

Radioactive waste management in The Netherlands I

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COVRA NV

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CONTENT

- **Policy in the Netherlands**
- **Management in practice**
- **Geological disposal**

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RADIOACTIVE WASTE MANAGEMENT

- **Isolate, Control, Monitor**
 - **radioactivity will decay**
- ➡ **hazard disappears**



keep the waste in a safe place

RADIOACTIVE WASTE MANAGEMENT

- **isolate in buildings**
- **shallow land burial**

100 - 300 years

- **control by society**

- **isolation by nature (geology)**

up to many millions of years

RADIOACTIVE WASTE



- **2 nuclear power plants**
 - 1 operating (500 MWE)**
 - 1 shut down (GKN 1997)**
- **2 research centers**
- **U-enrichment plant**
- **Mo-production**
- **industry**
- **medicine**
- **research**

1300 license holders

RADIOACTIVE WASTE



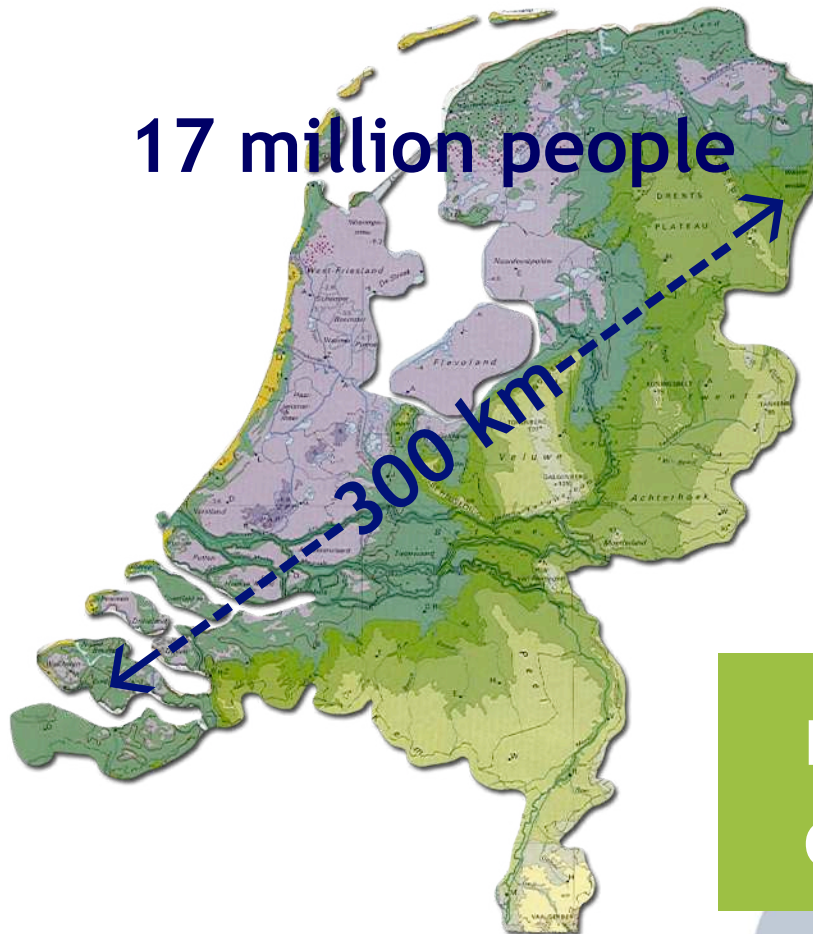
- **HLW: 90 m³**
- **LILW: 11.00 m³**
- **NORM: 17.000 m³**







SOLUTIONS FOR THE NETHERLANDS



- small amount of waste
- high ground water table
- high population density
- high environmental awareness
- advanced spatial planning

no shallow disposal,
only deep disposal

RADIOACTIVE WASTE POLICY

- **all waste managed and owned by COVRA**
- **all waste at one industrial site**
- **at least 100 years storage, in buildings**
- **disposal after 100 years either in national or international context (dual track)**
- **research**

stable policy since 1984

COVRA_{NV}

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COVRA SITE





RADIOACTIVE WASTE



Source low and intermediate level radioactive waste (LILW)

- NPPs
- Hospitals & laboratoria
- Oreprocessing & process industry

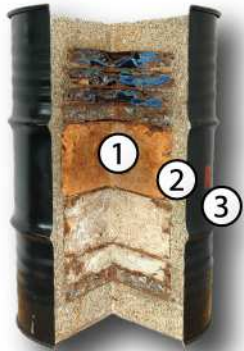
SUPERCOMPACTION



INCINERATION



STORAGE CONTAINERS LILW



- 1. Supercompacted puck**
- 2. Concrete**
- 3. Galgalvanised drum**
- 4. Concrete overpack**



