disposal capacity used
- Operating life: initially estimated at approximately 30 years
- Processing units: compaction units, solidification unit, package verification facility

Changes to disposal cell design



The technical capacity of the facility could be higher by about 40% than its presently licensed capacity



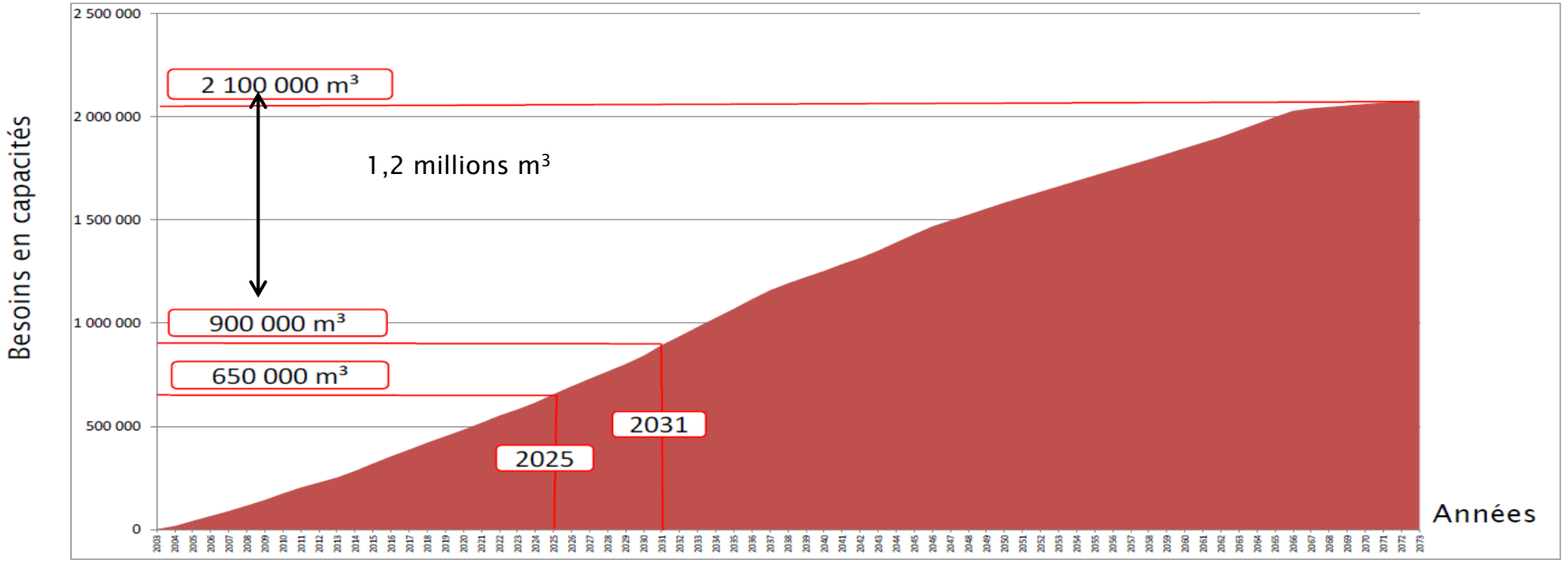
The initial use of the disposal area

V


+ ~ 250,000 m³
Disposal area
Presently
650,000 m³
Clay storage area

Scenario in the continuation of the current scheme

- A new VLLW disposal facility to be commissioned around 2030
- A capacity of about 1 million m³
- Flow averaging 35,000 m³/an



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Optimization of the volumes: The technical options studied

Option		Potential for annual flows reductions to CIRES
VALORISATION	Scrap metal	10 000 m^3/y (on average)
	Rubble	1 800 m^3/y
VOLUME REDUCTIONS	Metals (fusion for densification)	12 000 m^3/y (on average)
	Incinération	2000 m^3/y
	Compaction	< 2000 m^3/y
REORIENTATION ALTERNATIVE DISPOSAL (simplified)	For VVLW	Up to 10000 m^3/y

Non-cumulative scenarios

Options to be assessed as to their technical, economic, environmental efficiency and to the social acceptability

