Developing Safeguards Approaches for Future Encapsulation Plants and Geological Repositories

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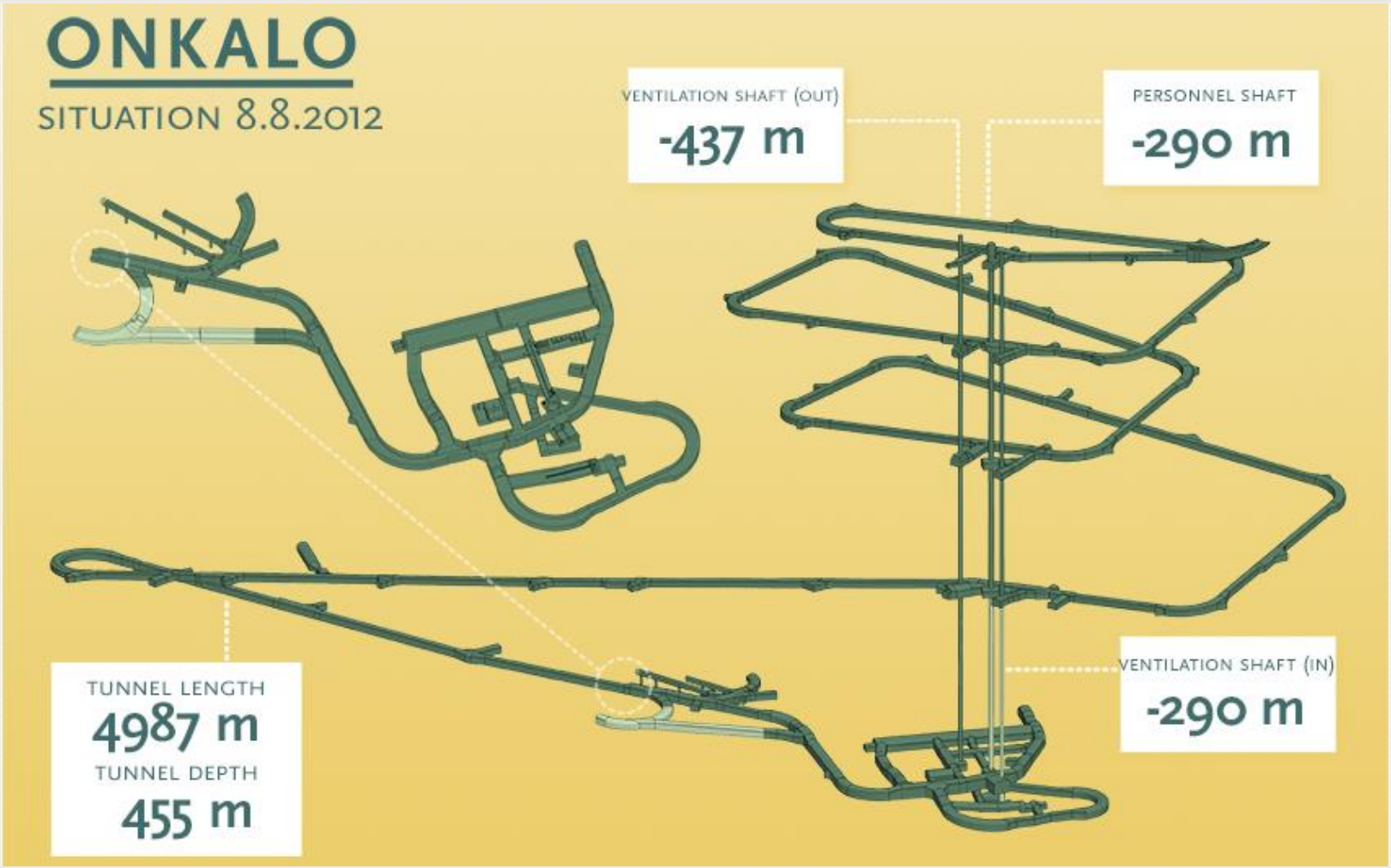
Yuri Yudin
Department of Safeguards

IAEA
International Atomic Energy Agency

EPGR in Finland

EPGR in Finland (2)



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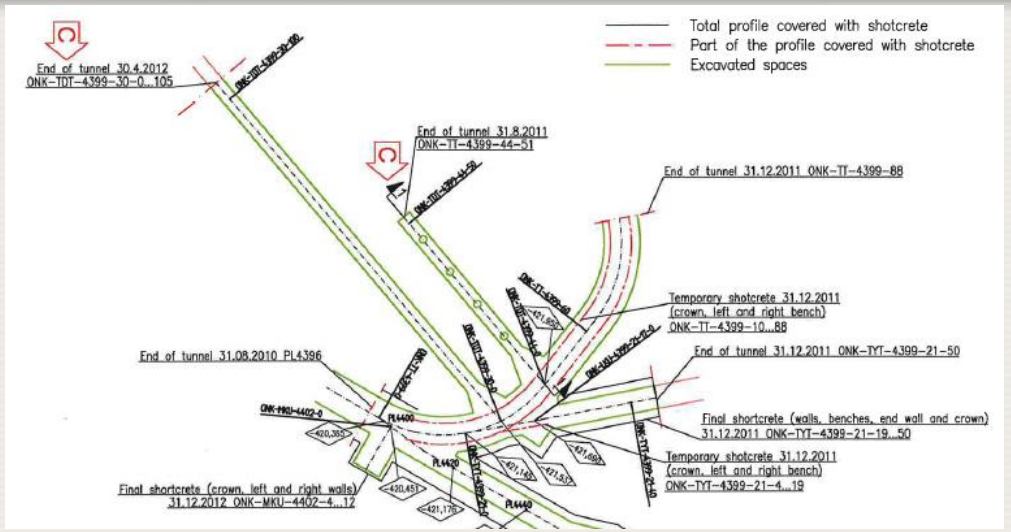
EPGR in Finland (3)



