The European Commission's Science and Knowledge Service

Joint Research Centre

Some of JRC R&D activities supporting nuclear safeguards and non-proliferation

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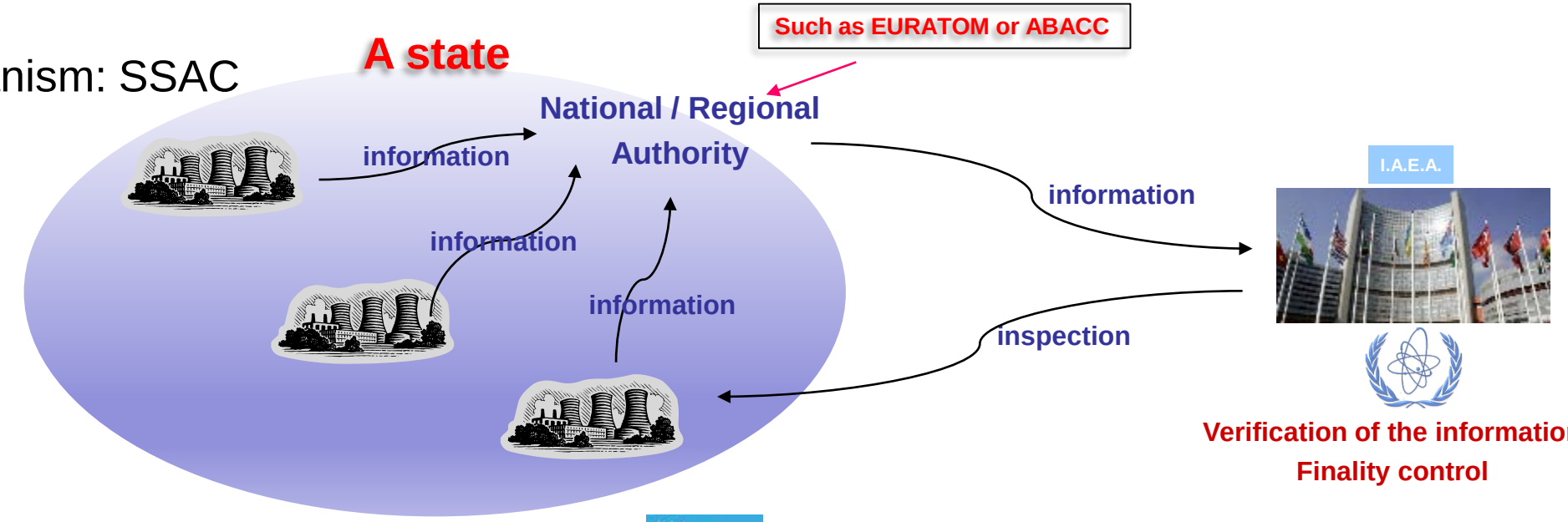
Safeguards what are for and how do they work?

Safeguards are **a set of activities and measures** to verify that a **State is complying** with its international obligations to not use nuclear material for nuclear weapons.

The safeguards system is based on assessment of the **correctness** and **completeness** of the **State's declarations** concerning nuclear material and nuclear-related activities.

Mechanism: SSAC



Horizon 2020 – the 'Euratom Programme' (Regulation (EURATOM) No 1314/2013)

- Integral part of Horizon 2020
- Years 2014-2018
- JRC - direct actions

JRC Multi-annual Work Programme 2014-2018

- Improve nuclear safety including: fuel and reactor safety, waste management and decommissioning, and emergency preparedness
- Improve nuclear security including: nuclear safeguards, non-proliferation, combating illicit trafficking, and nuclear forensics
- Raising Excellence in the nuclear science base for standardisation
- Foster knowledge management, education and training
- Support the policy of the Union on nuclear safety and security and the related evolving Union legislation

JRC Support to Euratom Safeguards (Euratom Treaty Chap. VII)

- JRC scientific and technical support for over 50 years
- Technical areas include:
  - Non-destructive analysis
  - Methods and standards for samples analysis
  - Containment and surveillance techniques
  - Enhanced process monitoring and modelling
  - Operational support to Euratom inspection regime
  - Operation of analytical on-site laboratories
  - Provision of training

