

Safeguards by design: Industry's role in customer nonproliferation compliance

RIC2024, Rockville, MD – March 12, 2024

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Safeguards awareness: a new priority



SMRs, advanced reactors:

- Novel technology and deployment models: need for new safeguards approaches, measures and equipment



Back-end management:

- Novel processes, large volumes: preparation needed for safeguards measures and termination on waste

Role of IAEA safeguards

Credible assurance that countries are honouring their international obligations (under the NPT) not to divert nuclear material from peaceful use to a nuclear weapon (or other nuclear explosive device).



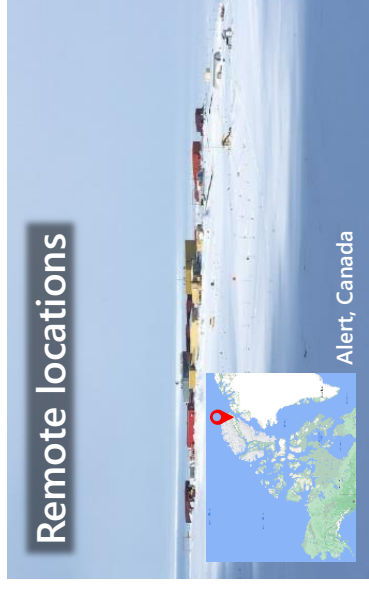
- In safeguards planning scenarios, the State is the prime 'actor'.
- In non-nuclear weapon states (NNWS) the IAEA needs to verify both declared material and lack of undeclared material.

The challenge:

- A new nuclear facility in a non-nuclear-weapon State (NNWS) will need to be safeguarded **when deployed**
 - *regardless of the size, complexity, accessibility, owner/operator or supplier of the technology*
- Many vendors are not aware of the significance of this **customer requirement**
 - *lack of awareness of international safeguards, or perception that it doesn't impact design*
- Advanced reactors may require **advanced safeguards** (which requires R&D... and time)
 - *new core/fuel designs, plant layouts, SF management, fuel cycle facilities, IAEA equipment*
- Enhanced security and 'inherent' PR **do not necessarily mean simpler safeguards**
 - *'safeguardability': often overlooked external component of PR*

