ONDRAF/NIRAS

Monitoring of the future near surface disposal site and facility

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Safety Objectives – safety functions

Disposal = Final step in the management of radioactive waste

Safety Objective = Protection of man and environment

- Now and in the future
- Against the dangers of ionising radiation
- By preventing accidents and, if an accident occurs, to limit the consequences of that accident

- Shielding of external radiation from the radioactivity in the waste (only during operational period)
- Isolation of the waste from the biosphere
- Containment of radionuclides

Safety Objectives – safety functions

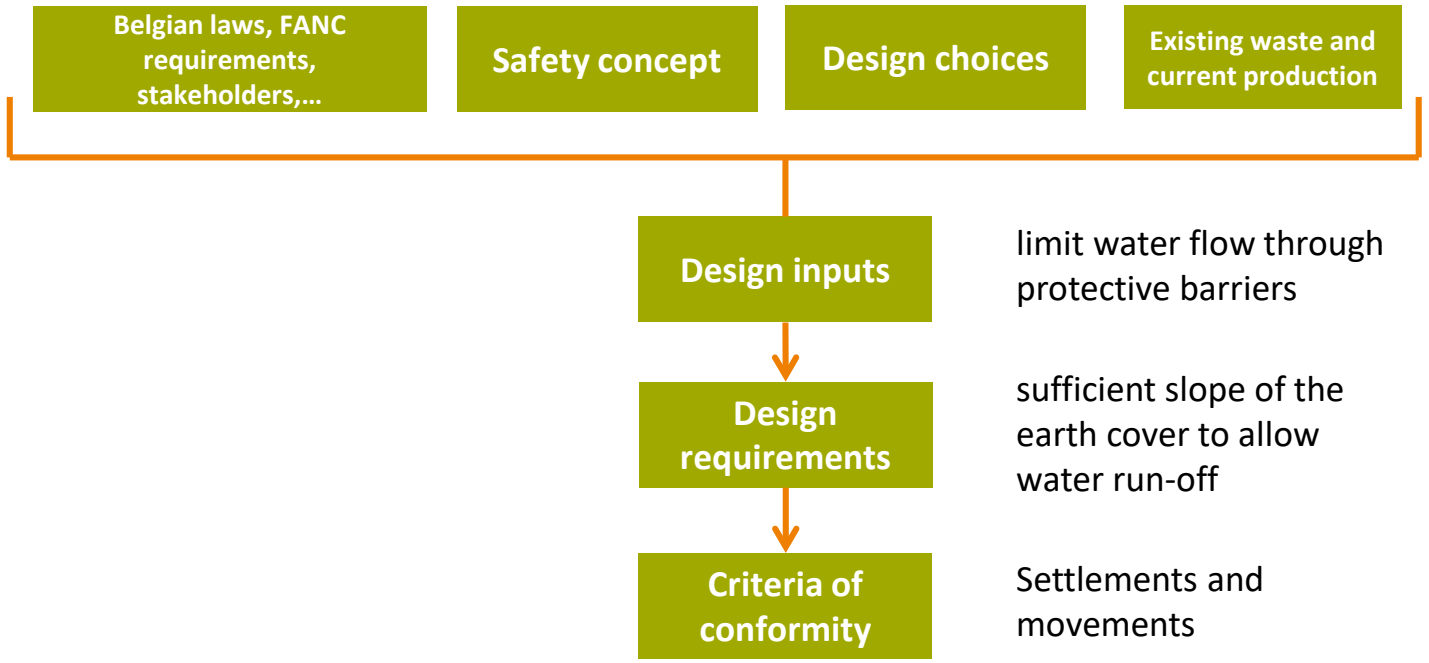
- **Follow-up and control**
  - Control on
  - Control on
    (production of monoliths and disposal activities)

To verify that design requirements (DR) of Systems, structures and components (SSC's) are met

Safety Objectives – safety functions

SSC? DR?

- **SSC**
  - = systems, s
  - contributing lity (e
- **DR**



Safety Objectives – safety functions

- **Follow-up and control**
  - Control or rks
  - Control or s (production of monoliths and disposal activities)
  - Control or d after operation
  - Optimalisa

To verify that design requirements (DR) of Systems, structures and components (SSC's) are met

To understand and confirm the behaviour of the disposal installation in it's environment