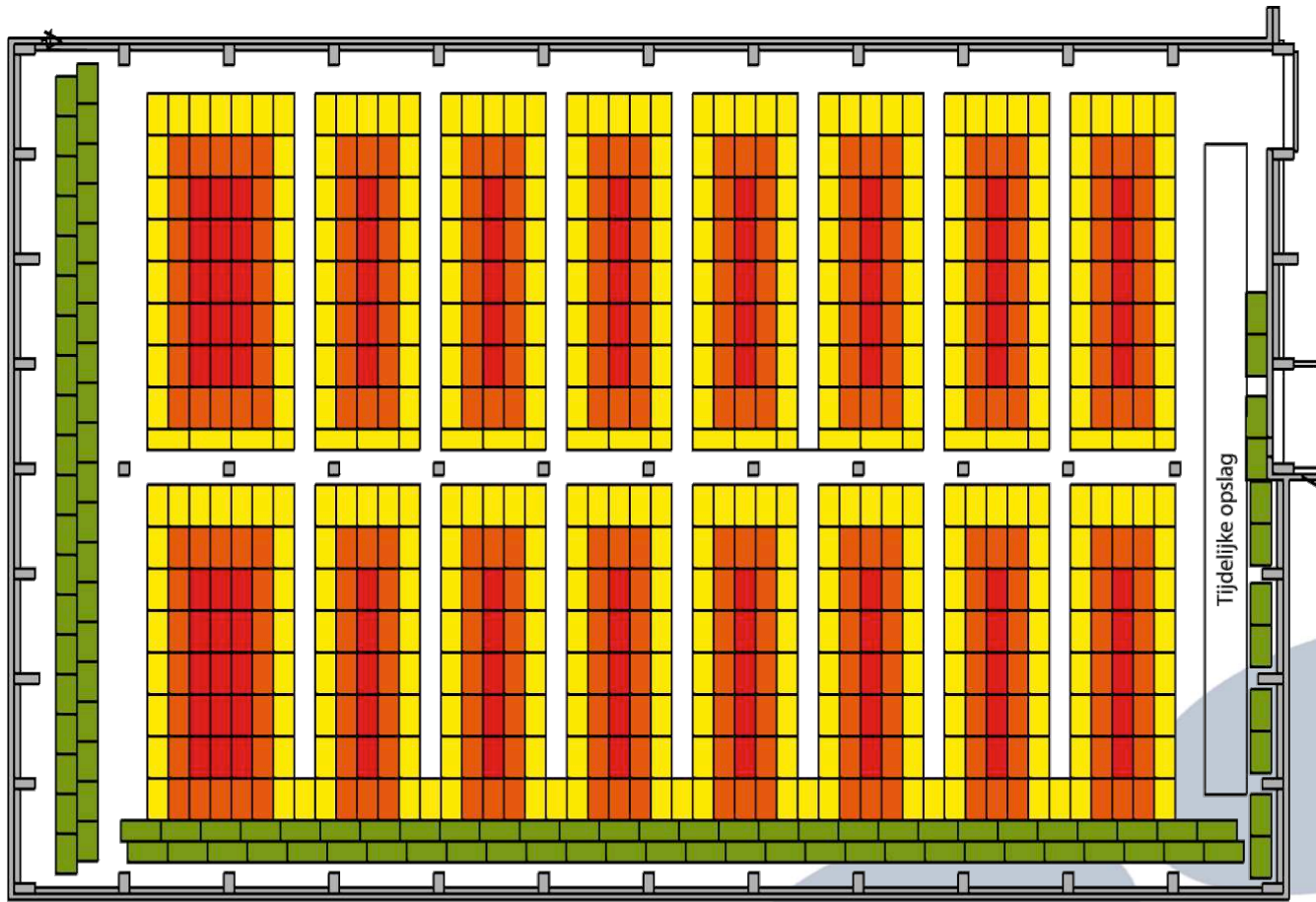




STORAGE LILW

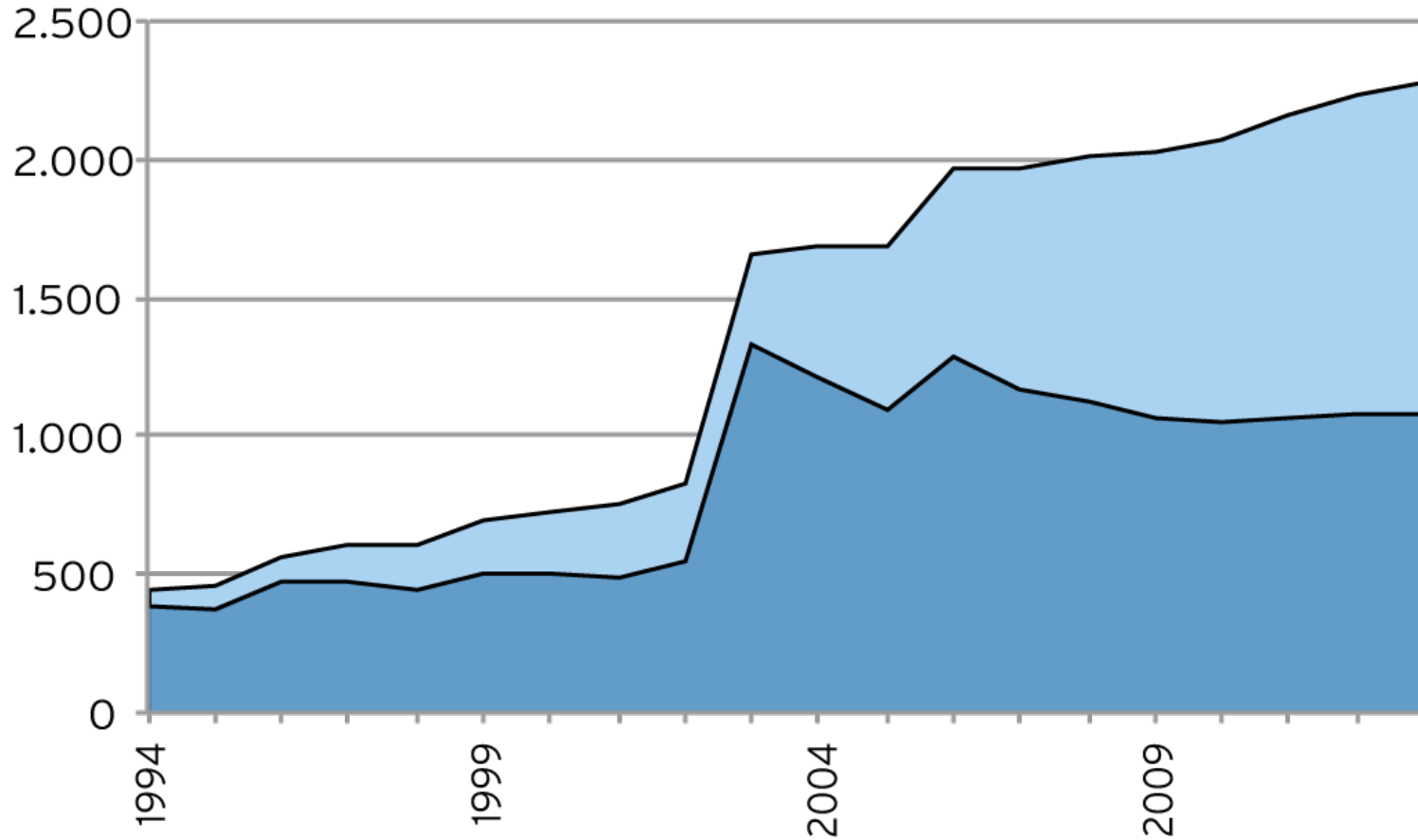


STACKING LILW CONTAINERS



 < 10.000 $\mu\text{Sv}/\text{uur}$  < 200 $\mu\text{Sv}/\text{uur}$  < 100 $\mu\text{Sv}/\text{uur}$  < 1 $\mu\text{Sv}/\text{uur}$