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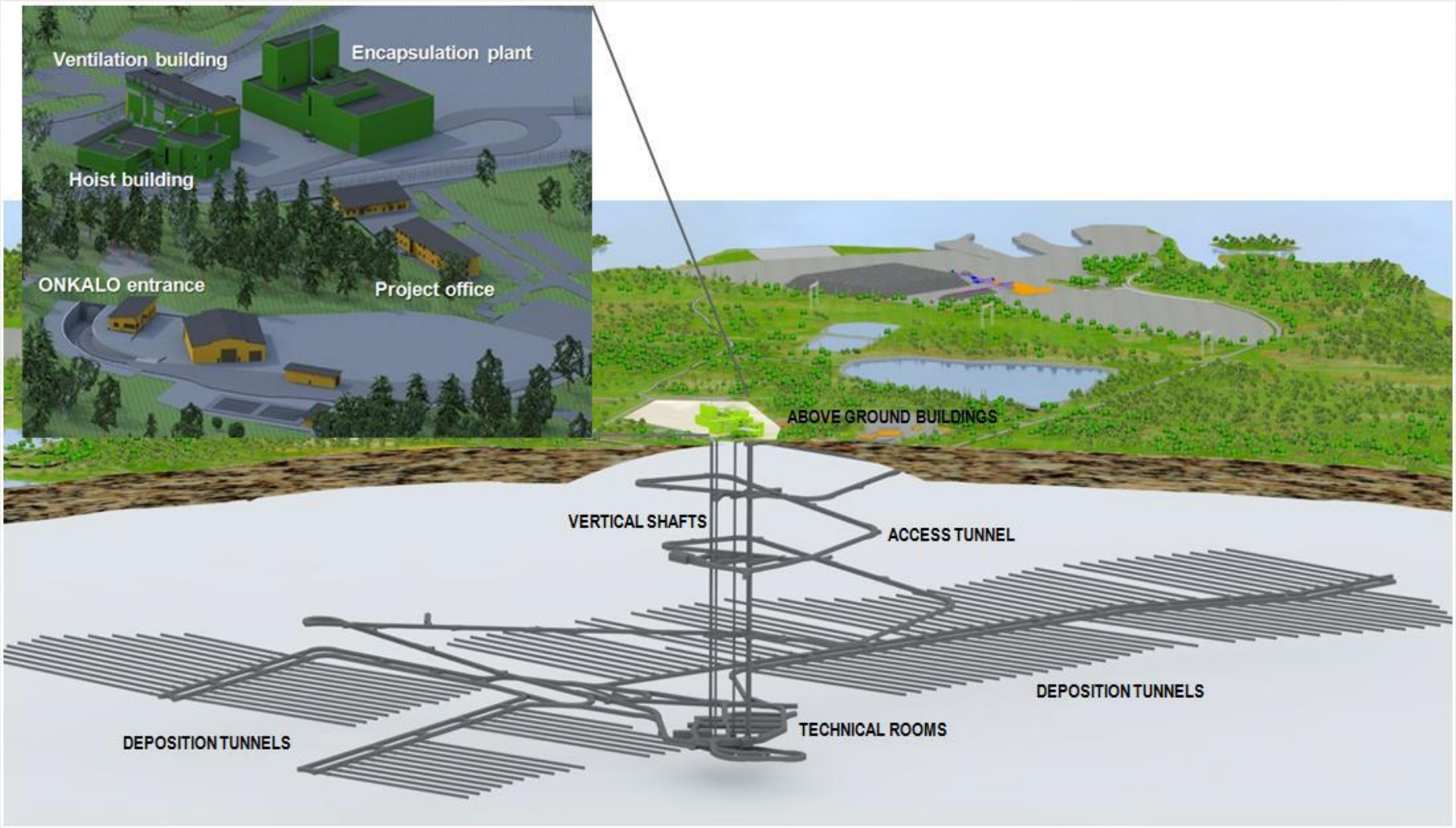
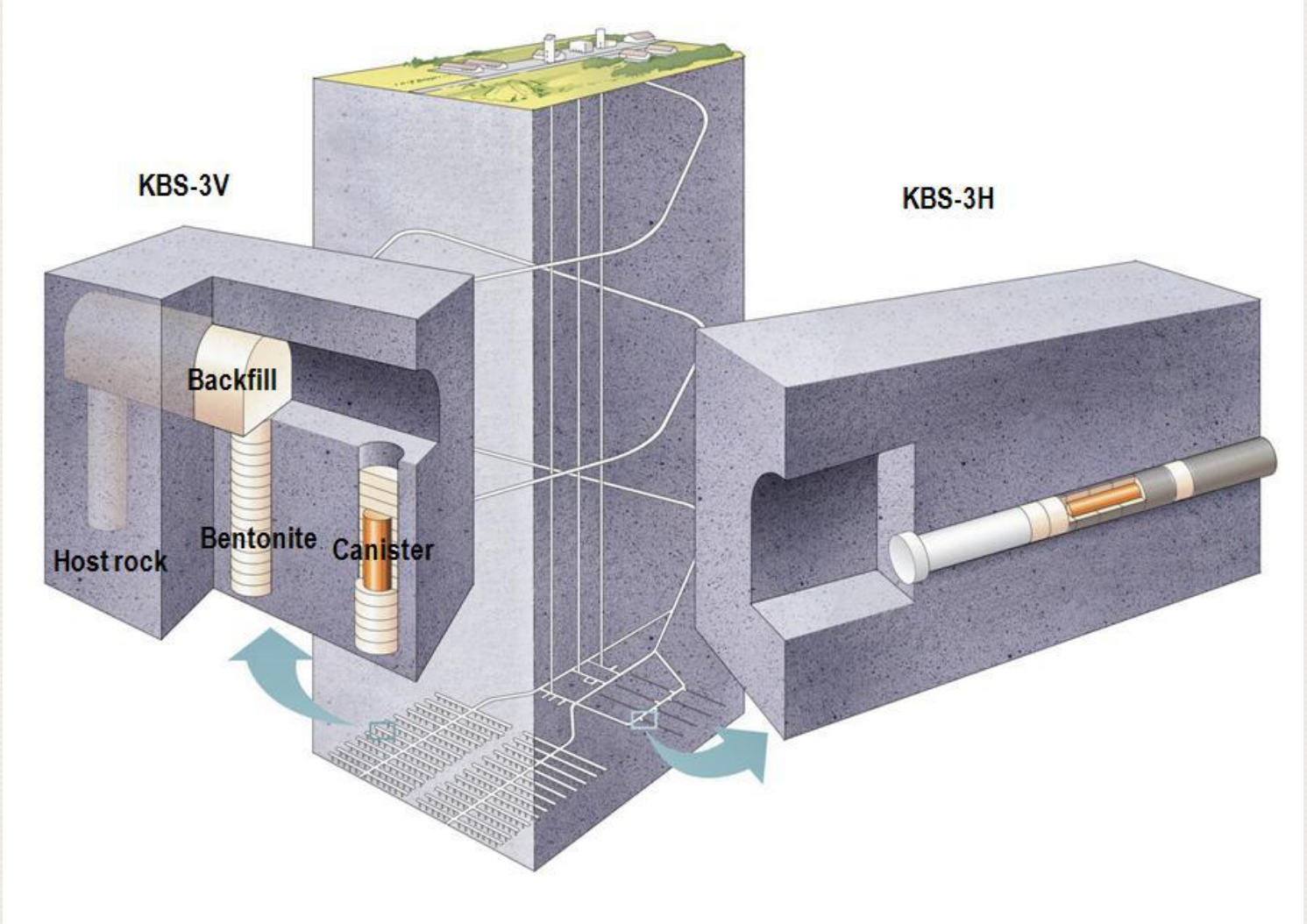
EPGR in Finland (4)