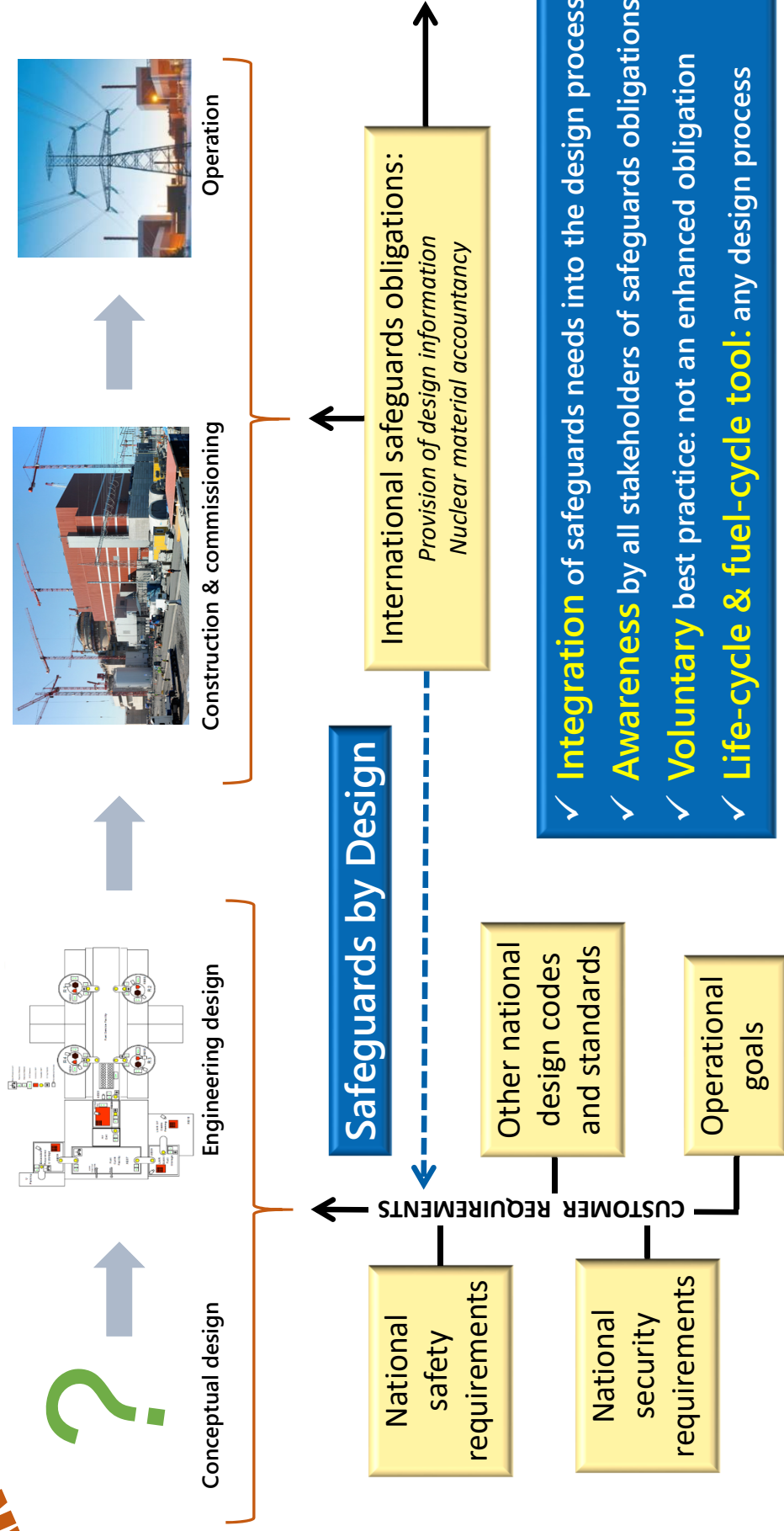


We need to be ready to safeguard these:



WANTED:

Efficient, effective safeguards



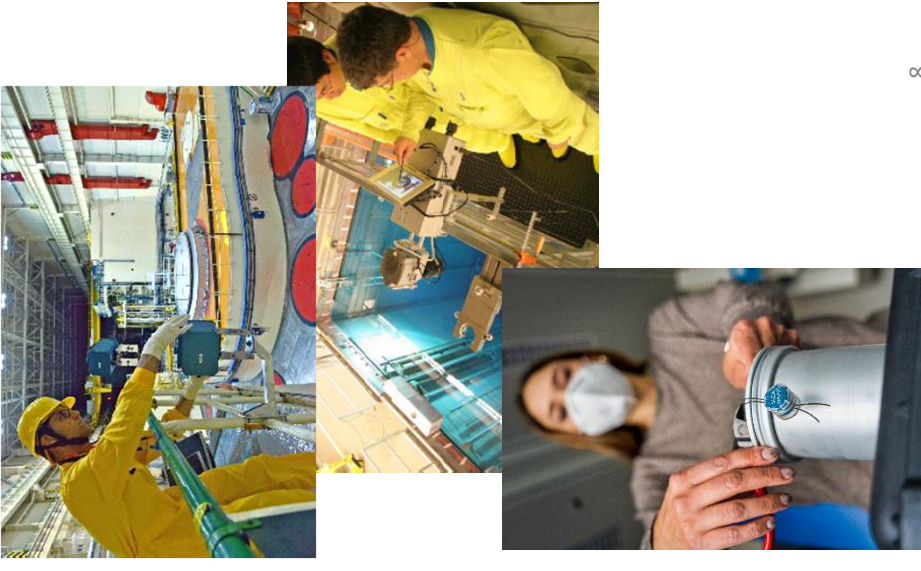
Benefits of safeguards by design

- ✓ Reduce **operator/IAEA** burden by optimizing (reducing) inspections
- ✓ Enhance possibility to use advanced technology like **unattended monitoring systems (UMS)**, and **remote data transmission (RDT)**
- ✓ Reduce need for **retrofitting**
- ✓ Facilitate **shared used of operator equipment and process information**
- ✓ **Increase flexibility** for future safeguards equipment installation