Main conclusions

A technical capacity of 900 000 m3 for CIRES

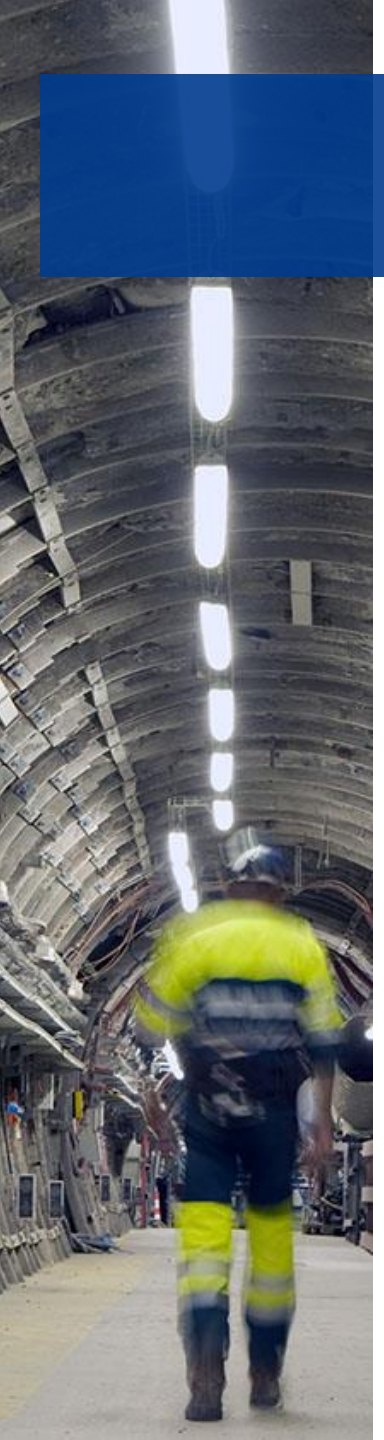
- With a technical capacity of 900 000 m3, the CIRES can ensure the continuity of the acceptance of VLL wastes by requesting an extension of the regulatory capacity within the site area.
- Needs for additional disposal capacity by 2030 will range between 600,000 and 1,200,000 m3 according to the different scenarios studied

Main issues

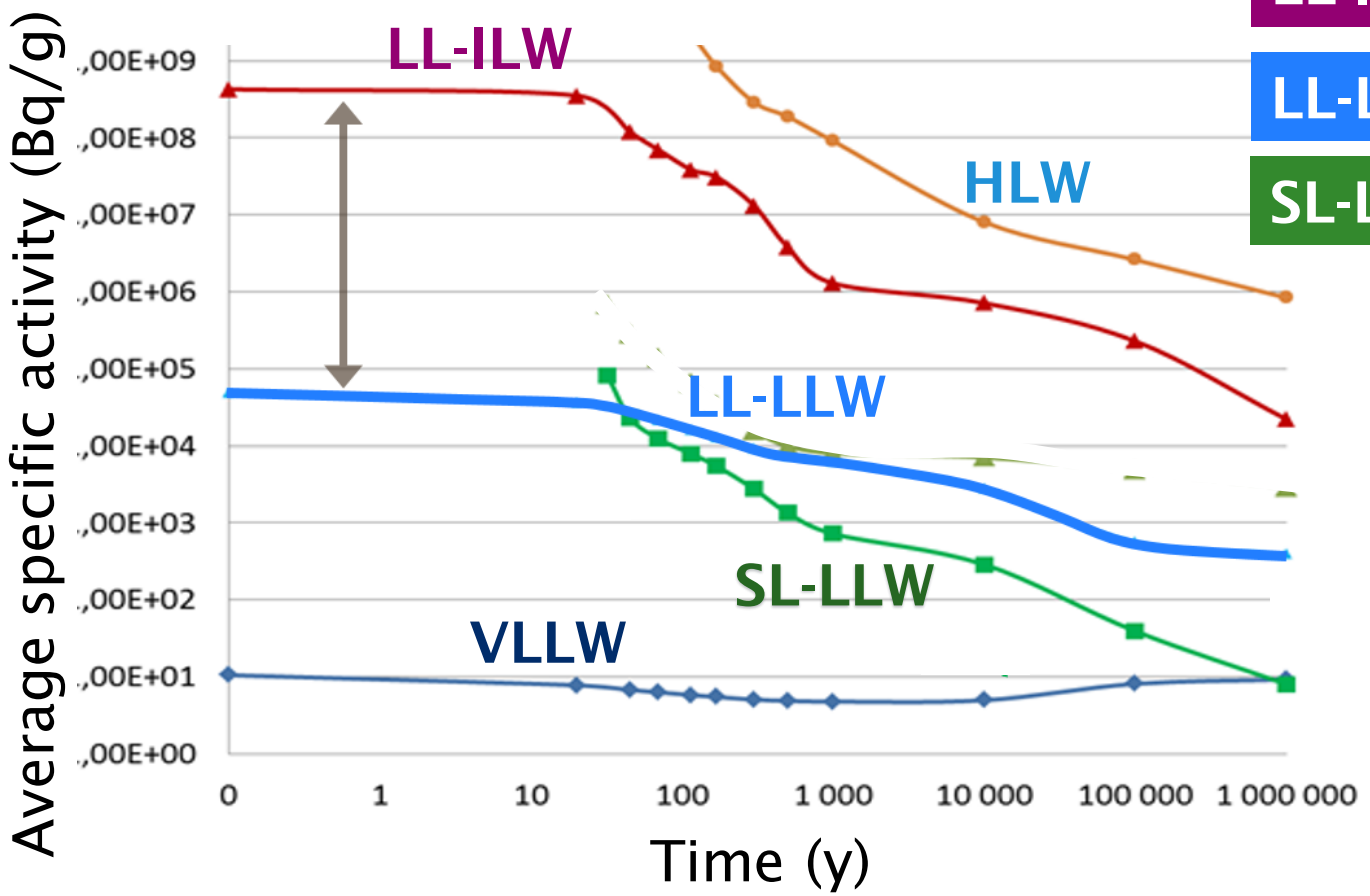
- Successfully recycle metallic waste, which can be dismantled without contamination above natural level, after melting
- Quantify wastes with extremely low activity level,fo r which disposal at CIRES constitutes an "oversized" solution