RADIOACTIVE DECAY



Activity LILW
without decay (TBq)



Activity LILW
with decay (TBq)



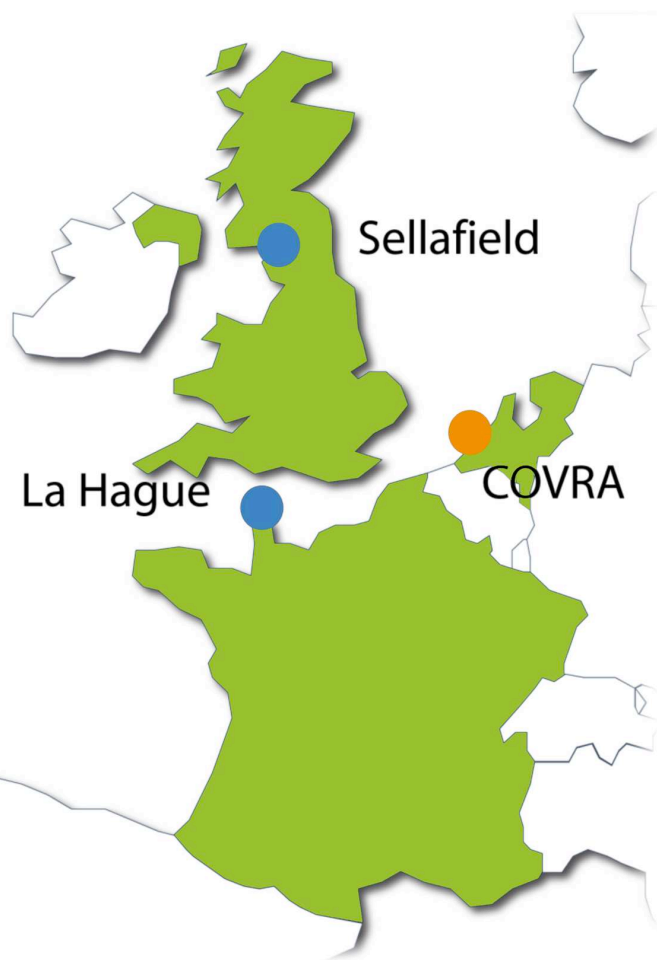
RADIOACTIVE WASTE



Source High Level radioactive Waste (HLW)