Benefits of safeguards by design (cont'd)

- ✓ **Avoid conflicts and leverage synergies** with safety and security
- ✓ Facilitate **termination of safeguards** on radwaste
- ✓ **Reduce risk** to scope, schedule, budget
- ✓ **Better understanding** of customer's needs (operator, State authority): *"it's just good design engineering"*
- **SBD benefits all stakeholders, not just the IAEA**



Suggestions to US industry and R&D community

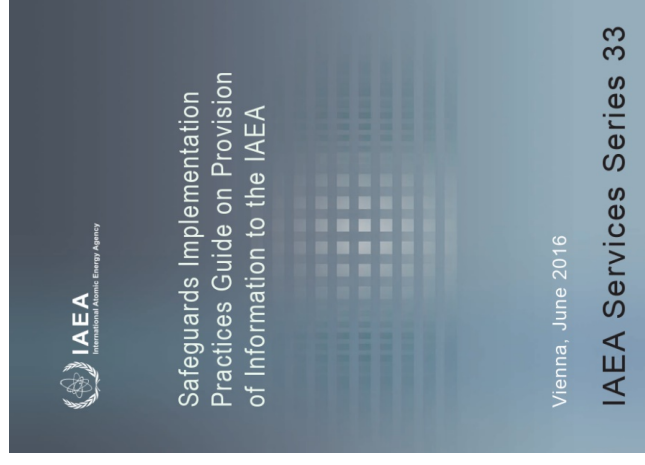
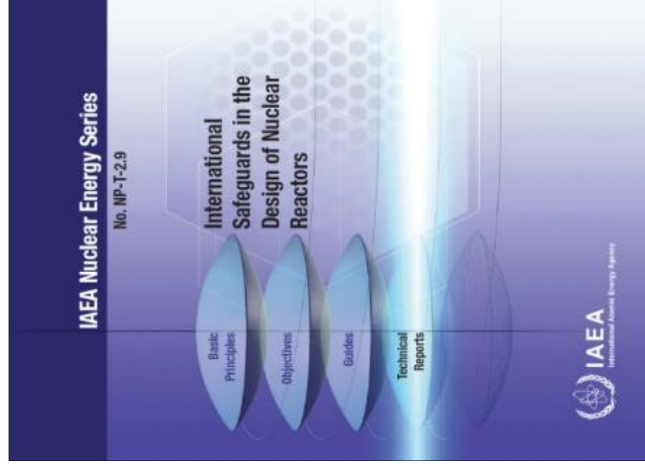
- **Raise awareness** of international safeguards in design community, engage with IAEA
- Consider the value of having **one design that is applicable to all customers**
- Consider possibility of **VOA acceptance of innovative facilities** by the IAEA
- Consider **impact of IAEA safeguards needs** in near-term designs (e.g., conventional C/S equipment installation, accommodation for IAEA seals on containers)
- Consider **impact of evolutionary 'concepts of operations'** on safeguards implementation (e.g., multiple modules, smaller footprints, remote monitoring)
- Support development of **advanced NDA equipment** and other measures for bulk and on-line fuelled designs (~10 year lead time)



IAEA safeguards-by-design (SBD) guidance



Safeguards





Thank you for your attention!



Safe, secure, peaceful use of nuclear energy

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Dr. Jeremy Whitlock is a Senior Technical Advisor in the Department of Safeguards at the IAEA, with three decades' experience as a scientist and manager in the Canadian and international nuclear community. Prior to moving to the IAEA in 2017 he spent 22 years at Canadian Nuclear Laboratories as a reactor physicist and manager of non-proliferation R&D.

