Security and Safeguards Considerations in Radioactive Waste Management

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Commission canadienne de sûreté nucléaire

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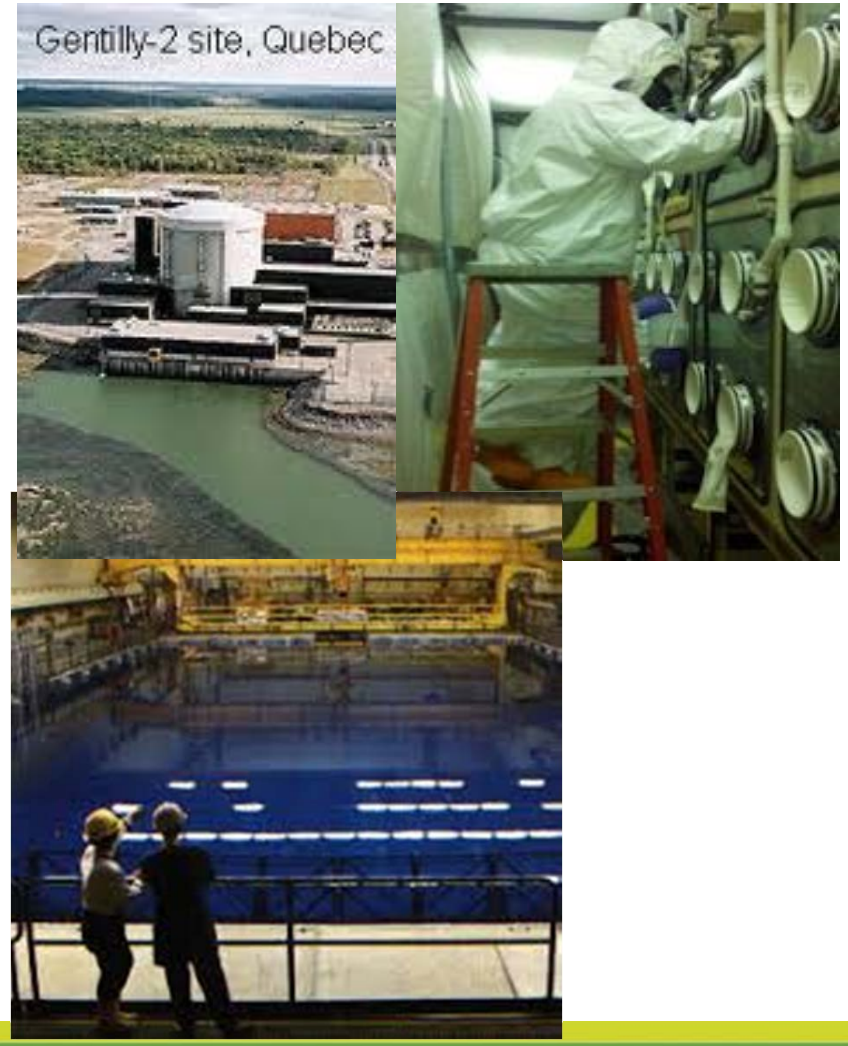
Radioactive Waste Management

- **What is waste?**

1. From reactor operation
2. Decommissioning
3. Spent Fuel
4. Disused sealed radioactive sources
5. Other Radioactive sources
6. Contaminated items



Canada's Radioactive Waste Classification

1) High-level radioactive waste (HLW)
2) Intermediate-level radioactive waste (ILW)
3) Low-level radioactive waste (LLW)
   - o low-level short-lived radioactive waste (VSLLW)
   - o very-low-level radioactive waste (VLLW)
4) Uranium mine and mill tailings

