

# 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 m<sup>3</sup>**
- **LILW: 11.00 m<sup>3</sup>**
- **NORM: 17.000 m<sup>3</sup>**

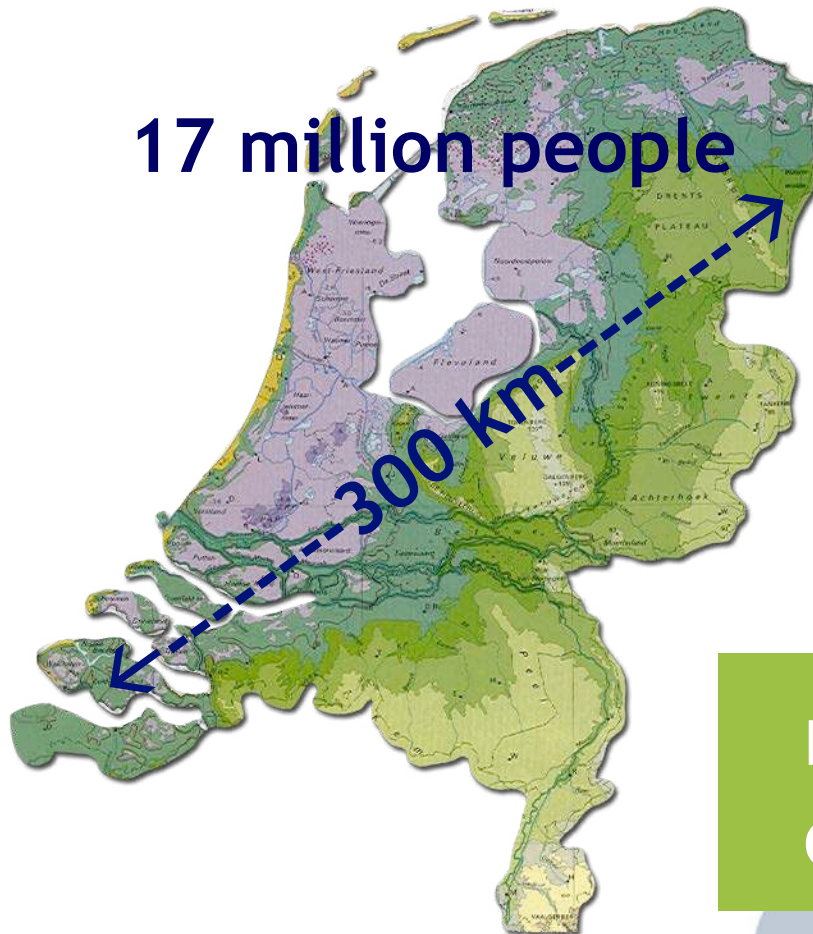








# SOLUTIONS FOR THE NETHERLANDS



- 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<sub>NV</sub>**

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# COVRA SITE





# RADIOACTIVE WASTE



## Source low and intermediate level radioactive waste (LILW)

- NPPs
- Hospitals & laboratoria
- Oreprocessing & process industry



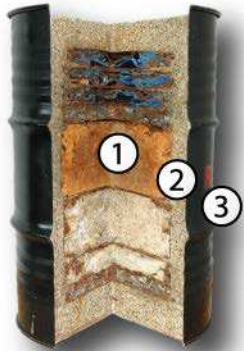