- NPPs
- Research reactors

RADIOACTIVE WASTE



Recycling HLW

- France
- GB

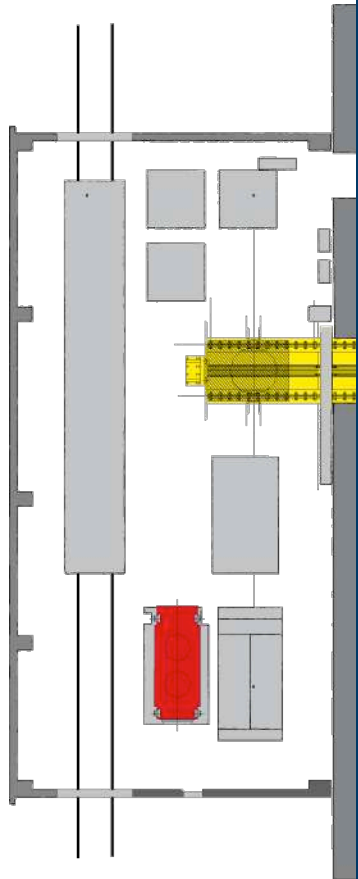
HABOG DESIGN CRITERIA

All events $> 10^{-6} / a$

- Earthquake
- Plane crash (F-16)
- Flooding + 10 m NAP
- Gas cloud explosions
- Whirlwind up to 125 m/s