HLW ILW LLW Uranium mine & mill tailings

Canadian Regulatory Approach for Waste

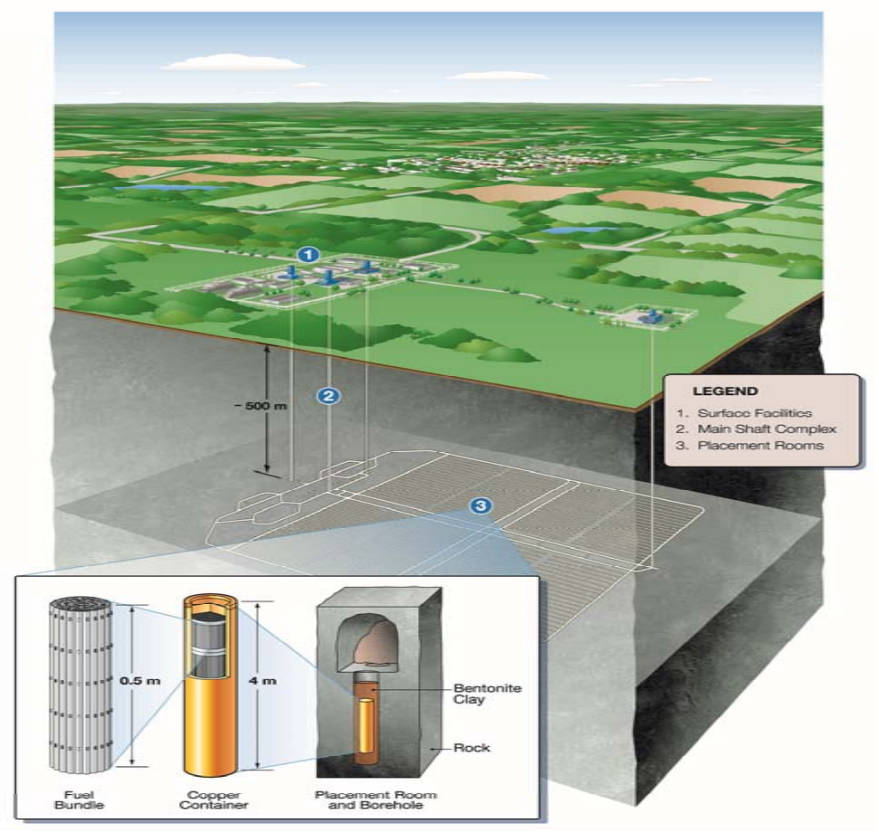
- Approach stems from the *Nuclear Safety and Control Act* (NSCA), Regulations, and CNSC regulatory policy document ***P-290, Managing Radioactive Waste***
- Principles:
  - Plan for the complete life of the facility
  - Multi-barriers between radioactive material and people/the environment
  - Defence in depth – never rely on a single system or process for protection
  - Measures to facilitate Canada's compliance with any applicable safeguards agreement

Safeguards – The Basics

- **What?**
  - measures through which the IAEA seeks to verify that nuclear material is not diverted from peaceful uses
- **Why?**
  - to deter the proliferation of nuclear weapons
- **Who?**
  - IAEA → implements safeguards internationally
  - CNSC → Canada's safeguards authority
  - Licensees → subset of CNSC licensees

Safeguards and Deep Geological Repository (DGR)

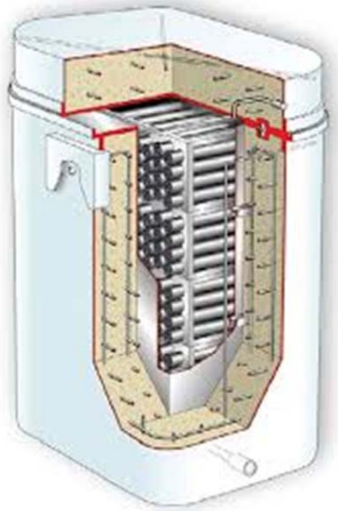
- Canada-IAEA Safeguards Agreement: DGR containing spent fuel will be under IAEA safeguards
- Canada is required to report on DGR development early in the process
- Provision of draft design information begins the process of developing a ***'safeguards approach'*** for the DG

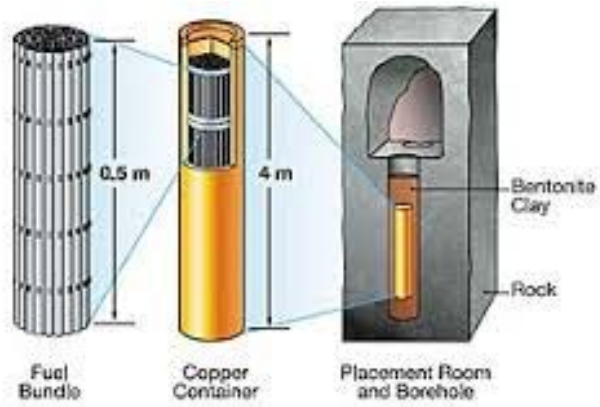


DGR containing spent fuel will be under IAEA safeguards

Safeguards Approach

- A DGR safeguards approach will dictate
  - The types, locations of installed IAEA instrumentation at the DGR (Starting with the Encapsulation Plant)
  - The types, frequencies of inspections to be carried out by the IAEA
- DGR safeguards in Canada might encompass IAEA verification of Spent fuel at the reactor sites, at the encapsulation plant and the encapsulated spent fuel prior to emplacement underground