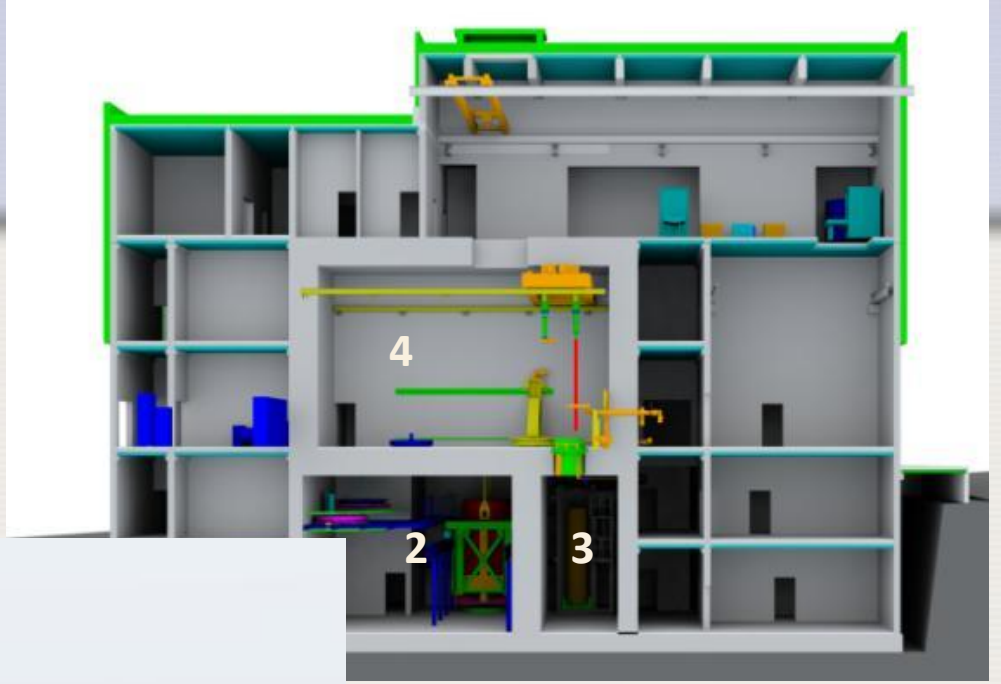
EPGR in Finland (5)