➔ A dialogue on the relevance of options with waste producers

Low level Long-Lived Waste



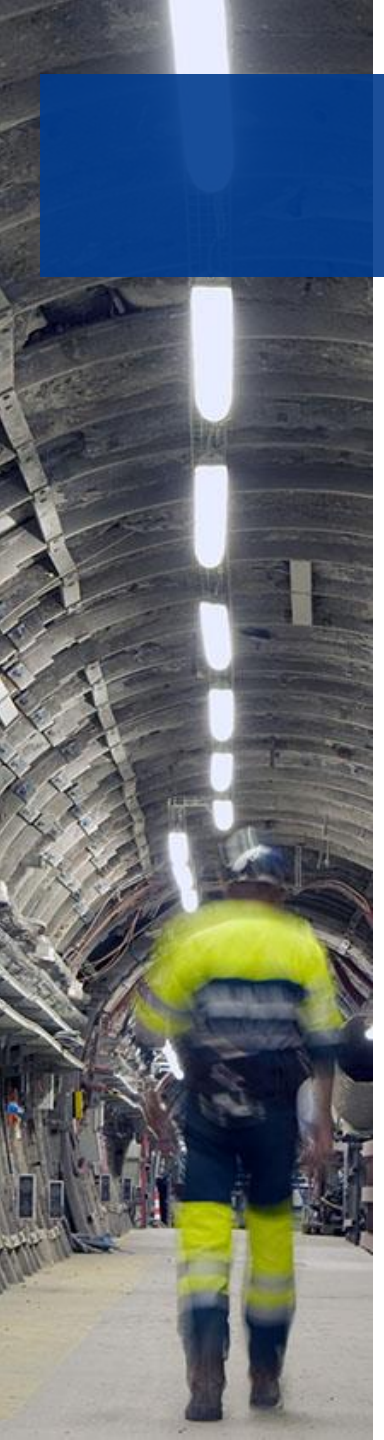
Waste activities evolution



LL-ILW (Cigéo) : ~ 75 000 m³

LL-LLW > 250 000 m³

SL-LLW (CSA) : 1 000 000 m³



Towards a graded approach in waste management

The French RW inventory identifies a range of waste with hazards in between the waste that can be accommodated in existing surface disposal facilities and those intended for Cigéo:

Short lived LLW – disposed of on the surface (CSA)

Limited inventory in long lived RN:

- ^{41}Ca : 0,12 TBq
- ^{14}C : 815 TBq

« Low level long-lived wastes »

Moderate content in long lived RN:

- ^{36}Cl : 2,2 TBq
- ^{41}Ca : 2 TBq
- ^{14}C : 927 TBq

Moderate specific activity (Bq/g):