# SUPERCOMPACTION



# INCINERATION



# STORAGE CONTAINERS LILW



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



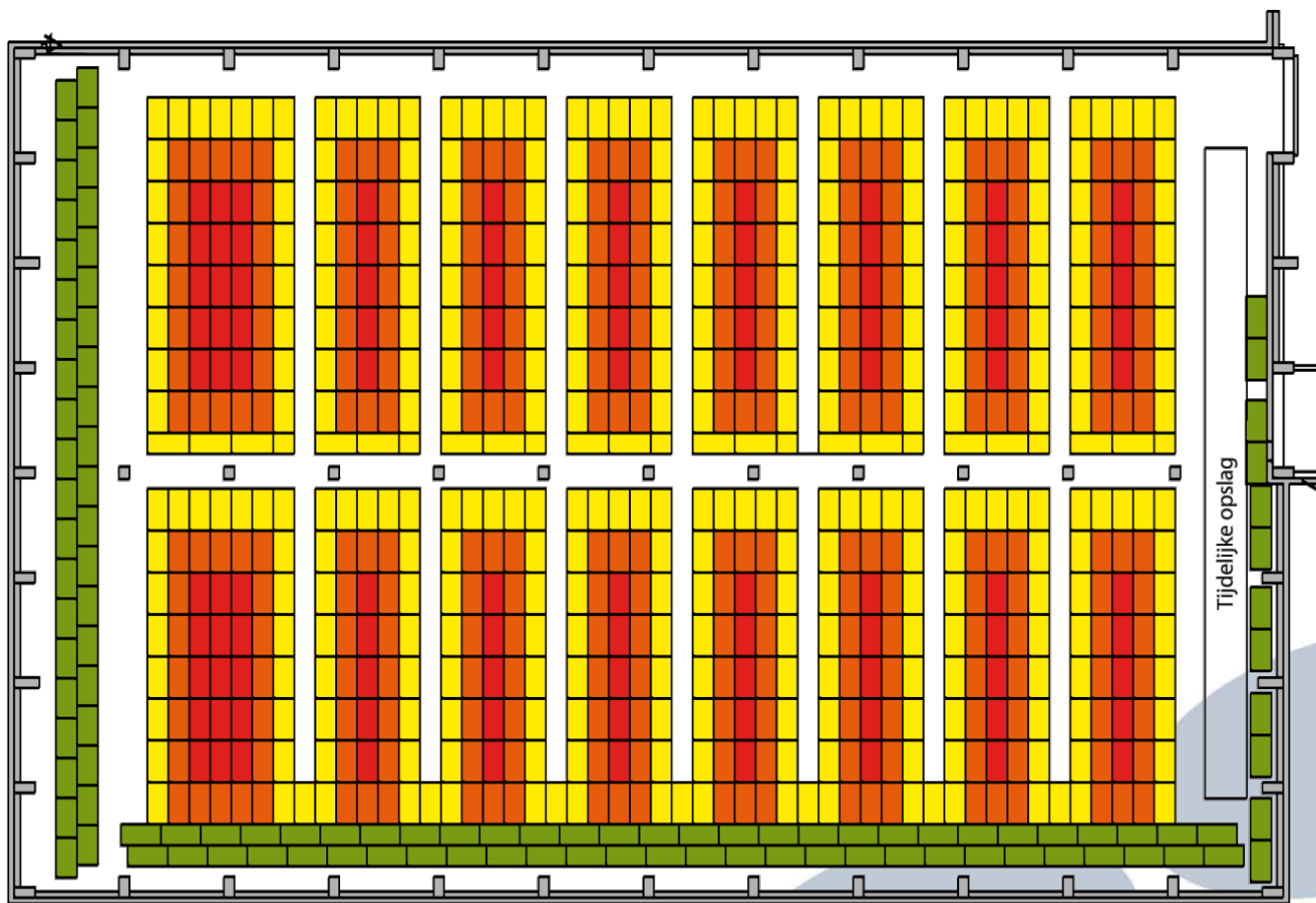




# STORAGE LILW

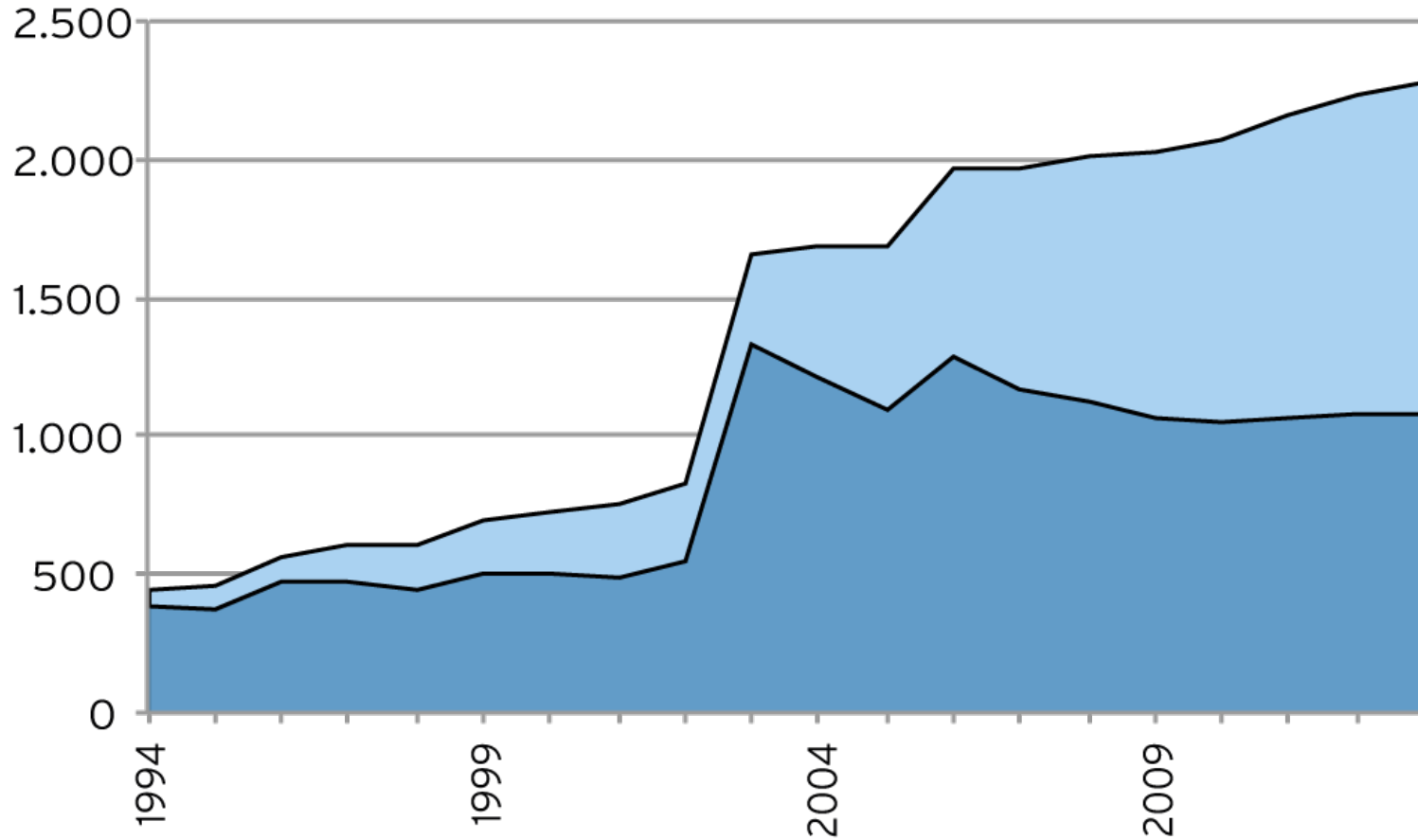


# STACKING LILW CONTAINERS



**Red** < 10.000  $\mu\text{Sv}/\text{uur}$    **Orange** < 200  $\mu\text{Sv}/\text{uur}$    **Yellow** < 100  $\mu\text{Sv}/\text{uur}$    **Green** < 1  $\mu\text{Sv}/\text{uur}$

# RADIOACTIVE DECAY



Activity LILW  
without decay (TBq)



Activity LILW  
with decay (TBq)