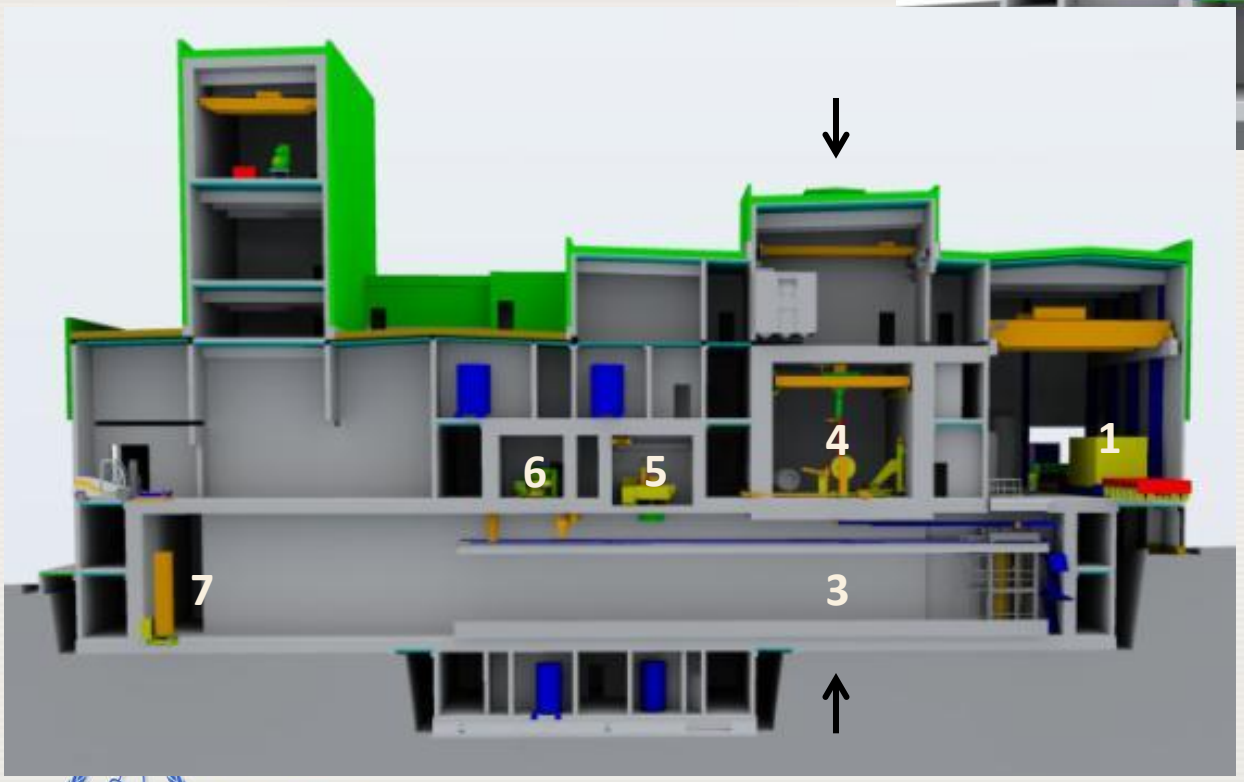
EPGR in Finland (6)

EPGR in Finland (7)

Cross section



Longitudinal section



1. Receiving area
2. Cask transfer corridor
3. Canister transfer corridor
4. Handling cell
5. Welding station
6. Weld inspection station
7. Canister lift