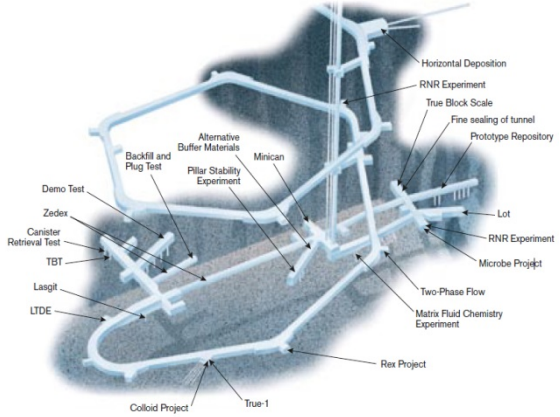


Short-Notice and Unannounced Inspections should be part of the DGR's Safeguards Approach

Safeguards Experience and DGR

- No one yet operates a safeguarded DGR for spent fuel; Finland and Sweden are most advanced
- DGR safeguards challenges include:
  - Finding the 'right' balance between instrumentation and live inspectors
  - Carrying out meaningful design verification underground (labyrinth)
  - Determining how to ensure that emplaced fuel is not clandestinely removed from a DGR

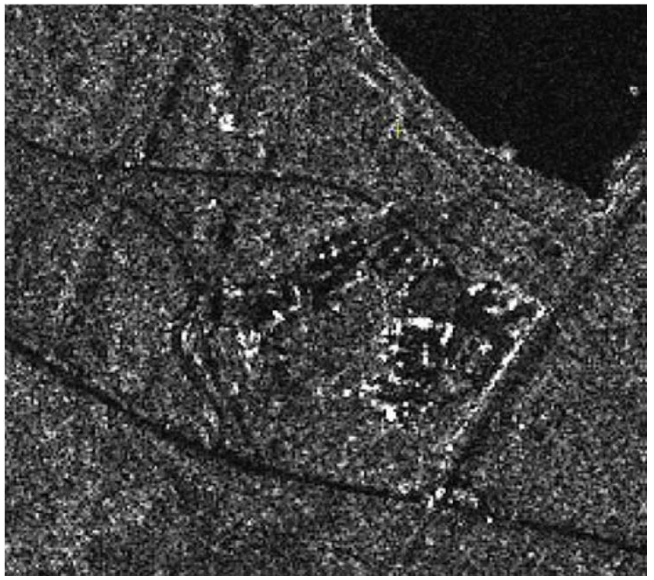
Finland – ONKALO: URL for Used Nuclear Fuel – may become part of final SF Repository



Source: "ASPO" Swedish Presentation at the 4th Review meeting of the Joint Convention

Application of **S**afeguards **TO** Deep Geological **R**epositories **- ASTOR**

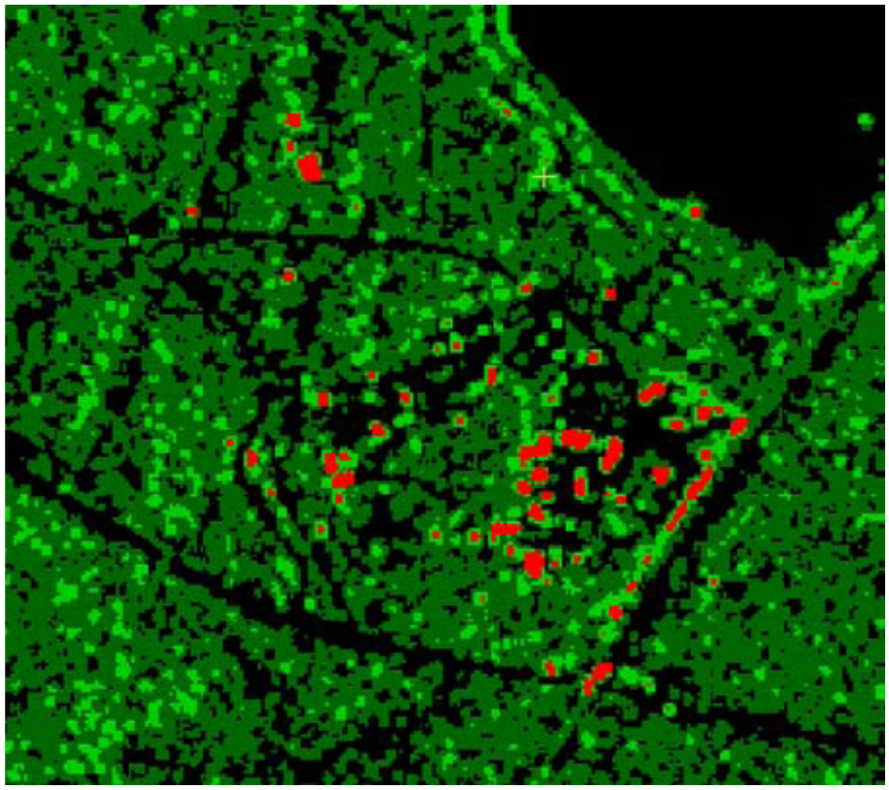
- A forward-looking group to explore how safeguards at DGRs might look
- 12 States plus IAEA and Euratom
- Explored different safeguards approaches for DGRs
- Investigated various types of instrumentation for use at DGRs
- Reviewed/Commissioned research on application of novel technology at DGRs
- Optical satellite imagery widespread