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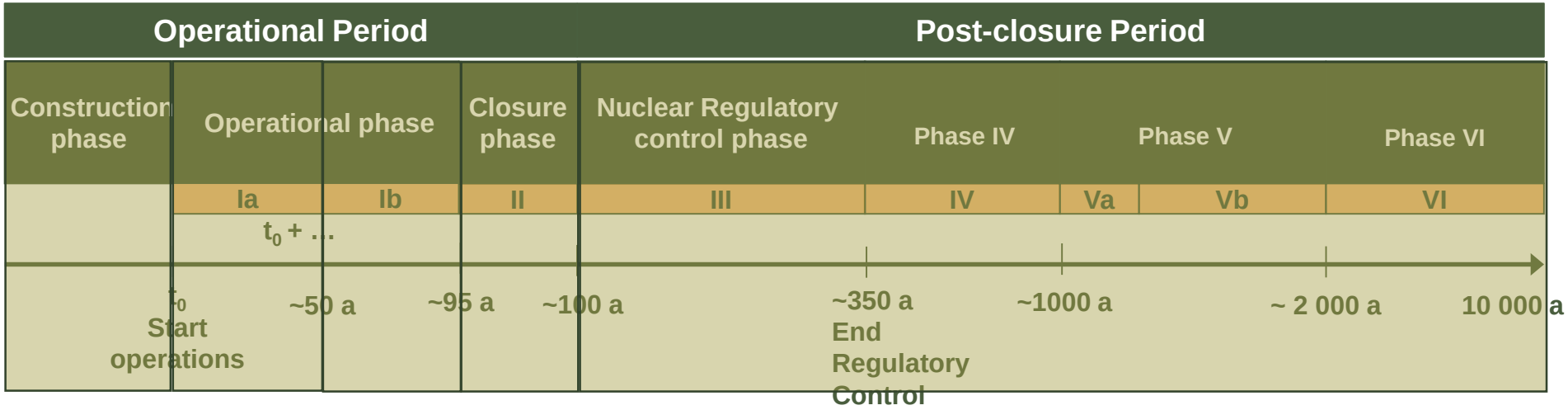
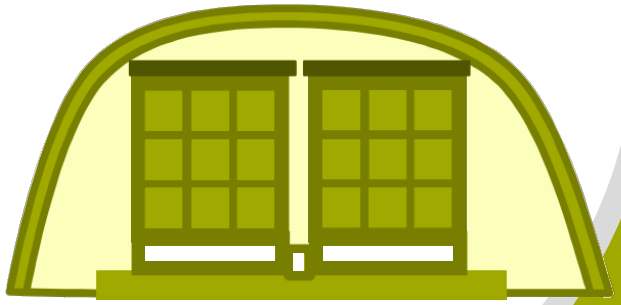
Configurations of the disposal facility





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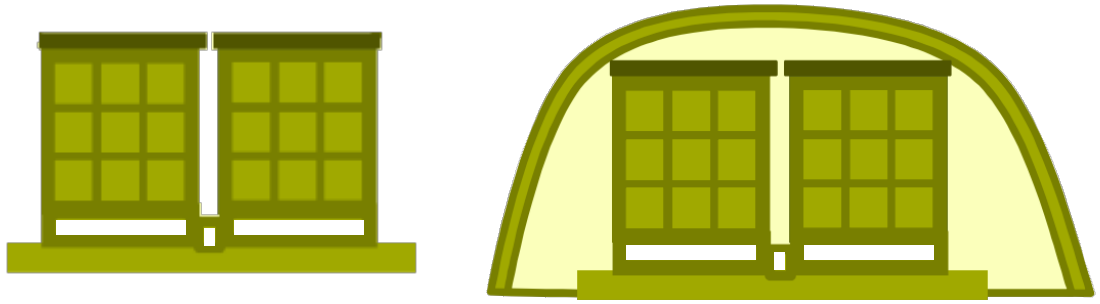
Monitoring programme

Radiological monitoring programme

- Monitoring during operational period (Ia en Ib)