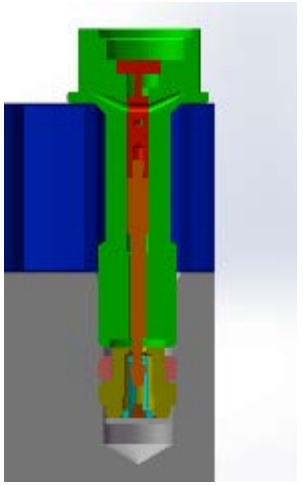
European Safeguards Research and Development Association (ESARDA)

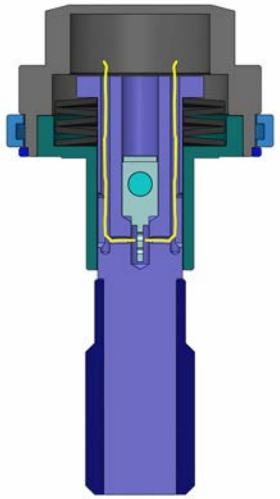
- Collaboration with major partners in EU involving European operators, regulators and researchers

Containment and Surveillance techniques

Development of Advanced Sealing & Identification Systems

- **Ultrasonic Optical Sealing Bolt for Castor V casks (Long Term Interim Storage)**
- **Operator Applied & Removed Seals for transport casks (Encapulation Plant & Geological Repository)**
- **Copper Canister Ultrasonic Identification & Integrity reading system (Geological Repository in Sweden)**



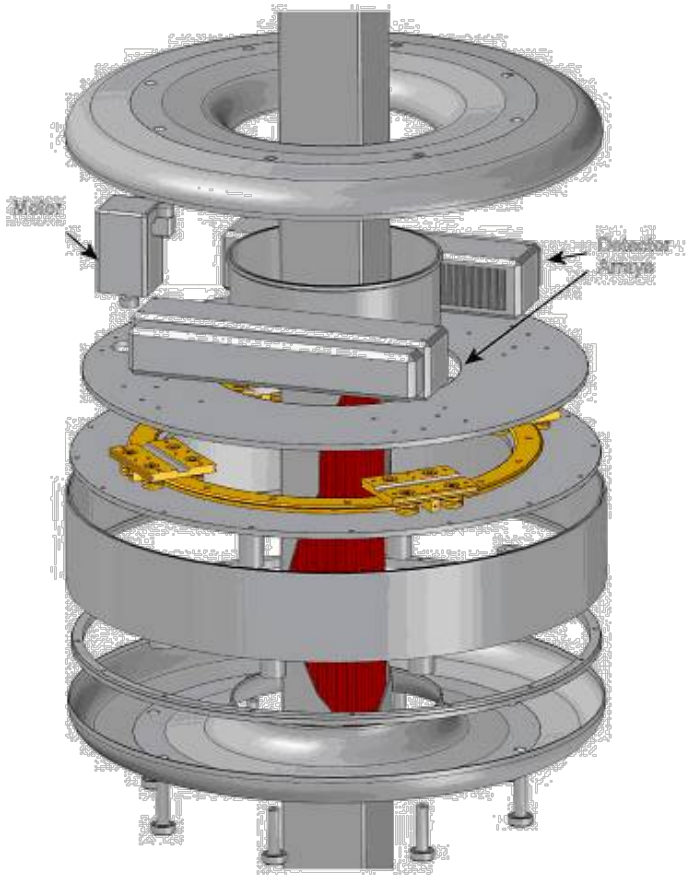


Passive Gamma Emission Tomography (PGET) for partial defect prior to transfer to difficult to access storage

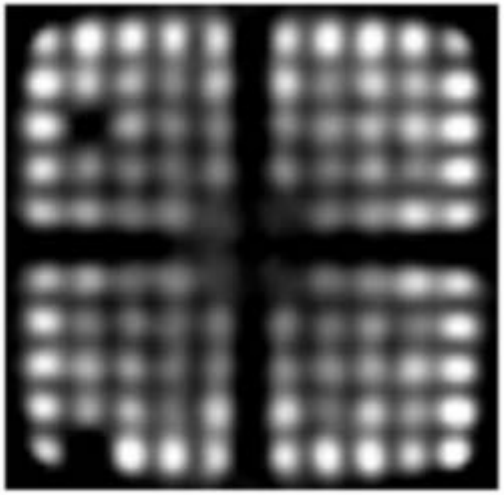
- Complementary to Fork detector
- Can confirm completeness of fuel assemblies
- IAEA authorization in 2018
- Neutron measurement capability
- Equipped with 172 CZT detectors
- Cooperation SP to the IAEA with