RadarSat image of Onkalo

Canada actively participates through the Canadian Safeguards Support Programme

ASTOR - satellite imagery



‘Simple’ classification

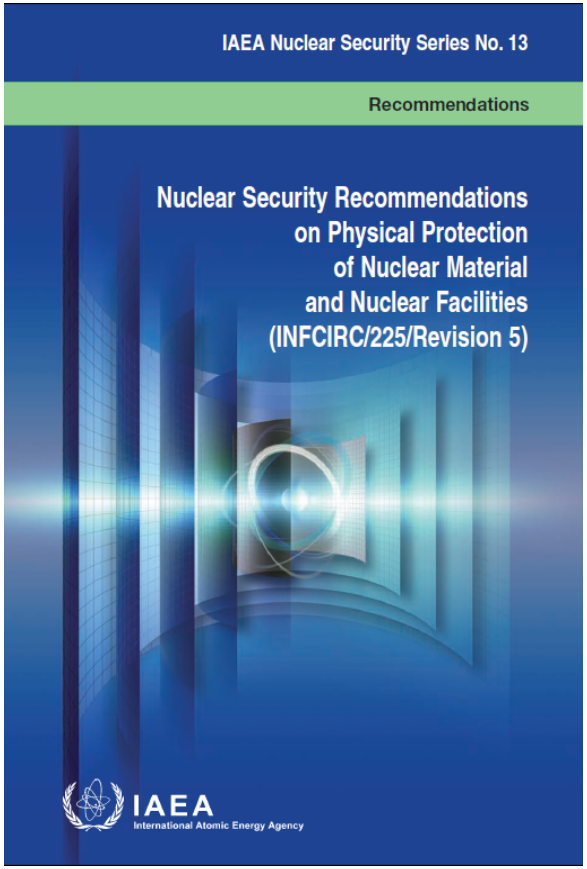
Optical overlay

Security and DGR

- Basic Principles:
  - Protect against unauthorized removal of Nuclear Material
  - Protect against sabotage
  - Mitigate or minimize effects of sabotage
    - Characterization
    - Radiological consequences
  - Graded Approach
    - Low Level Waste and below (Safety Guide GSG-1)
    - High Level Waste

Security and DGR

- Existing Guidance:
  - Nuclear Security Series: Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities -NSS No.13 (INFCIRC 225/Rev.5)
- Additional Guidance
  - Nuclear Security Series: Recommendations on Radioactive Material and Associated Facilities -NSS No.14
  - Nuclear Security Series: Security of Radioactive Sources-NSS No.11



Protection Of DGRs

- Physical Protection measures
  - Deterrence, Detection, Delay and Response





Graded Approach based on the DBT and Facility's TRA

Protection Of DGRs

- Prudent Management Practices:
  - Administrative procedures and controls that restrict access to authorized personnel
  - Security Clearance and other measures (two person rule)
  - Detection and surveillance systems to monitor all waste treatment and storage areas
  - Monitoring security systems are integrated in the facility design
- Inventory control measures
  - Timely, accurate (Encapsulation Plant)
- Vital Area and Protected Area
  - protection measures for each area that are implemented

Conclusion

- High level Radioactive Waste (RW) containing spent fuel will be under IAEA safeguards
- Specific Safeguards approach of high level RW should be developed (Verification, Inspection for all phases: Fuel transfer, encapsulation etc.)
- Unauthorized removal or sabotage of intermediate and high level RW shall be addressed:
  - Current work to establish a link between the nuclear security requirements found in NSS Nos.11 and 14, and the recommendations of NSS No.13.
  - RW must be characterized (Chemical and Physical) to determine the radiological consequences and the associated nuclear security protection requirements

THANK YOU

nuclearsafety.gc.ca