Safeguards by design for Small and Medium-sized or Modular Reactors

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IAEA: Atoms for Peace and Development

promoting the safe, secure, and peaceful use of nuclear technologies since 1957
Purpose of IAEA safeguards

...provide credible assurance that States are honouring their legal obligations that nuclear material is being used only for peaceful purposes.
Safeguards agreements

Safeguards agreements in force in 182 States:

- 174 Comprehensive Safeguards Agreements (CSA): non-nuclear weapons States
- 5 Voluntary Offer Agreements (VOA): nuclear weapons States
- 3 “item-specific” agreements: non-NPT States

Additional protocol in force in 135 States:

- provides additional information about a State’s nuclear fuel cycle and related activities (addresses completeness of a State’s declaration)
Safeguards objectives

For States with a comprehensive safeguards agreement (CSA):

- Detect diversion of declared nuclear material in declared facilities or “locations outside of facilities” (LOFs)
- Detect undeclared production or processing of nuclear material in declared facilities or LOFs
- Detect undeclared nuclear material or activities in the State as a whole
Safeguards in-field measures

Nuclear Material Accountancy
- To verify State’s declaration of nuclear material inventory and flow (e.g. item counting, weighing, non-destructive assay)

Containment and Surveillance
- To maintain continuity-of-knowledge (e.g. cameras, seals) between inspections

Design Information Verification
- To verify State’s declared facility design (construction, operation, modification or decommissioning)

Complementary Access
- To assure “completeness” of declaration: i.e., absence of undeclared nuclear material or activities

https://www.iaea.org/topics/safeguards-and-verification
Safeguards by design (SBD)

- Integration of safeguards considerations into the design process (new or modified facility) from initial planning through design, construction, operation, waste management and decommissioning

- Goal is **AWARENESS**: making all stakeholders (State, designer, operator, other IAEA departments) aware of SG obligations, and opportunities for early discussion with Dept. of Safeguards.
Benefits of SBD

SBD benefits all parties involved, not just the IAEA

- Reduce **operator burden** by optimizing inspections
- Reduce need for **retrofitting**
- Facilitate **joint-use-equipment**
- **Increase flexibility** for future safeguards equipment installation
- Enhance possibility to use facility design/operator **process info**
- Reduce **risk** to scope, schedule, budget, and licensing
SBD is a “Facility Lifecycle” concept

- R&D Phase
- Pre-conceptual Design
- Preliminary Design
- Final Design
- Construction
- Commissioning
- Operation
- Refurbishment
- Decommissioning
Staying ahead of the game: fuel cycle challenges

- **New fuels:** Th/U-233, RepU, MOX, TRU fuels, ...
- **New reactors:** Molten Salt Reactors (MSRs), fast reactors, transportables, PBMRs, ...
- **New fuel cycles:** Pyroprocessing and any breakthroughs in Reprocessing / Recycling related to SMR fuels, ...
- **Longer operation cycles** between refuelling (SMRs): issue around core and key component access
- **New waste management** technologies, and deep geologic repository development

- IAEA verification capabilities must keep pace
Safeguards by design (SBD) guidance

www.iaea.org/topics/assistance-for-states/safeguards-by-design-guidance
Questions?
Contact

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