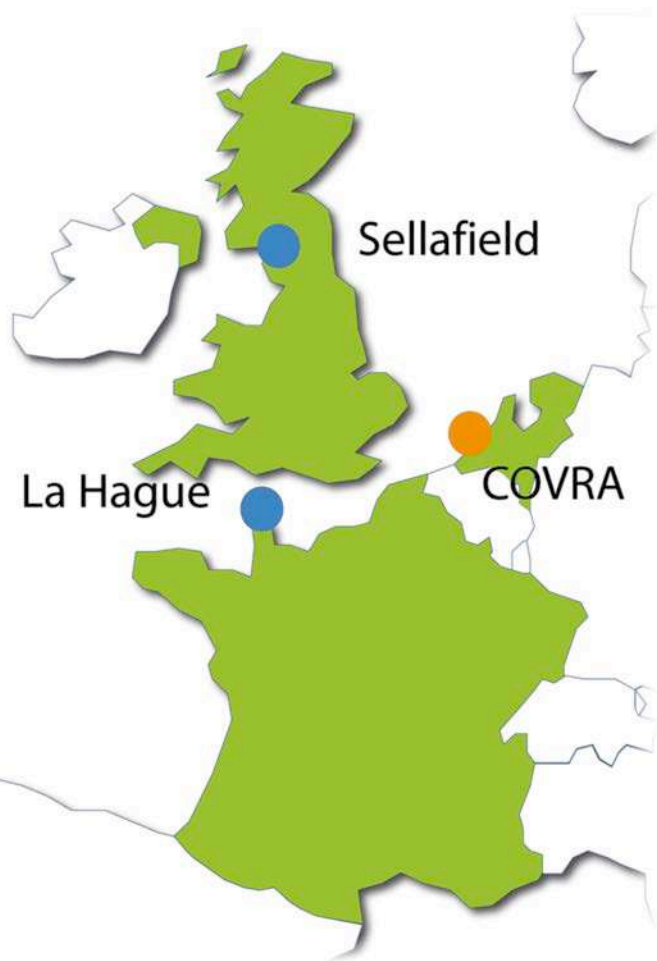
# RADIOACTIVE WASTE



## Source High Level radioactive Waste (HLW)

- NPPs
- Research reactors

# RADIOACTIVE WASTE



## Recycling HLW

- France