Dr. Whitlock received a B.Sc. in Physics from the University of Waterloo (1988), and an M.Eng. and PhD in Engineering Physics (reactor physics) from McMaster University (1995).

Dr. Whitlock is a Past President, Fellow, and former Communications Director of the Canadian Nuclear Society. Since 1997 he has maintained *The Canadian Nuclear FAQ* (www.nuclearfaq.ca), a personal website of frequently-asked questions (FAQs) on Canadian nuclear technology.

Dr. Whitlock lives in Vienna, Austria, and feels that canoes are the closest humans have come to inventing a perfect machine.



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Additional slides

How can design make safeguards easier?

Verification of Nuclear Material Accountancy

- To verify State's declaration of nuclear material **inventory and flow** (e.g. item counting, weighing, non-destructive assay)
- Can involve **inspections** or **remote monitoring of unattended equipment**

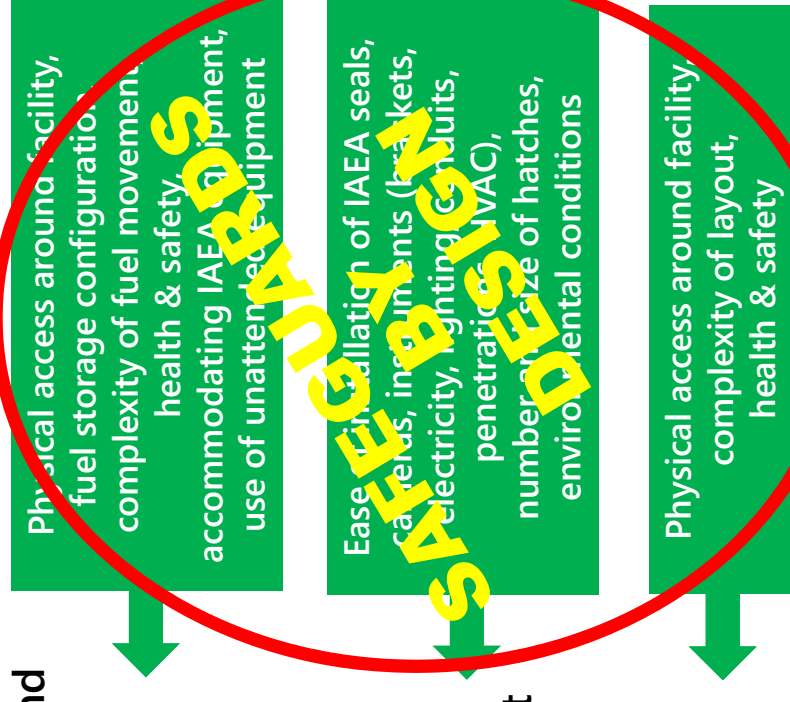
Containment and Surveillance

- To maintain **continuity-of-knowledge** (e.g. cameras, seals, measurements) between inspections
- Can involve **remote monitoring of unattended equipment**

Design Information Verification

- To verify State's **declared facility design** (construction, operation, modification or decommissioning)

SAFEGUARDS-RELATED DESIGN CONSIDERATIONS:



SBD: IAEA activities

- **SMR Member State support program tasks:**

- *Russia, South Korea, US, Canada, Finland, France, China*
- Technologies include FNPP, integral PWR, MSR, PB-HTR
- Goal is to work with Member States to:
 - evaluate design aspects that impact safeguards
 - investigate safeguards implementation strategies



- **Internal IAEA collaborations:**

- IAEA SMR Platform (single point of contact for Member States)
- Dept. of SG SBD Working Group (Safeguards, Nuclear Energy, Nuclear Safety and Security)
- Other internal collaborations with NE and NS (e.g., 3S interfaces in Design Safety Reviews)

- **External engagements:**

- Raising awareness with stakeholders through third-party interactions and collaborations