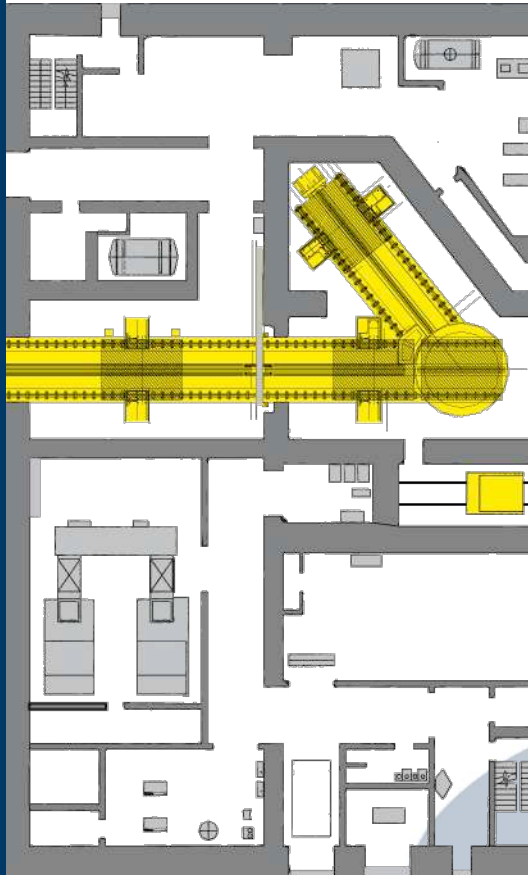
HABOG LAYOUT

Reception



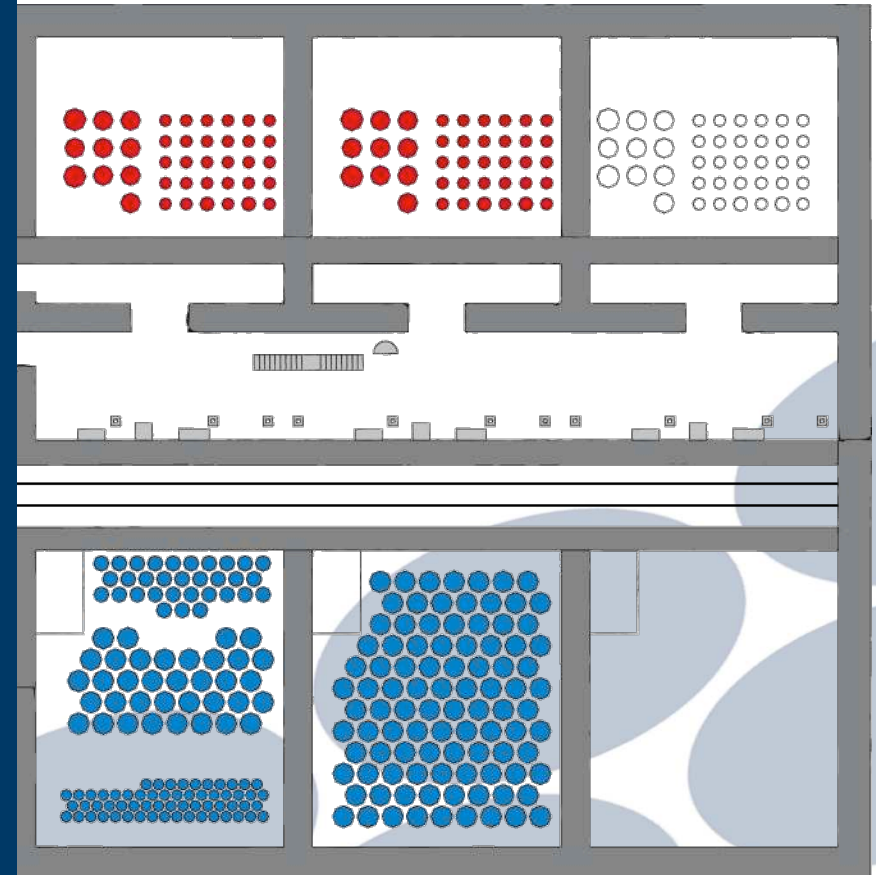
HABOG LAYOUT

Treatment

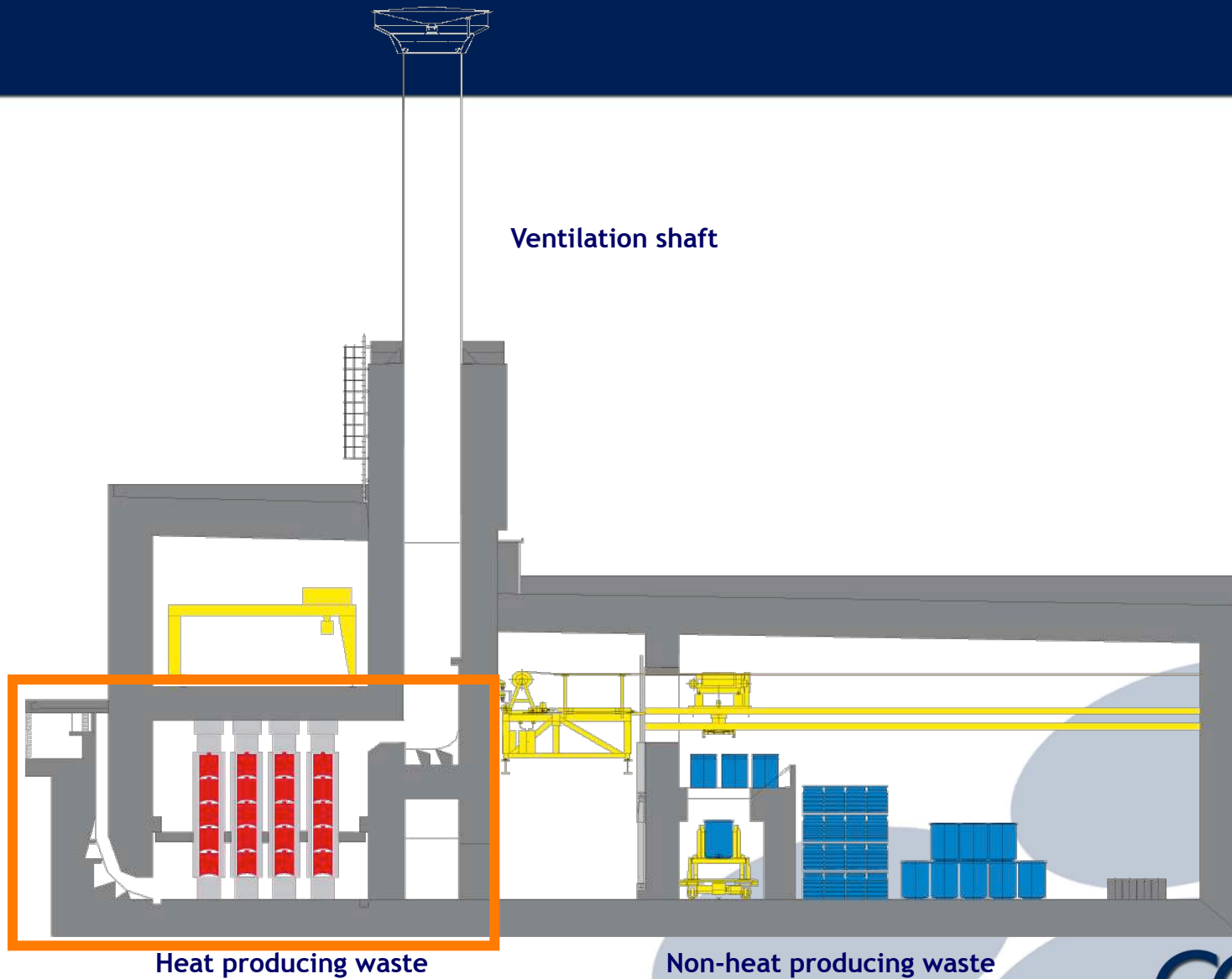