- GB

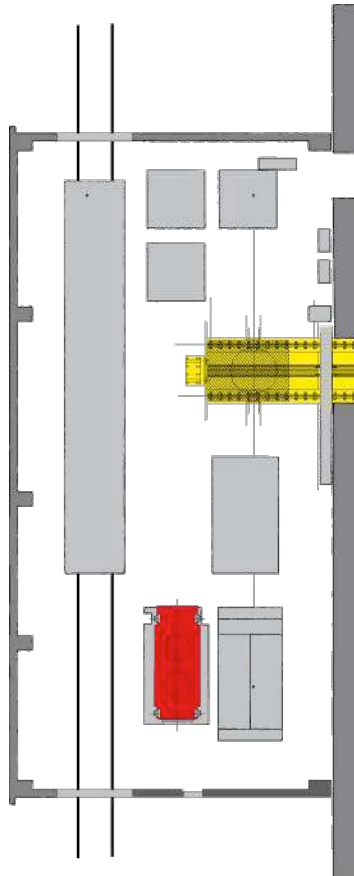
# HABOG DESIGN CRITERIA

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

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

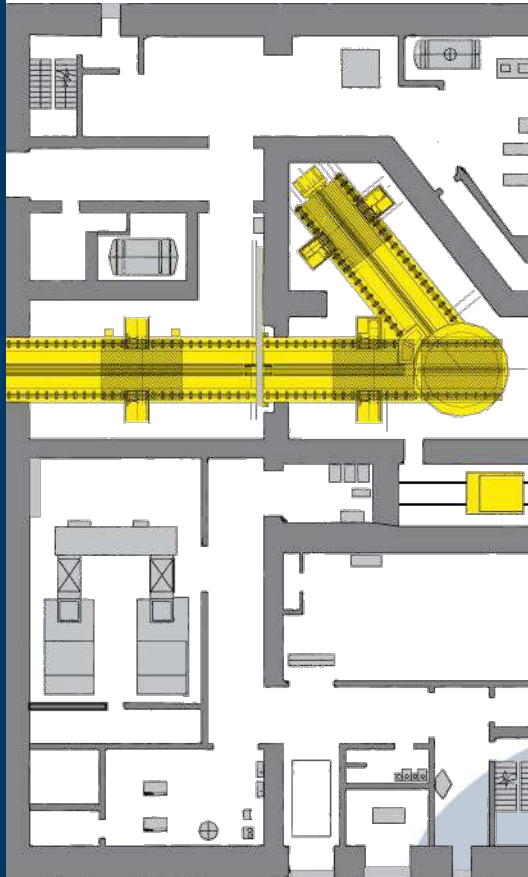
# HABOG LAYOUT

Reception



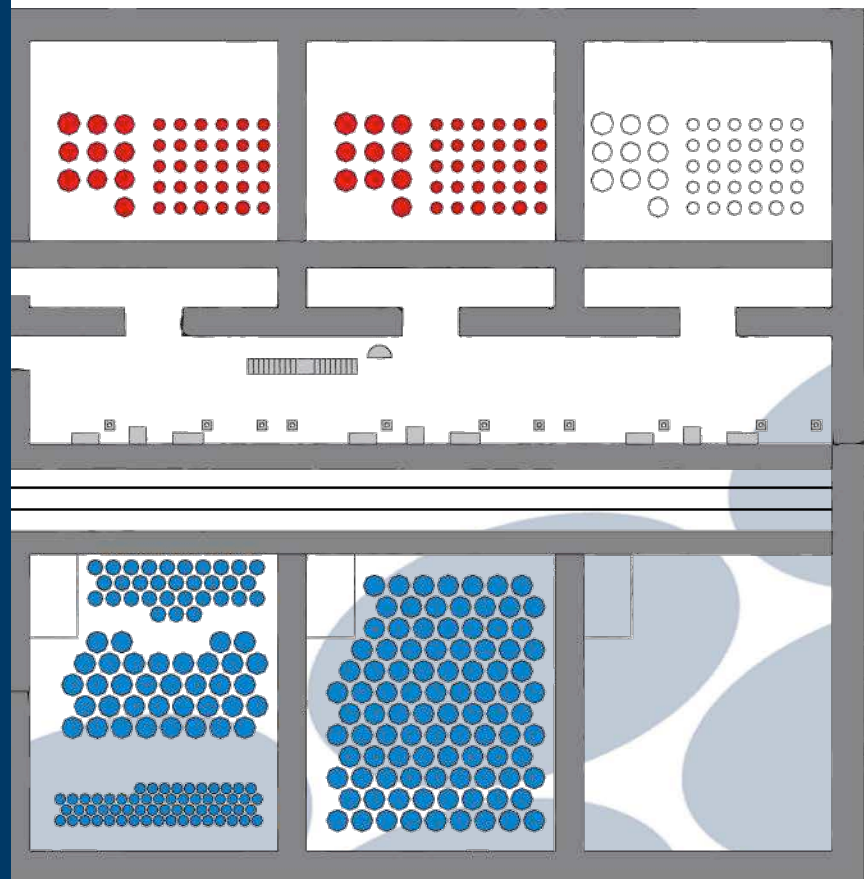
# HABOG LAYOUT

Treatment

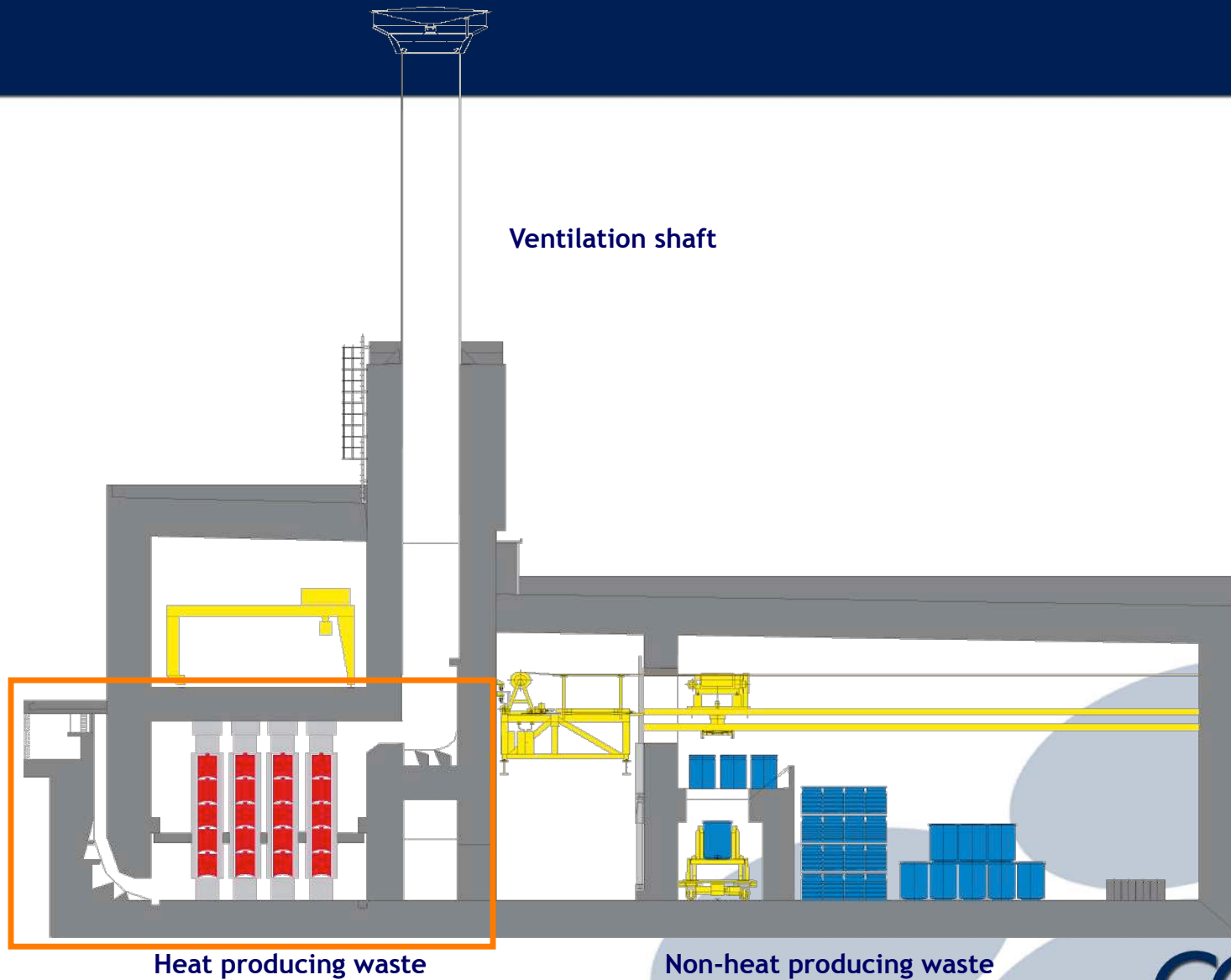