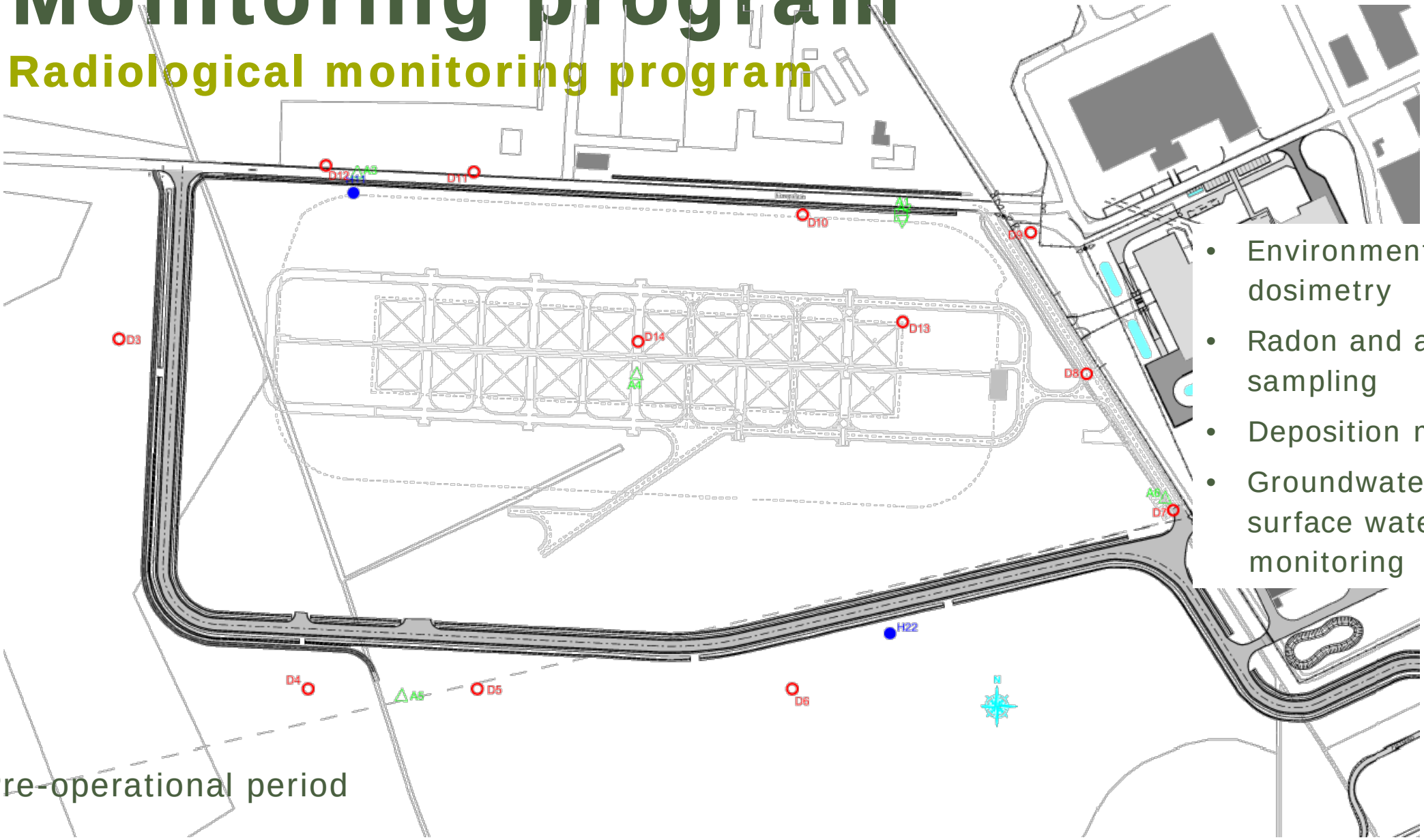
- Disposal activities → external radiation
- Water possibly present in drainage system and potentially contaminated

- Post-closure period

- No more disposal activities
- Potential gradual leaching into the aquifer underneath the repository