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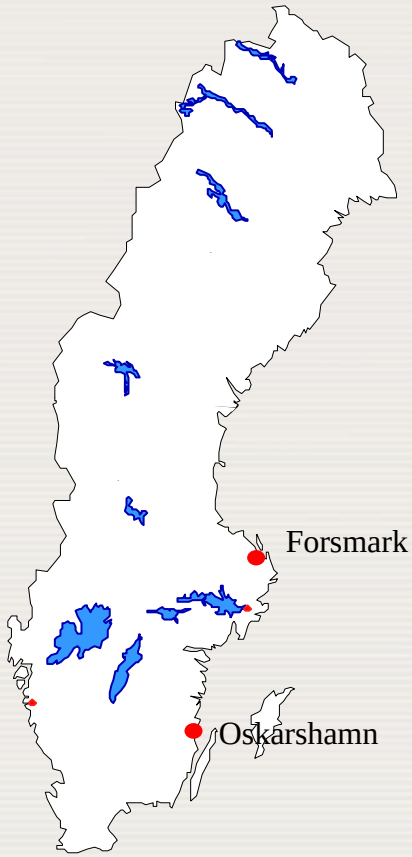
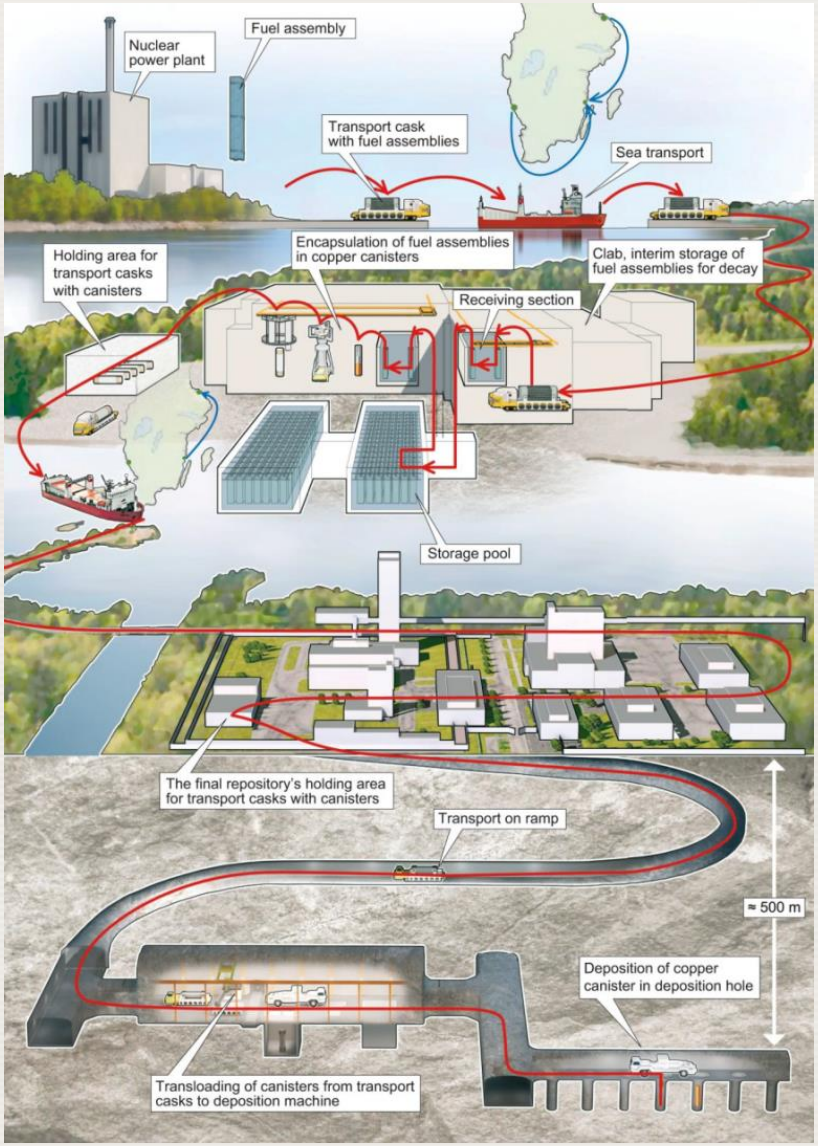
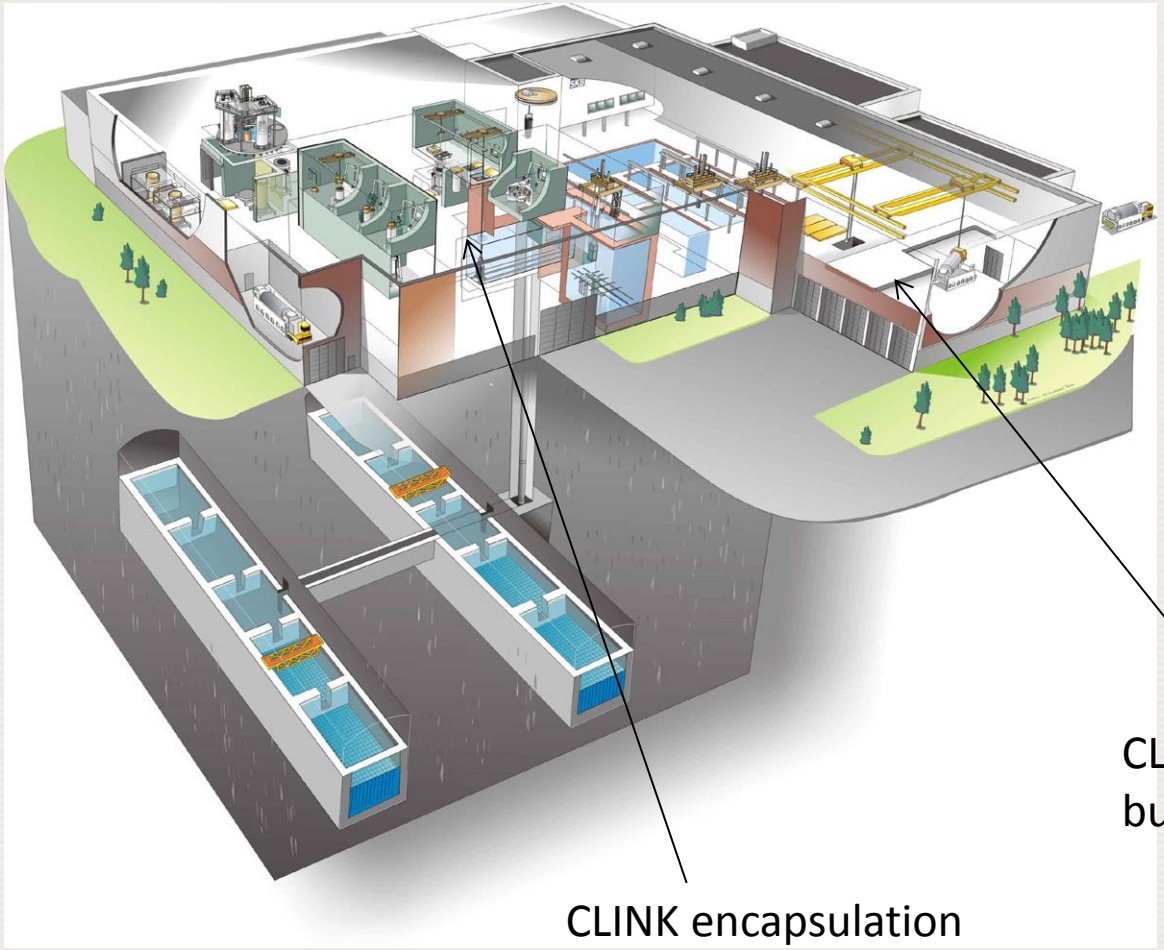
EPGR in Sweden