HABOG LAYOUT

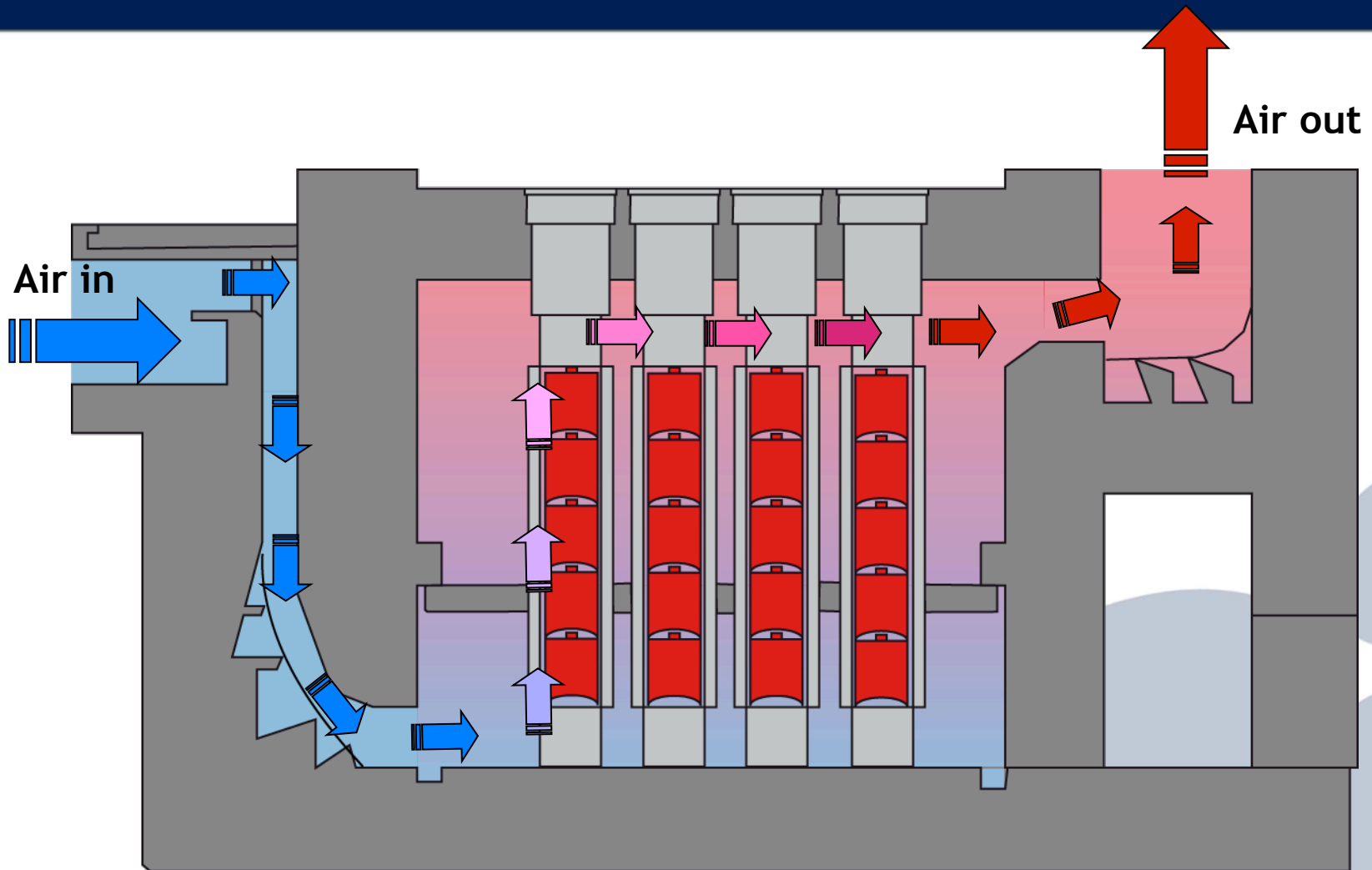
Storage



HABOG CROSS-SECTION



HABOG PASSIVE COOLING SYSTEM



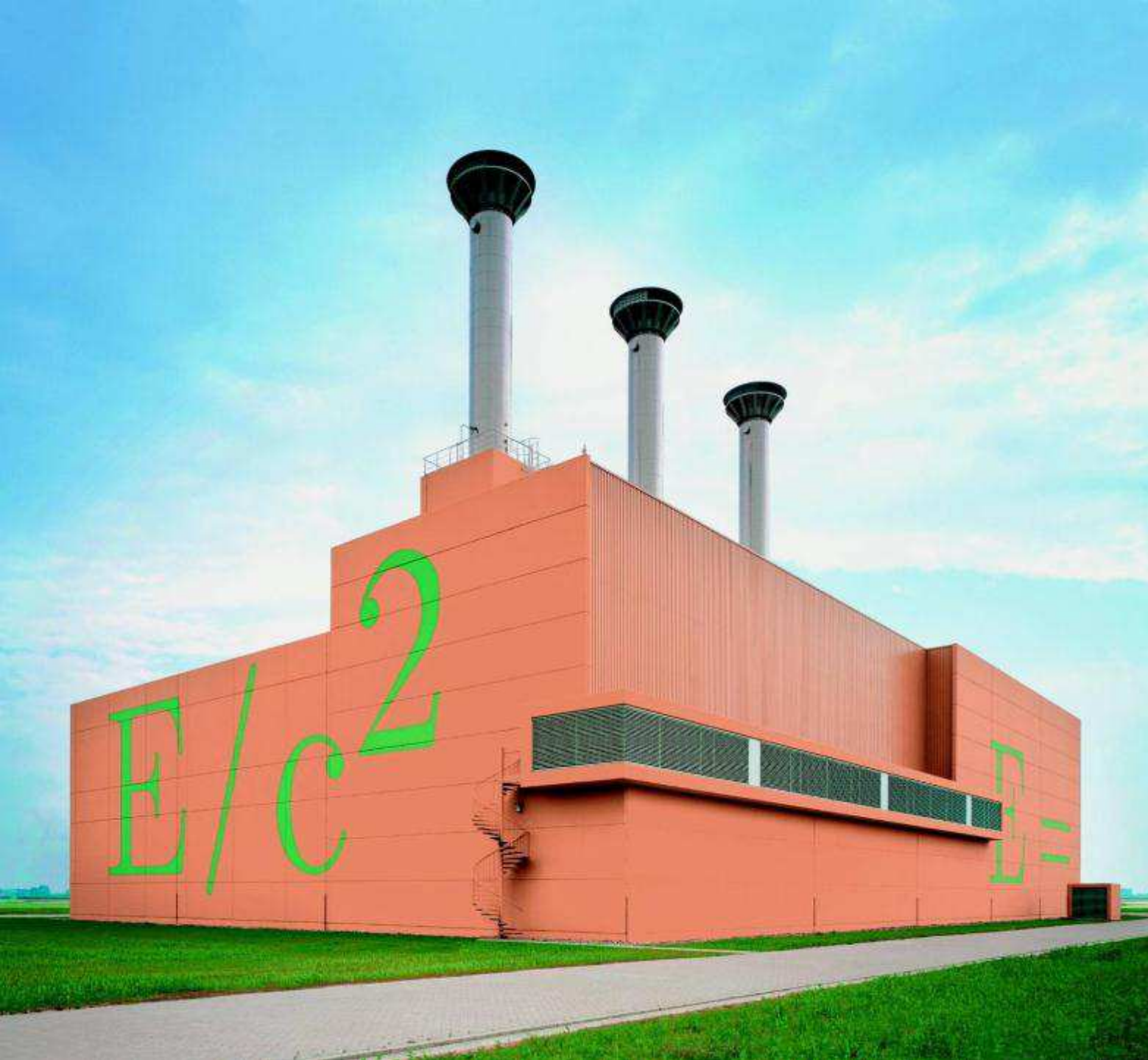