Monitoring program

Radiological monitoring program

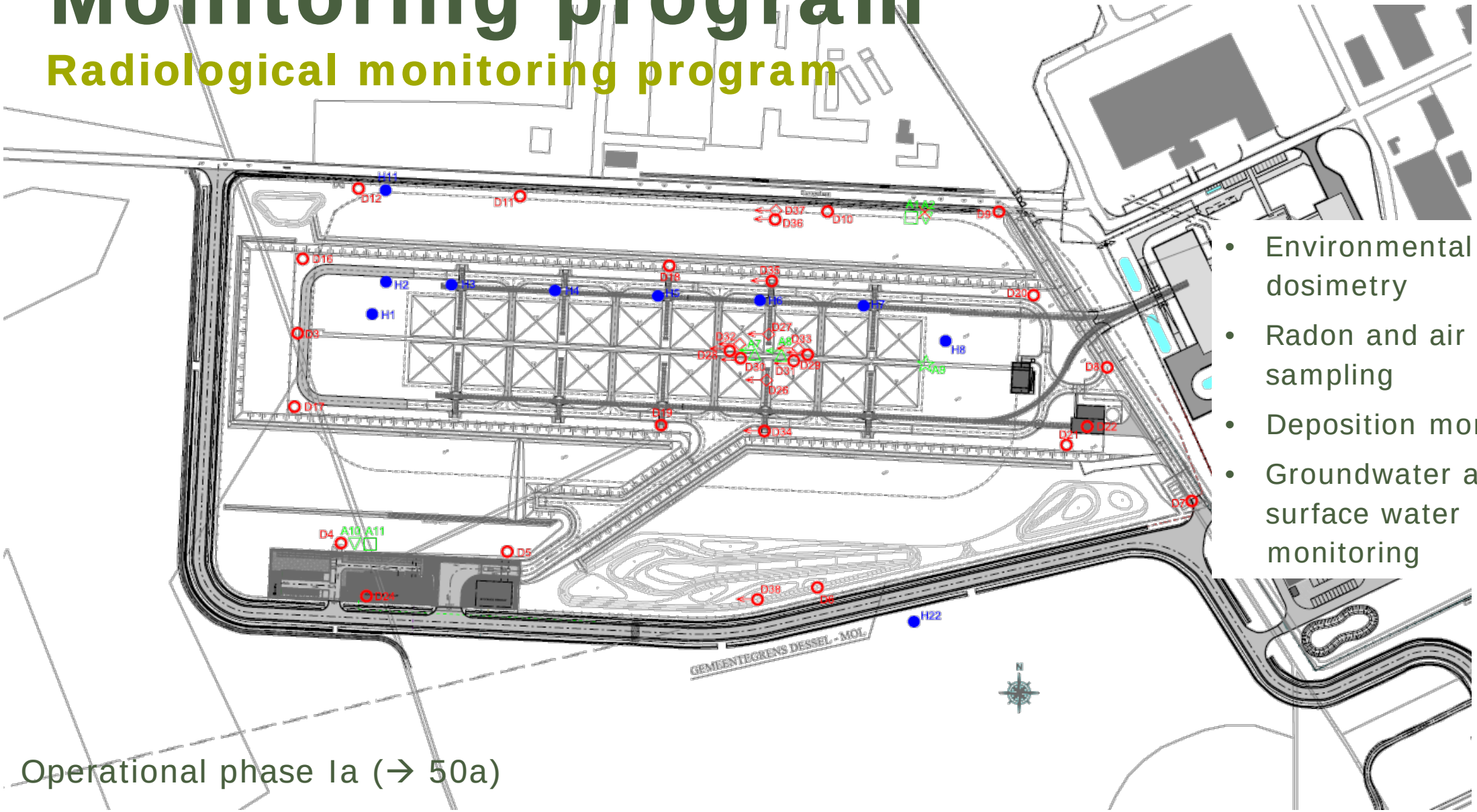


- Environmental dosimetry
- Radon and air sampling
- Deposition monitoring
- Groundwater and surface water monitoring

Pre-operational period

Monitoring program

Radiological monitoring program



- Environmental dosimetry
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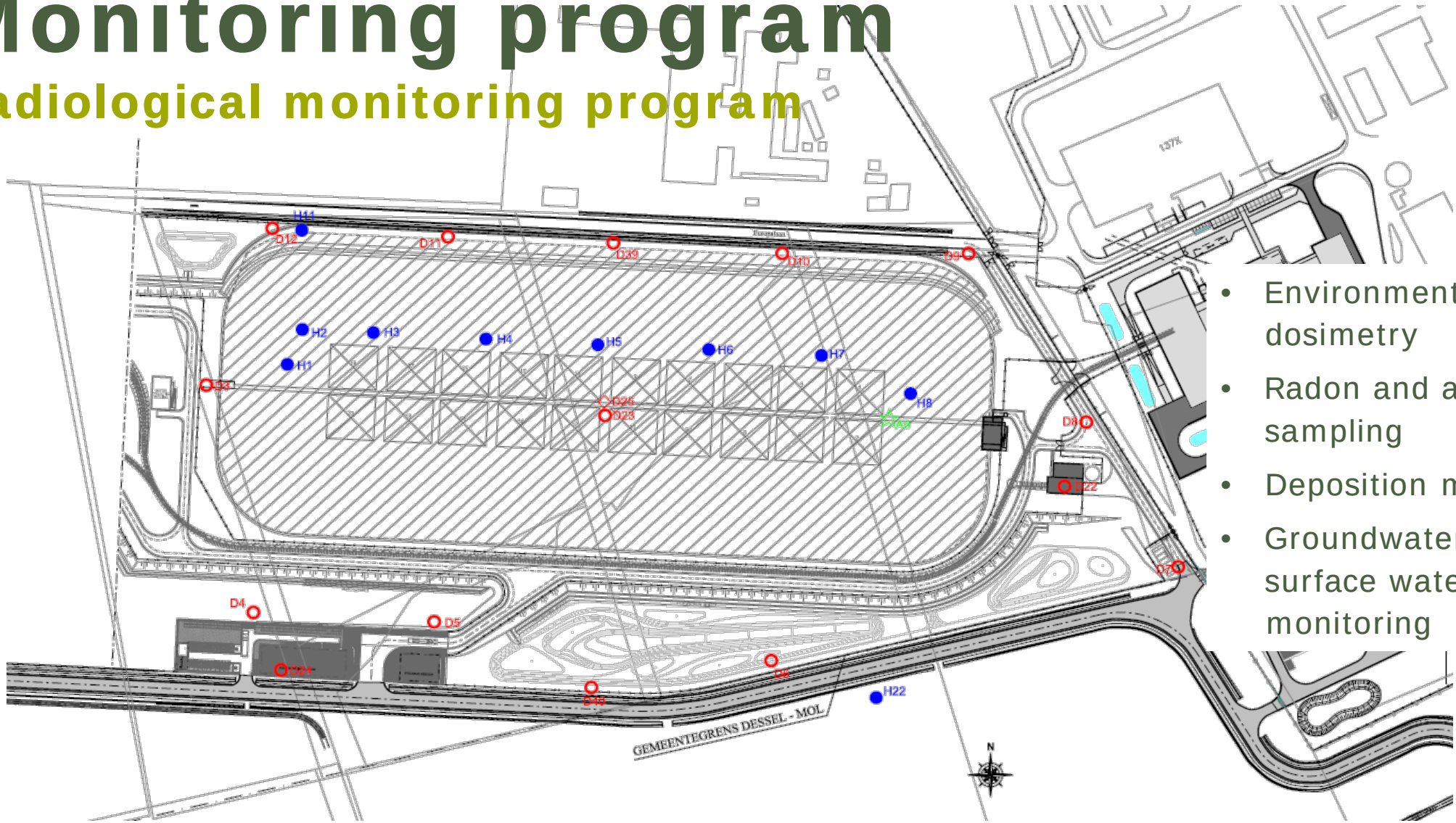
- Deposition monitoring
- Groundwater and surface water monitoring