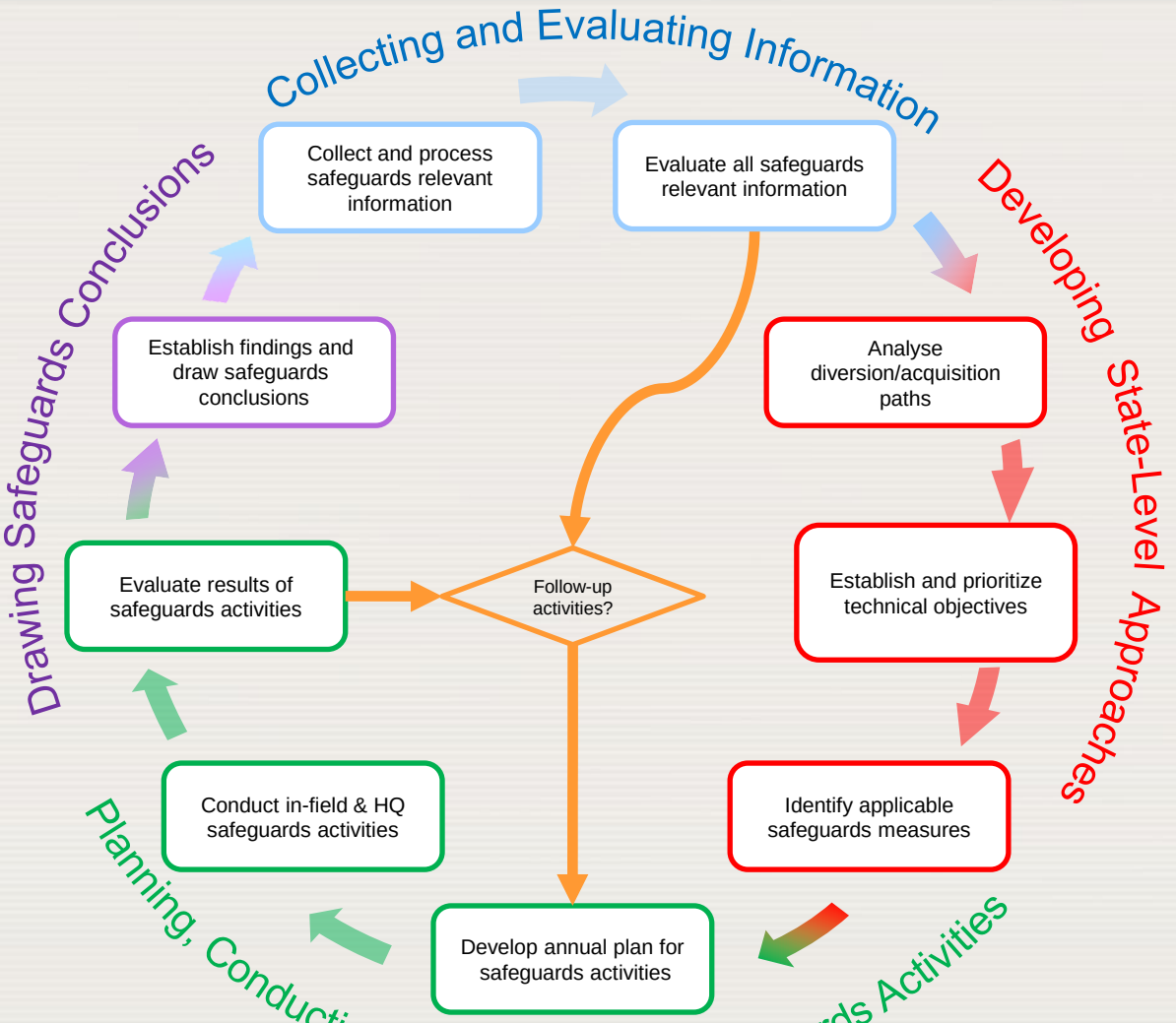


EPGR in Sweden (2)

EPGR in Sweden (3)



Processes to Support Safeguards Implementation



Generic State-level Safeguards Objectives

For a State with a comprehensive safeguards agreement (CSA), the Agency plans and conducts its safeguards activities in order to fulfil the following generic State-level safeguards objectives:

- to detect any diversion of declared nuclear material in declared facilities or locations outside facilities (LOFs)
- to detect any undeclared nuclear material or activities in the State as a whole
- to detect any undeclared production or processing of nuclear material in declared facilities or LOFs

Safeguards Approach Development

SAGOR* I	To develop model safeguards approach for the final disposal of spent fuel in geological repositories (1994-1998)
SAGOR II	To evaluate safeguards measures for implementing safeguards approach and recommend on R&D activities (1999-2004)
ASTOR **	To assist the Agency in application of safeguards to geological repository systems (2005-present)

***SAGOR: The Programme for Development of Safeguards for the Final Disposal of Spent Fuel in Geological Repositories**

****ASTOR: Application of Safeguards to Geological Repositories**

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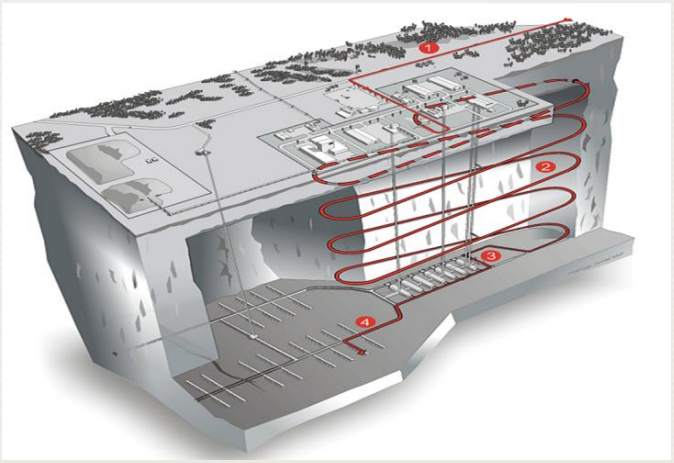
Current Status