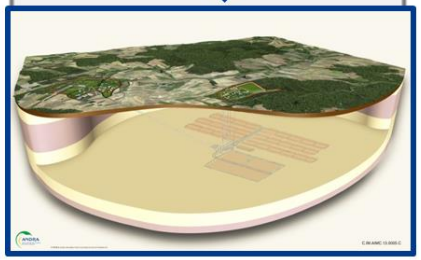
- ^{36}Cl (Graphite) : de 29 à 260
- ^{99}Tc (Bitumes) : 800
- ^{129}I : 4
- ^{79}Se (Bitumes): 1,67

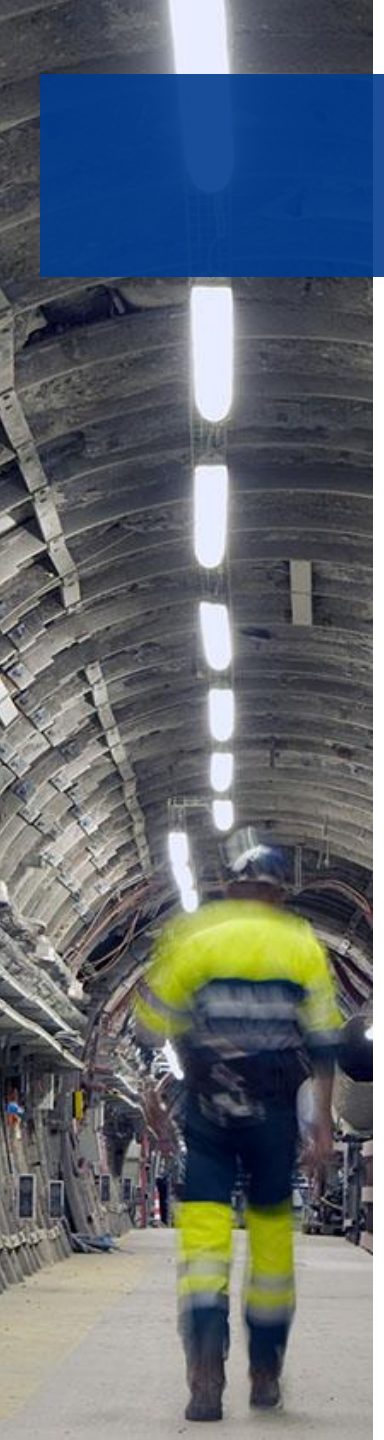
?

ILW to be disposed of in Cigéo

Specific activity (cladding and endpieces) (Bq/g):