Operational phase Ia (→ 50a)

Monitoring program

Radiological monitoring program



- Environmental dosimetry
- Radon and air sampling
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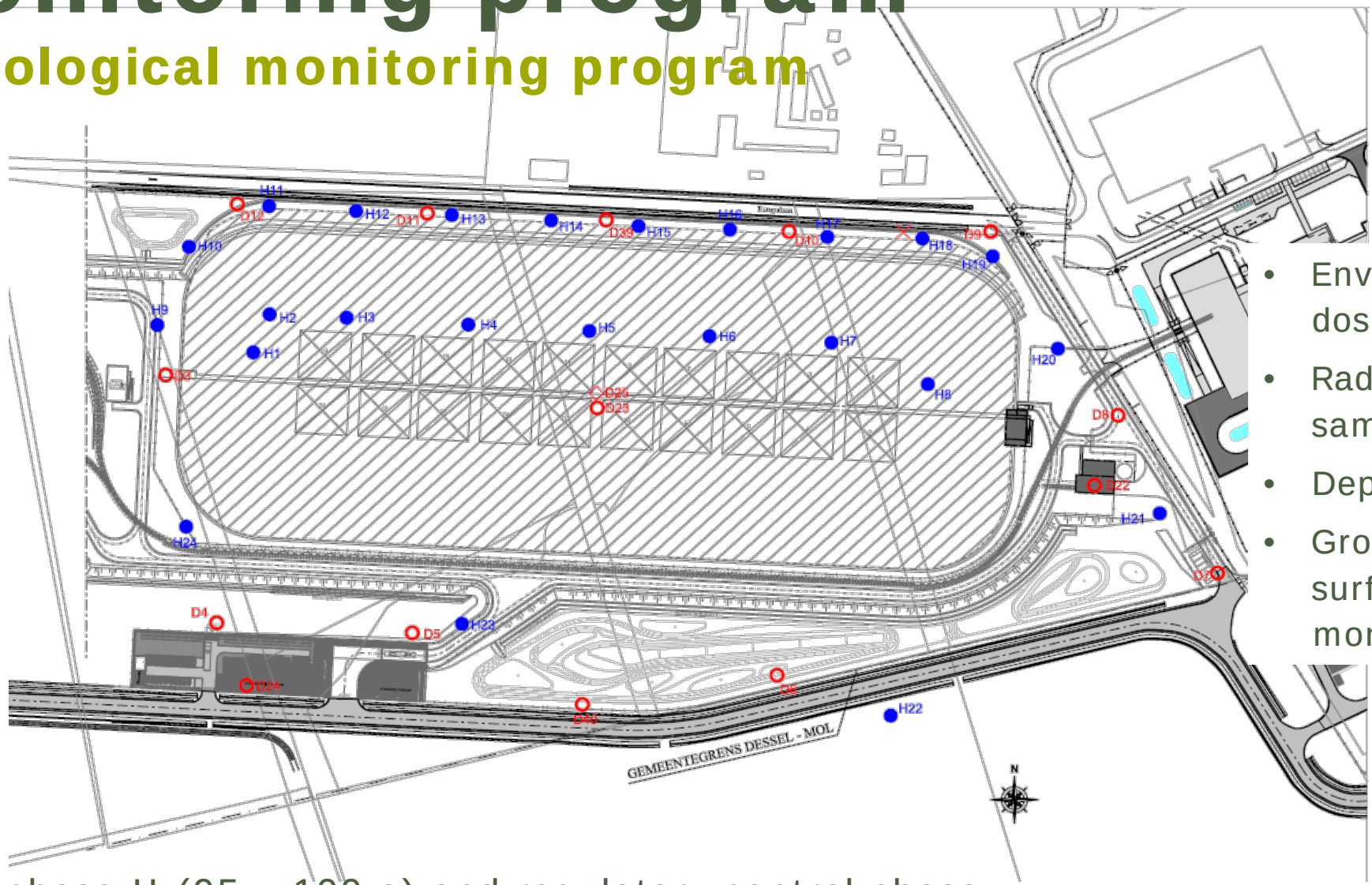
Exploitation phase Ib (50 – 95 a)

Monitoring program

Radiological monitoring program



- Environmental dosimetry
- Radon and air sampling
- Deposition monitoring
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Closure phase II (95 – 100 a) and regulatory control phase