SAFE = BEAUTIFUL



2003



2023



2043



2063



2083





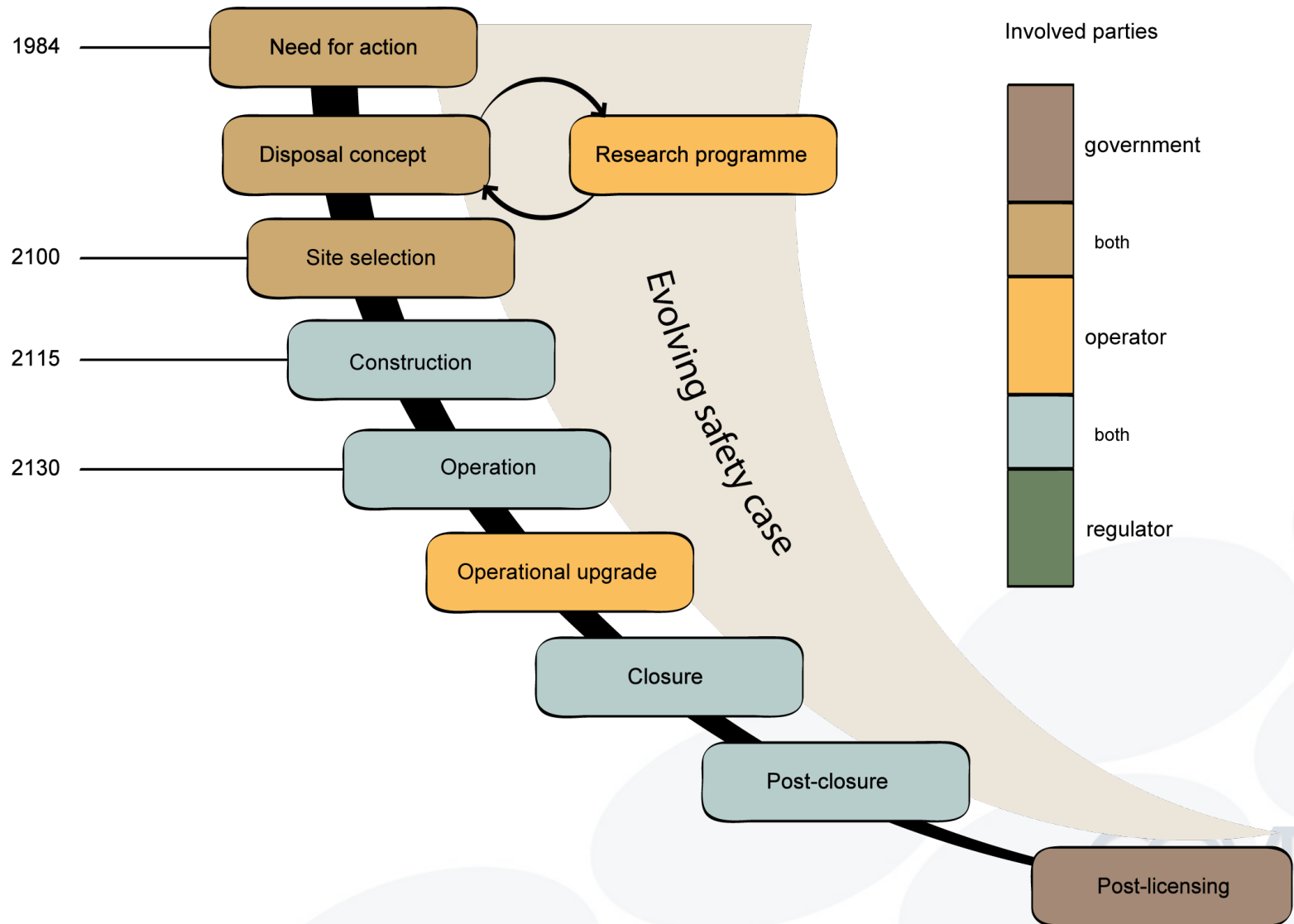
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RADIOACTIVE WASTE POLICY