US / Sweden / Finland / EC

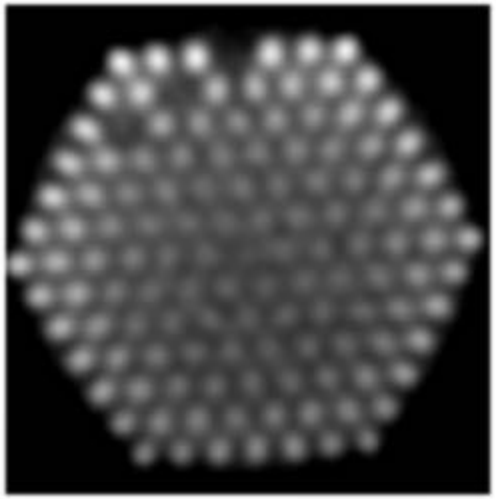
- Target: pin-level integrity verification of SF



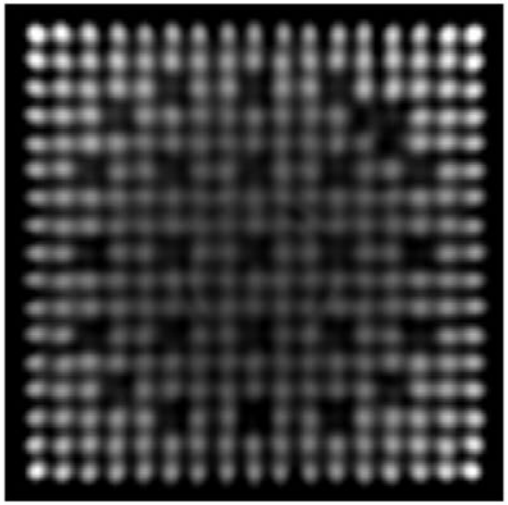
NDA development
Encapsulation Plants



BWR

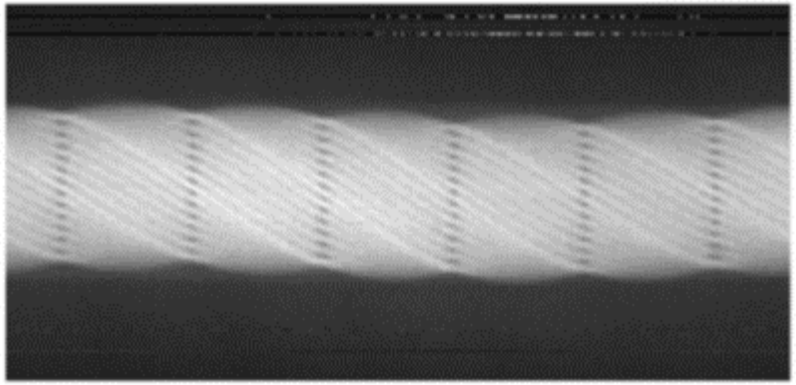


VVER

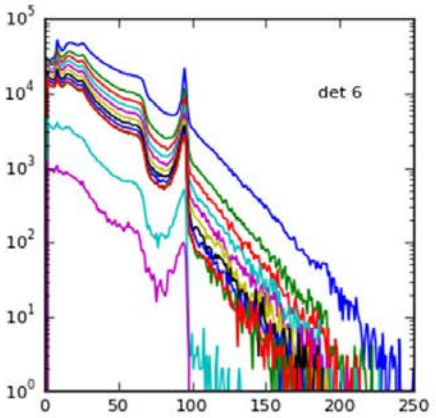


PWR

VVER Sinogram



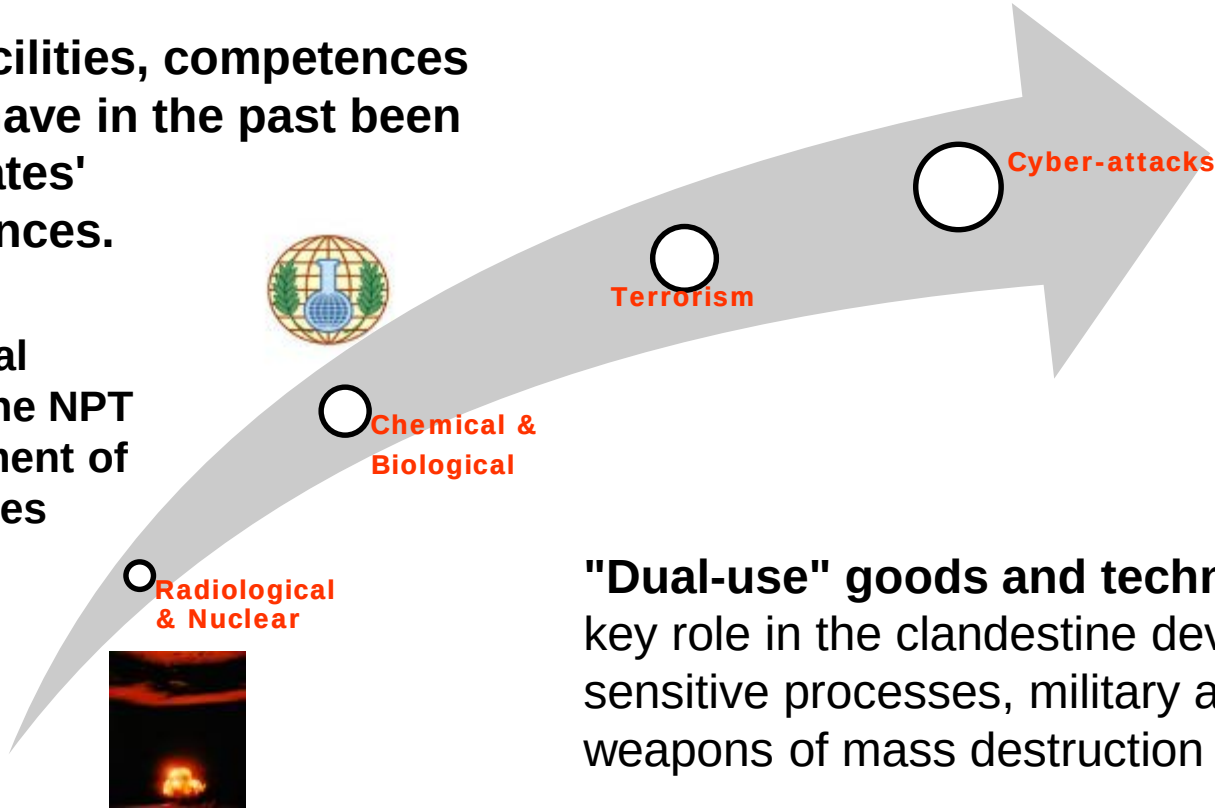
Spectrometric features



Strategic Dual-Use Trade Control
Implementation and Knowledge Management
for Non-Proliferation of Weapons of Mass Destruction and other Threats

Sensitive turn-key facilities, competences as well as weapons have in the past been transferred under States' agreements and alliances.

The stricter international framework started by the NPT has made the development of proliferation programmes more difficult



"Dual-use" goods and technologies play a key role in the clandestine development of sensitive processes, military applications and weapons of mass destruction