- ^{36}Cl : 530
- ^{99}Tc : 6 330
- ^{129}I : 7,5
- ^{79}Se : 77



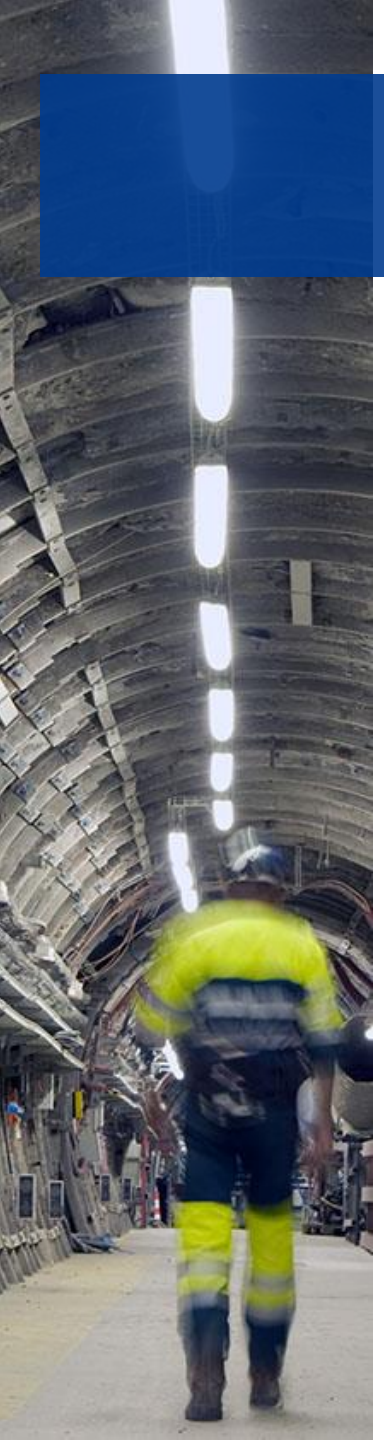


Towards a graded approach in LLW-LL management

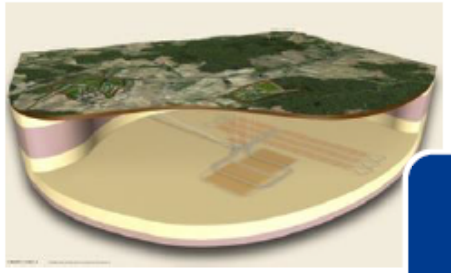
- The French Act (2006) provides for a **shallow depth** disposal concept for *low level and long-lived waste*;
- There is no threshold to define a shallow depth in France.
  - The Safety Guide issued by the French regulator (ASN) for **deep** geological disposal defines a 200 m depth threshold for such a facility with regard to isolation over very long periods.

IAEA definitions:

- **Near-surface** addresses depths up to a few tens of meters: 0-30m typically;
- The concept of “intermediate depth disposal” associated to ILW is no more considered as appropriate;
- The concept of “**geological disposal**” might be extended in the future to any underground disposal facility at a depth higher than “a few tens meters”.



Towards a graded approach in waste management

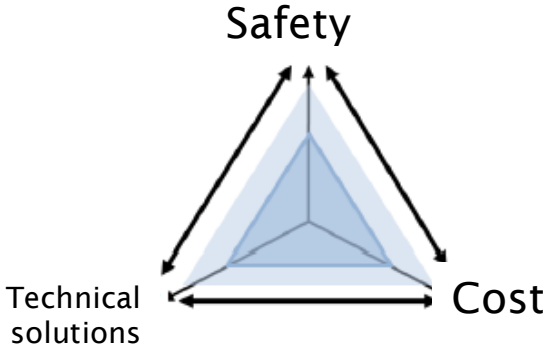


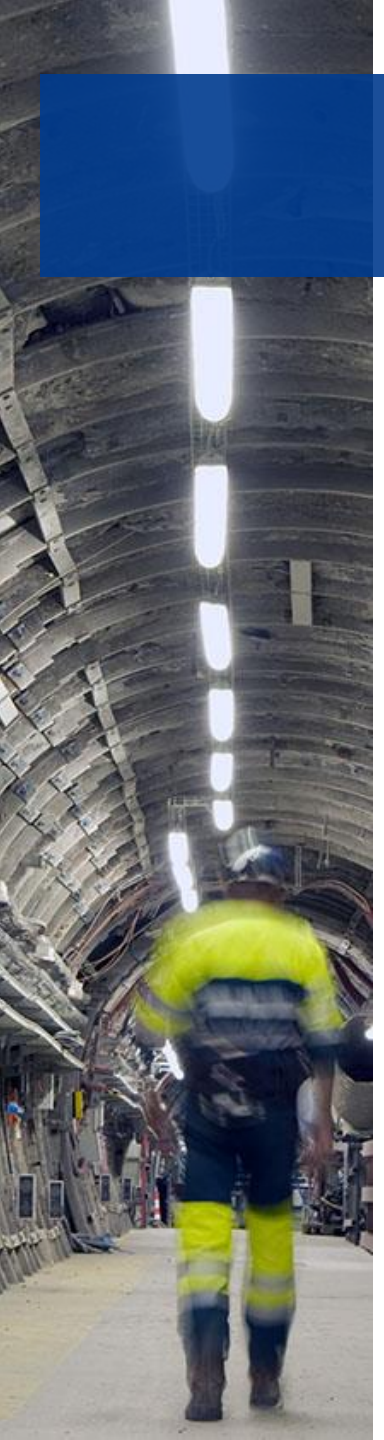
Moderate specific activity not requiring deep disposal