# HABOG LAYOUT

Storage

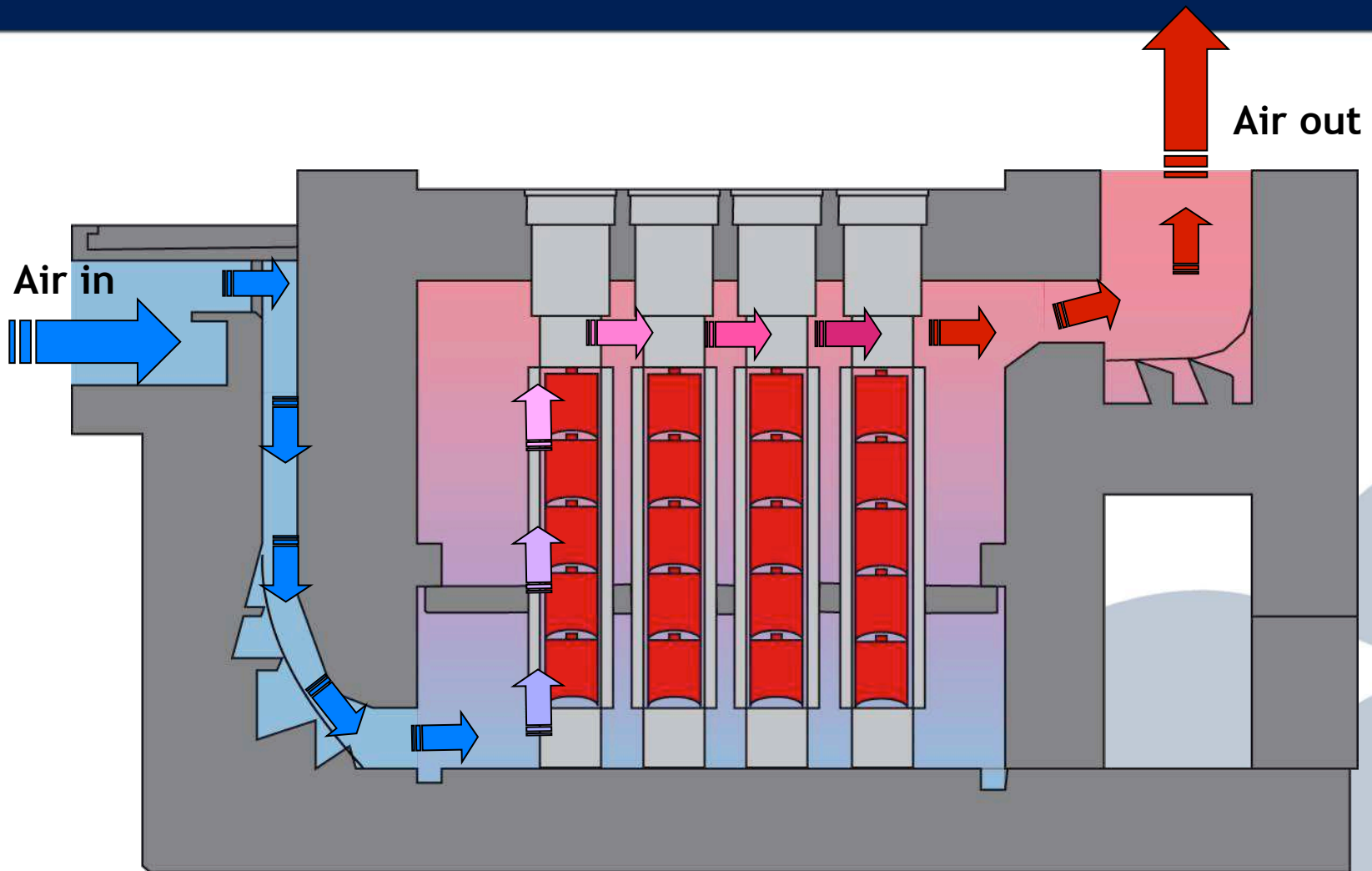


# HABOG CROSS-SECTION





# HABOG PASSIVE COOLING SYSTEM



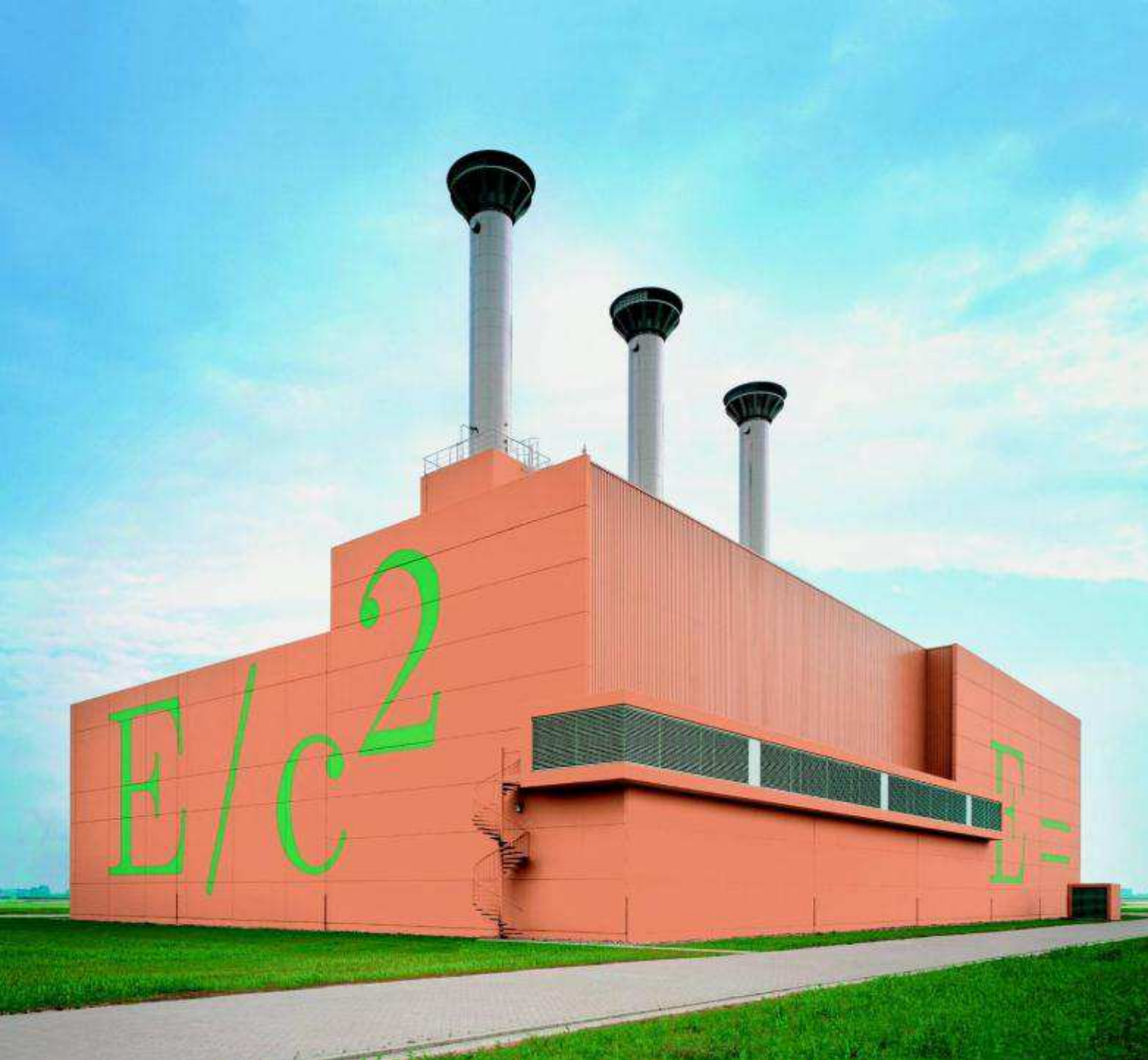