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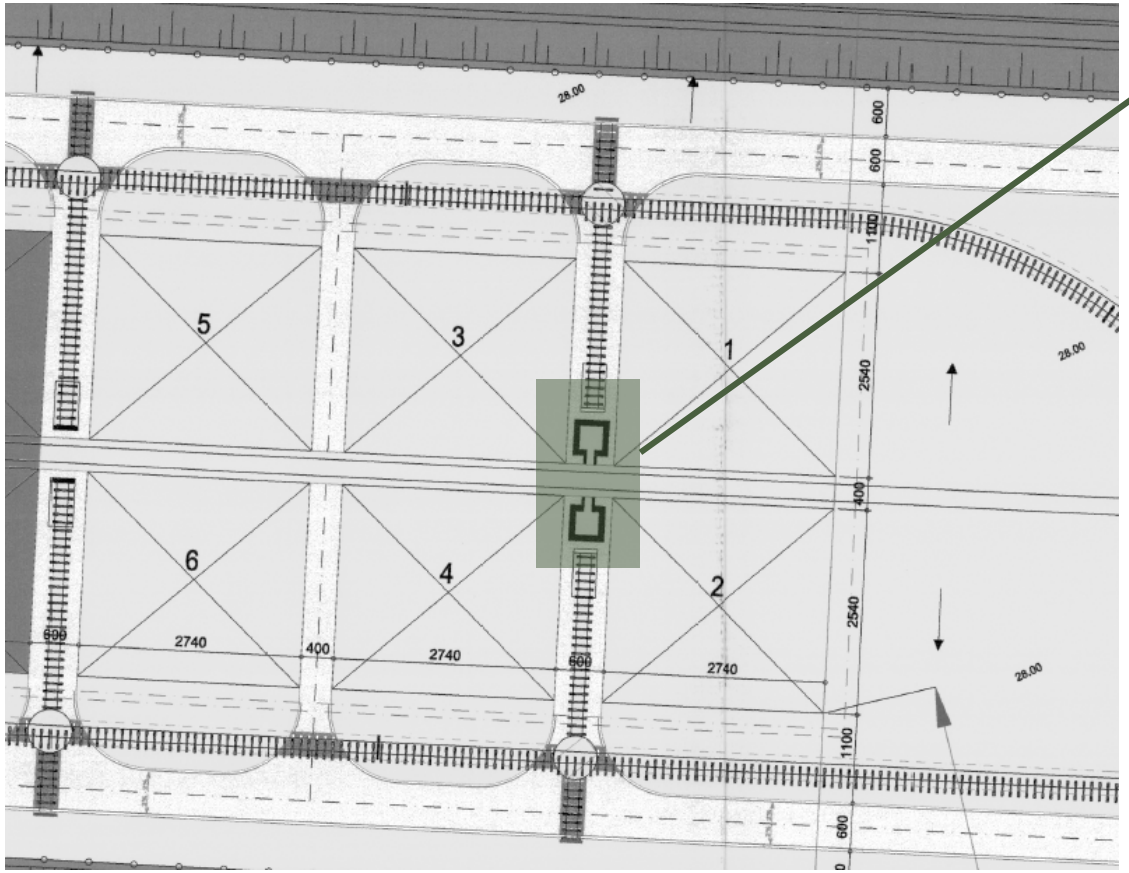
Monitoring programme

Physical and structural monitoring programme



Sample rooms
with witness monoliths and test specimens

- Non destructive measurements via active monitoring (built-in instrumentation)
- Destructive testing once every 2 to 5 years

Goal:

- Confirmation of expected degradation rate
- Confirmation of compressive strength
- Confirmation of expected carbonatation rate

Monitoring programme

Physical and structural monitoring programme

Inspection rooms

Inaccessible for humans, accessible for an inspection robot

- Detection of traces of water
- Detection of cracks in concrete floors and walls (> ~300 µm)

Frequency

- Modules in operation: once a year
- Modules next to modules in operation: once every 2 years
- Closed modules: once every 4 years

Goal

- Confirmation of absence of degradation processes

Monitoring programme

Physical and structural monitoring programme

- Monitoring of modules:
  - Inspection during construction (e.g. Temperature evolution)
  - Visual inspection after construction (e.g. Absence of cracks)
  - Settlements and movements of modules (as expected)
- Monitoring of the cover
  - Settlements and movements of the cover
  - Visual inspection (absence of biological of physical degradation – erosion, perturbation,…)
- Weather station and accelerometers (cfr seismic activity)