Content in long lived RN not compatible with CSA

Technical and economical optimization of waste disposal routes

Disposal at a shallower depth

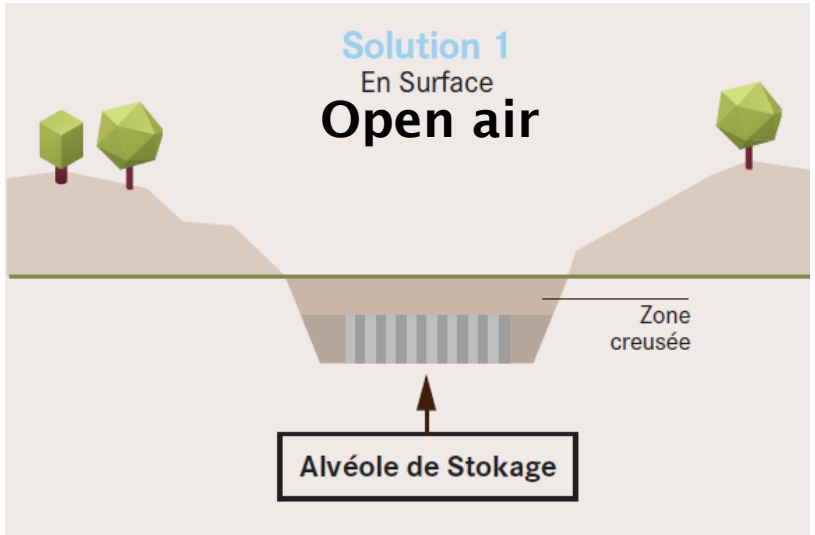


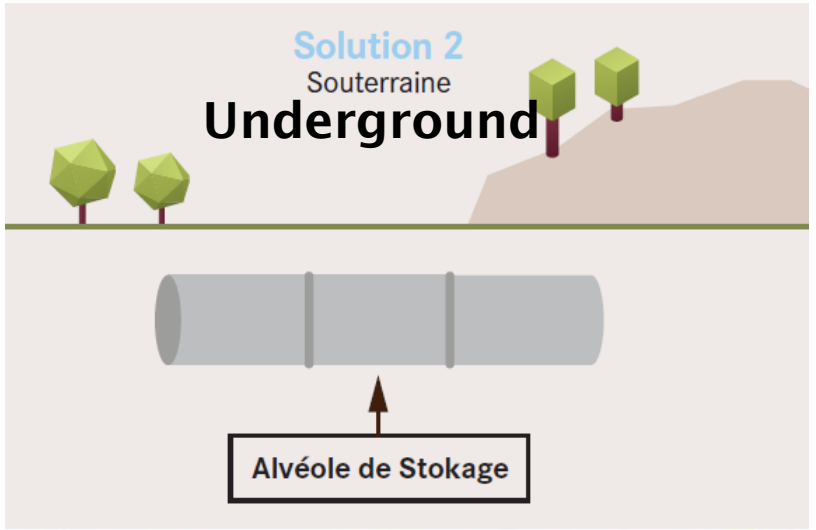


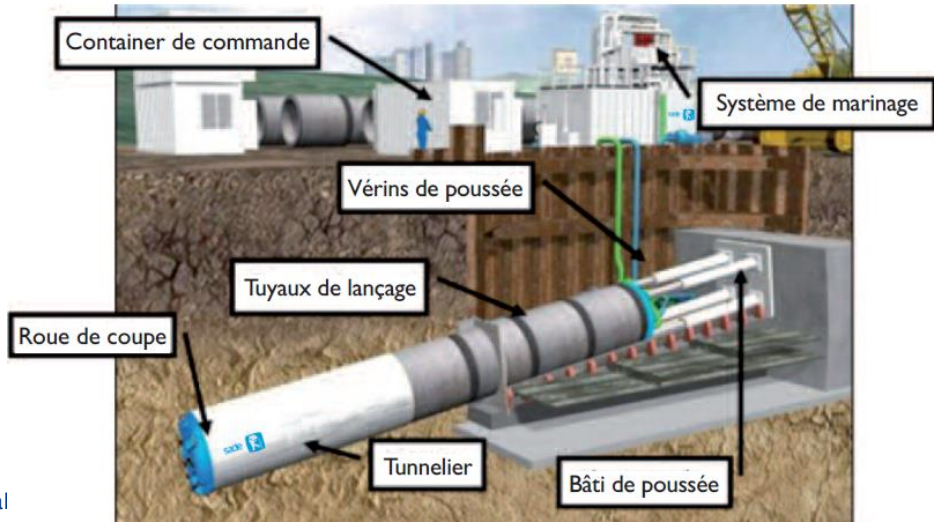
Safety factors for defining an appropriate shallow depth and relating waste acceptance criteria