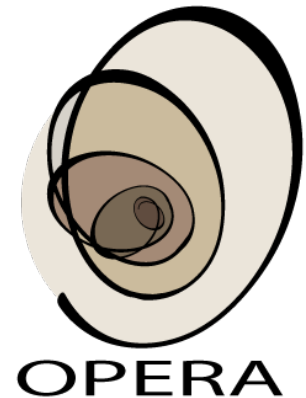
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COVRA TIME SCHEME

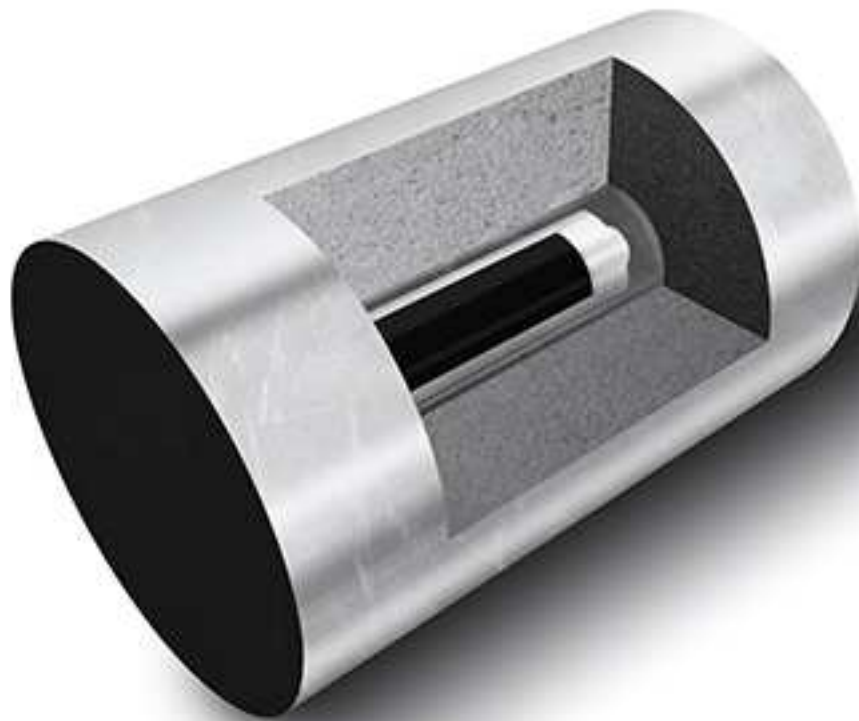


OPERA

- Goals & ambitions:
Roadmap Research
 1. Evaluation previous studies
 2. Initial, conditional Safety Case
 3. Societal aspects
 4. Re-activate competences
- Focus:
Boom clay (and rocksalt)



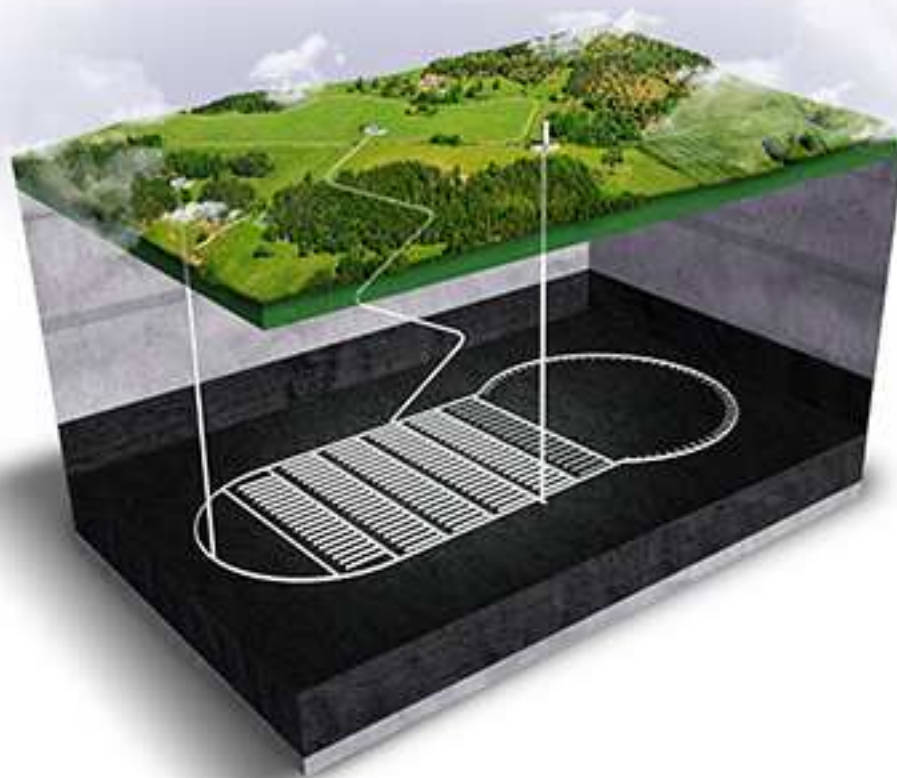
DISPOSAL CONCEPT



DISPOSAL CONCEPT



DISPOSAL CONCEPT



OPERA STATUS

- Two calls for proposals (in 2011 and 2012)
- 21 projects
- 20 organisations

Roadmap & Safety Case 2016