Conceptual phase

Safeguards Approach

Model Integrated Safeguards Approach for a Geological Repository

Development and application of specific safeguards approaches

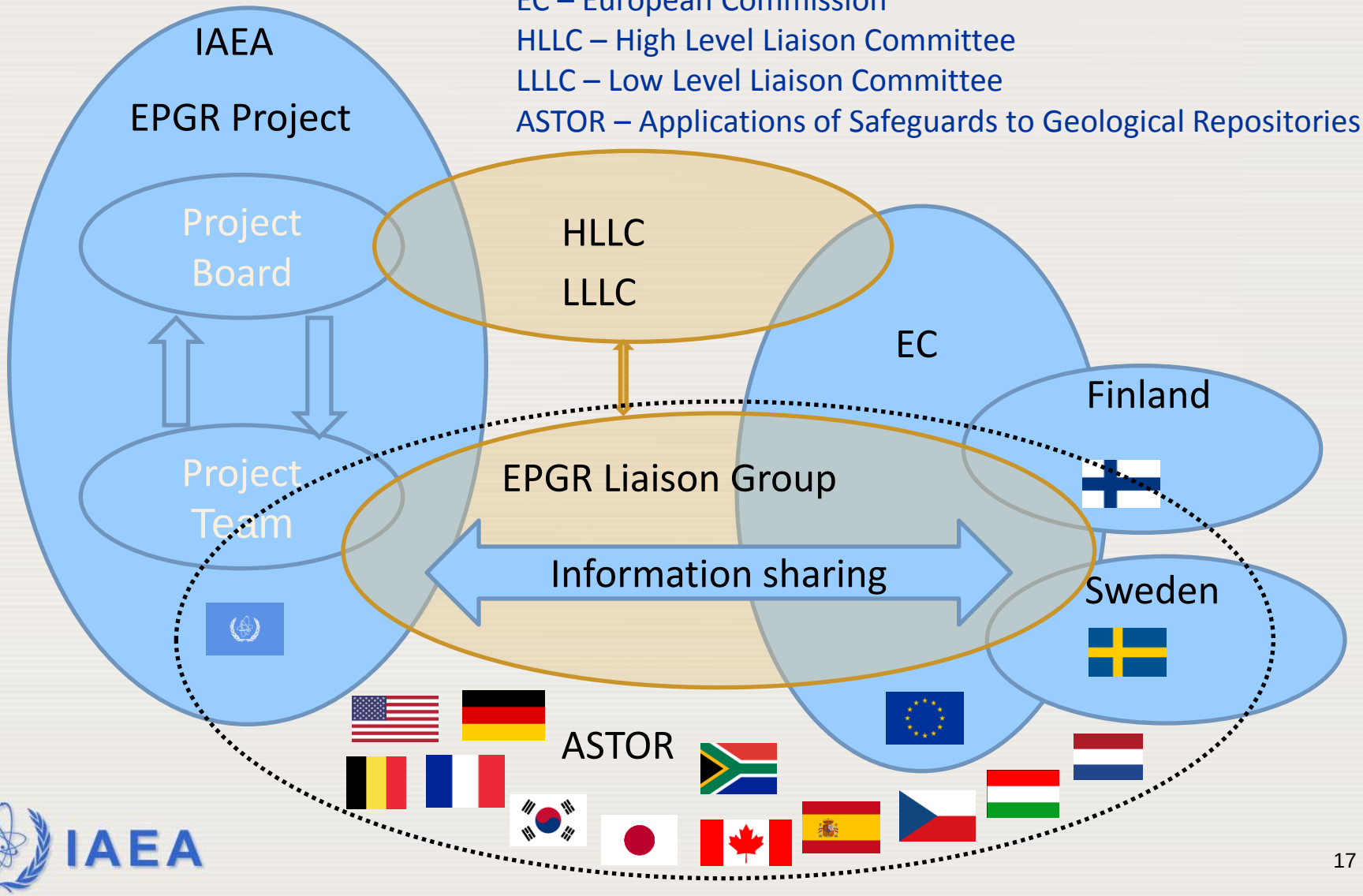


Safeguards for Geological Disposal

- For future geological repositories and encapsulation plants, safeguards measures and activities will be identified based on the results of the diversion/acquisition path analysis for a State to effectively and efficiently address respective technical objectives
- Safeguards approaches for specific facilities will be part of the State-level approach (SLA) for a State as a whole
- Existing documents – such as generic safeguards approaches – would provide guidance on the details for the conduct and performance targets of specific safeguards activities

Organizational Landscape

EC – European Commission
HLLC – High Level Liaison Committee
LLLC – Low Level Liaison Committee
ASTOR – Applications of Safeguards to Geological Repositories



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Main Challenges of Safeguarding EPGR

- Best available measurement of spent fuel
- ID/seals reliability up to 100 years
- ‘Virtual’ containment
- Assurance of no undeclared activity underground
- Remote monitoring of NM activities

Safeguards by Design

- Continuous dialogue between all stakeholders – the State, operators, EC and IAEA
- Safeguards requirements (non-intrusive, cost effective) are to be integrated in the EPGR design at early possible stages
- Technical requirements should be flexible to accommodate possible future changes in technologies and safeguards strategies