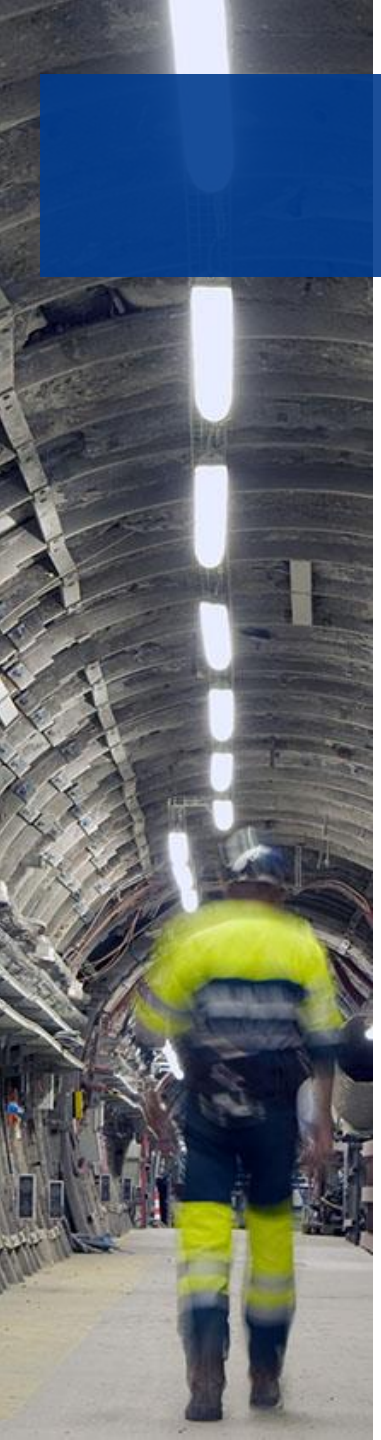
- **Time frame to be considered for long term safety functions**
  - Long term safety functions are available as long as the site specific geodynamic evolution does not significantly modify the configuration of the disposal system (via surface alteration processes, erosion, glaciation).
- **Isolation performance**
  - The isolation performance is directly connected to depth (IHI scenarios…)
  - Its suitability depends on the toxicity of RN and other substances in the waste and their concentration.
- **Containment performance**
  - The containment performance depends on:
    - site specific properties: permeability, hydraulic gradient, redox, retention, thickness of host formation, hydraulic conditions of outlets;
    - additional engineered barriers.
  - The needs for containment is a function of the types of radionuclides in the waste (their mobility in particular) and their amount.
- **Residual impact after loss of safety functions**
  - is a function of the decrease in the radiological content of the waste with time (half lives) and of concentrations.