SAFE = BEAUTIFUL



2003



2023



2043



2063



2083



2103





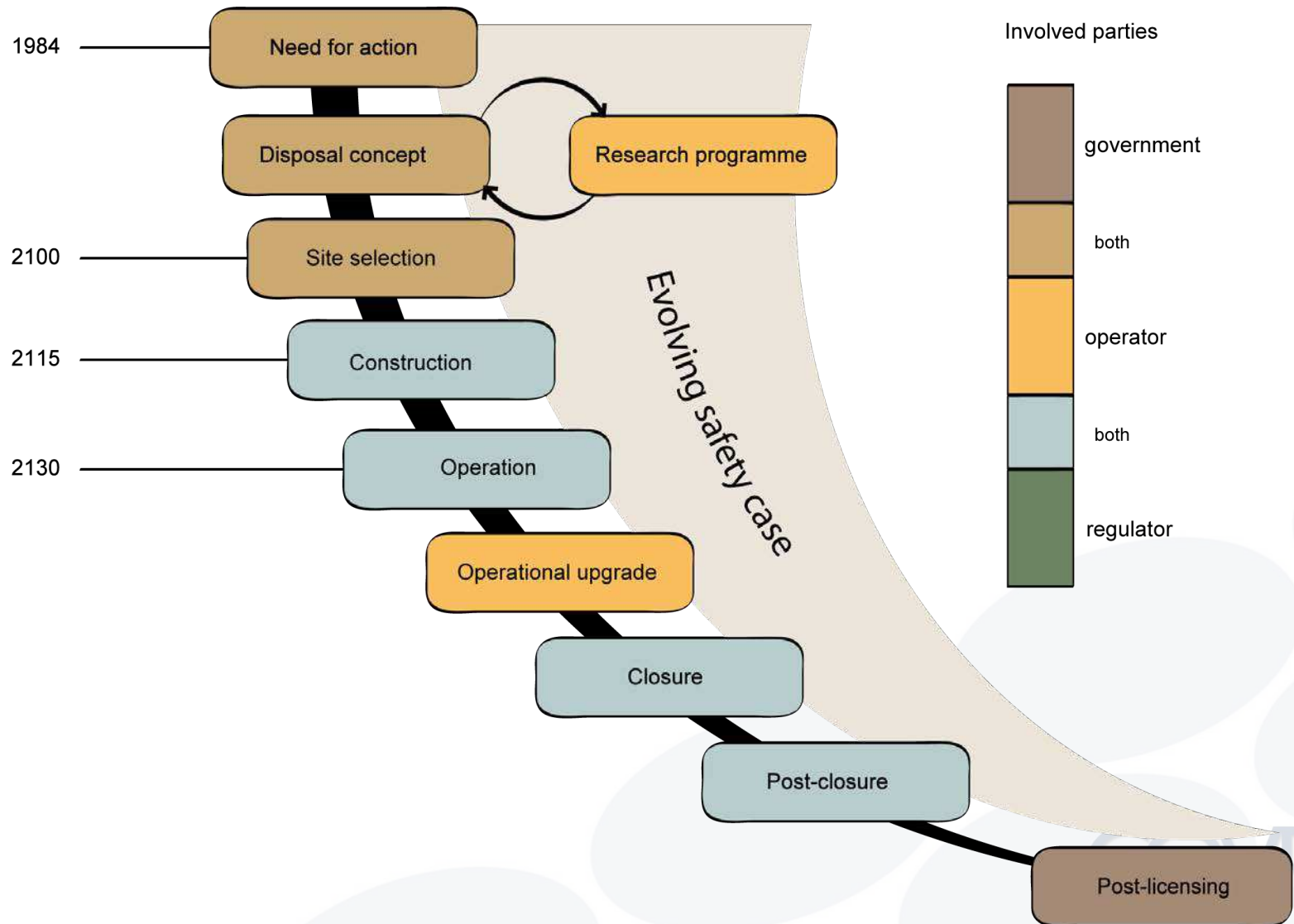
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# RADIOACTIVE WASTE POLICY