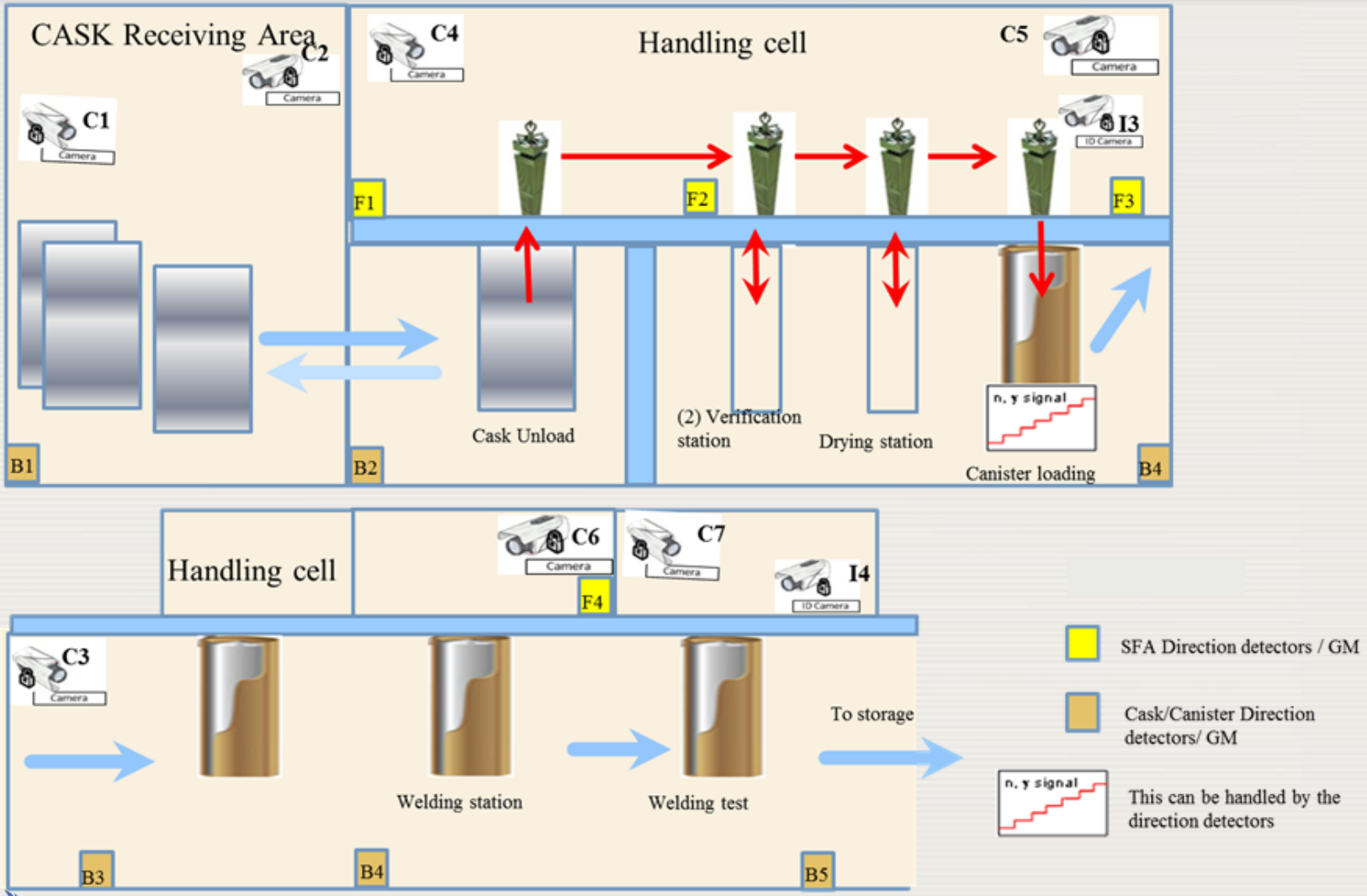
Safeguards Concept for EP

- Spent fuel is verified before encapsulation for gross and partial defects with best available equipment
- Continuity of knowledge should be maintained by containment and surveillance (C/S) and monitoring measures from the time of spent fuel verification through emplacement in the geological repository
- A highly reliable, redundant C/S system should be applied to minimize the possibility of C/S failure

Safeguards Concept for EP (2)

- An agreement with the operator to put the process on hold should an equipment/verification failure happen (a ‘green/red light’ agreement with the operator)
- Design information verification (DIV) to verify the correctness and completeness of the design information provided by the State

Safeguards Concept for EP (2)



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Geological repository

- Nuclear material will not be accessible for direct verification
- Disposal canisters will become inaccessible after a tunnel is backfilled or the repository is closed
- The design of the facility will not be frozen
- Only a small part of the facility will be visible above ground
- Undeclared areas can be ‘hidden’ behind declared tunnels
- Approach routes to the repository may be excavated before or during its operation life

Safeguards Concept for GR

- A ‘flow monitoring’ approach is considered for safeguarding a geological repository: the flow of items containing nuclear material should be, normally, only into the repository. Declared access points are to be rigorously monitored to ensure that nuclear material does not leave the underground area
- DIV to verify the correctness and completeness of the design information provided by the State
- ‘Virtual’ containment will be monitored to detect possible approach routes to the repository excavated during its operation

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Summary

- From the safeguards standpoint, geological disposal presents certain unique challenges for the IAEA
- The IAEA makes the best use of existing technologies to optimize resources and apply effective and efficient safeguards to geological repositories and encapsulation plants
- Given the long time frame for opening, operating, and closure of geological repositories, advances in technology are inevitable; these may change the safeguards approach

Thank you for your attention