2 construction methods at shallow depth

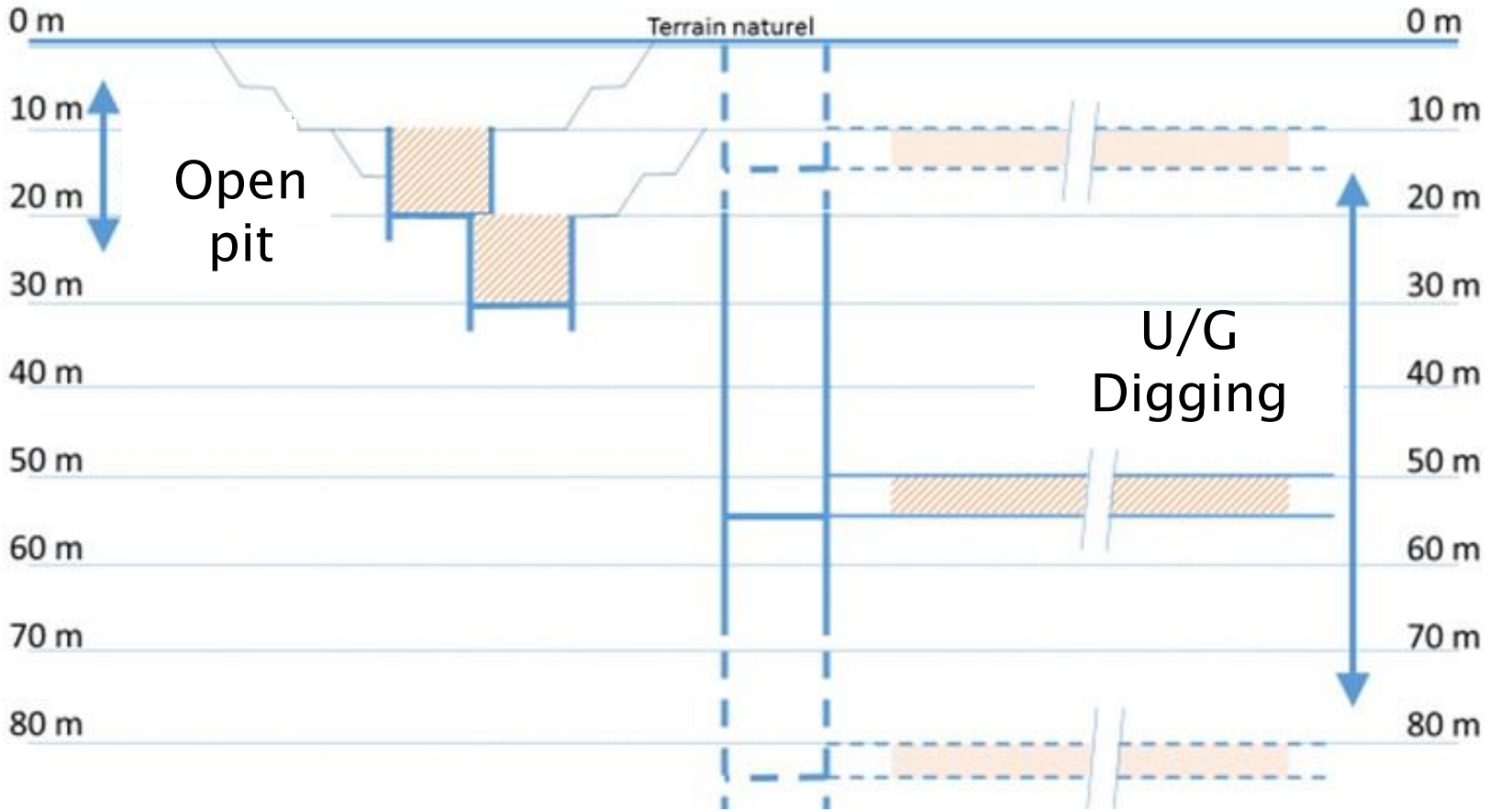




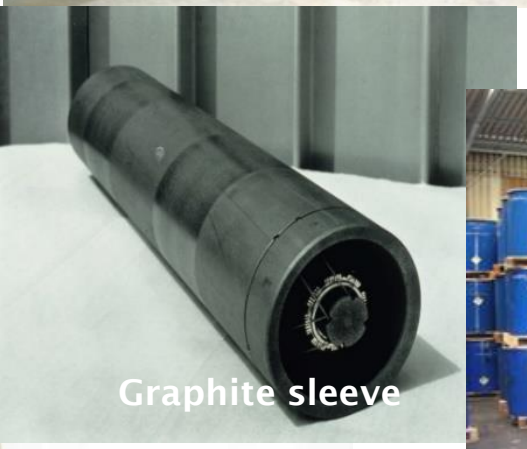


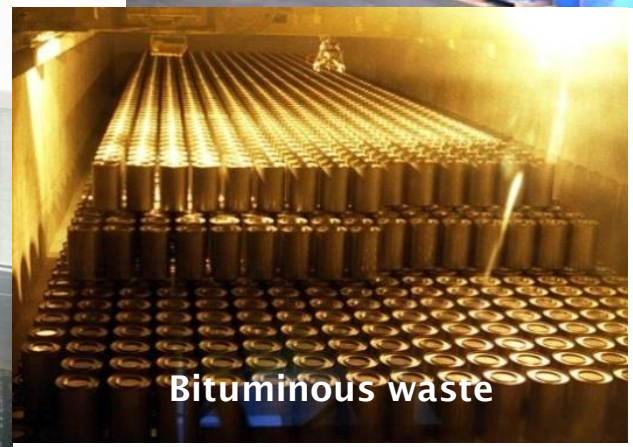


Range of shallow depths in clay



Defining long term management routes for LL-LLW is complex





- The French Regulator (ASN) considers that the Aube site will not be capable to accomodate all LL-LLW.
- The PNGMDR provides for new site screening in addition to the Aube site under survey.
  - ➢ A wider range of disposal concepts needs to be studied.
- Need to clarify the modalities of a graded safety approach in France:
  - What balance between isolation and containement?
  - What role for IHI scenarios?

…

➢ ASN safety guide is being updated

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Thank you!

nicolas.solente@andra.fr