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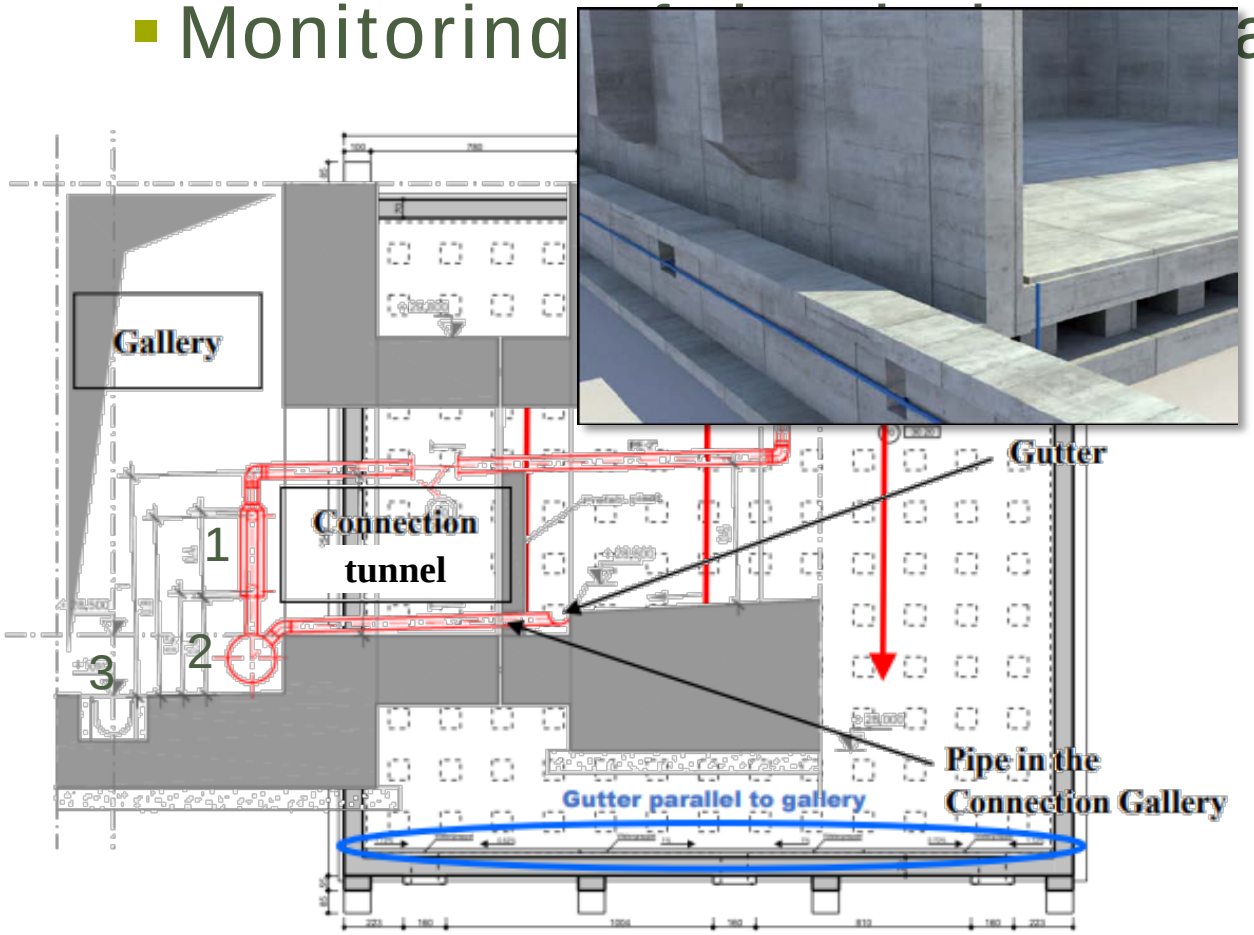
Monitoring programme

Monitoring of the drainage system

- Monitoring [illegible] ater



- Control 1: water coming from a module (3 recipients)
- Control 2: water coming from an inspection room (2 recipients)
- Control 3: water coming from the inspection gallery