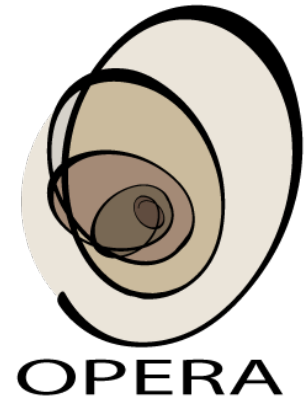
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# COVRA TIME SCHEME



# 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)



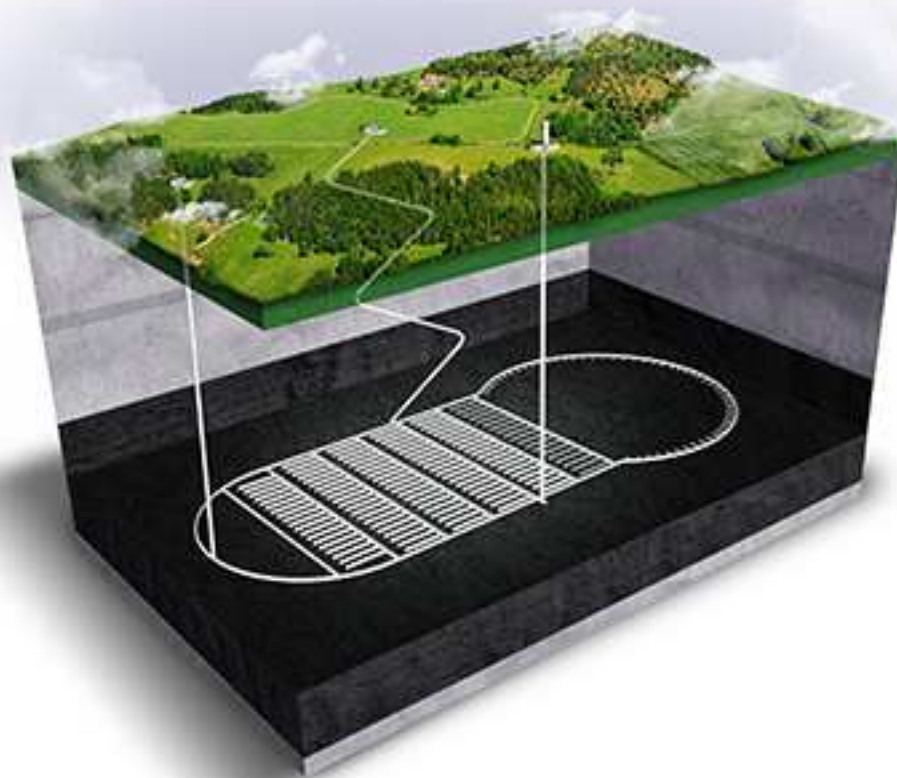
# DISPOSAL CONCEPT



# DISPOSAL CONCEPT



# DISPOSAL CONCEPT



# OPERA STATUS

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

**Roadmap & Safety Case 2016**