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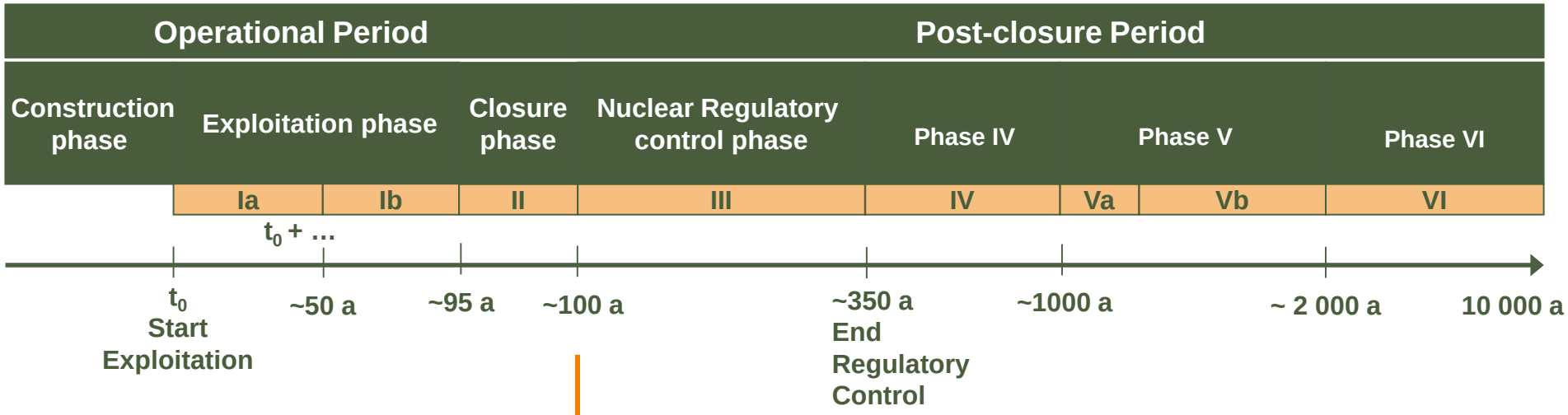
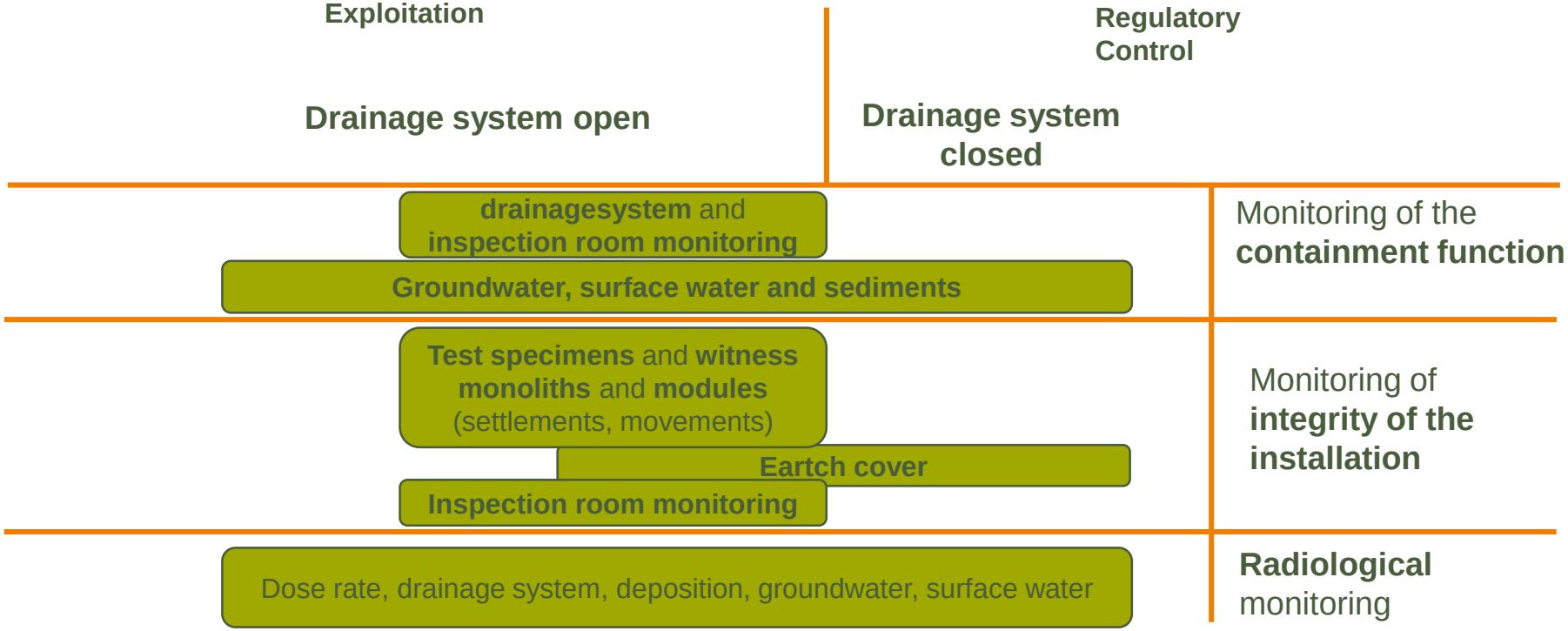
Conclusion


Operational Period
Post-closure Period
Construction phase
Exploitation phase
Closure phase
Nuclear Regulatory control phase
Phase IV
Phase V
Phase VI
Ia
Ib
II
III
IV
Va
Vb
VI
t_0 + …
t_0 Start Exploitation
~50 a
~95 a
~100 a
~350 a End Regulatory Control
~1000 a
~ 2 000 a
10 000 a


Drainage system open
Drainage system closed
drainagesystem and inspection room monitoring
Groundwater, surface water and sediments
Monitoring of the containment function
Test specimens and witness monoliths and modules (settlements, movements)
Eartch cover
Inspection room monitoring
Monitoring of integrity of the installation
Dose rate, drainage system, deposition, groundwater, surface water
Radiological monitoring