Strategic Dual Use Trade Control Implementation and Knowledge Management activities at EC JRC

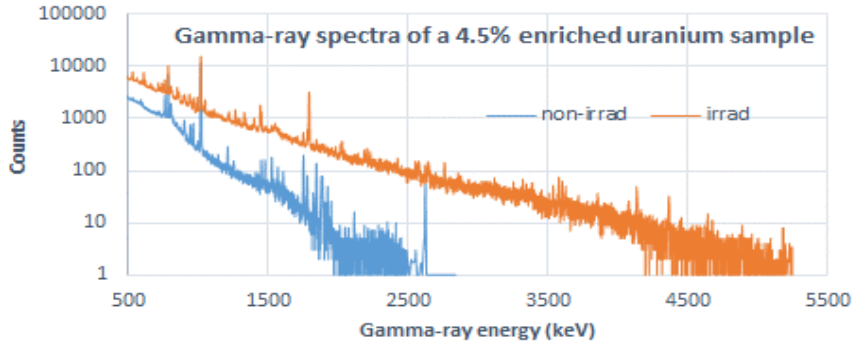
- Support the development and implementation of strategic trade control policy
- Capacity building for national authorities
- Technical advices to EU national authorities and COM services
- Contribution to definition and evaluation of EU cooperation with third countries
- Research on key elements of the strategic trade control process
- Strengthen partnerships and networking

An example of an International Collaboration: Development of an NDA technique for safeguards

JAEA DGS experimental set-up being tested in JRC Ispra

Application of the DGS technique

Preliminary system using Cf-252 as a surrogate for a pulsed neutron generator



The remote operation of the system is considered!

Concluding Remarks

- ✓ R&D is a key to successfully face safeguards, security and safety new challenges that emerged from the drastic global change of the nuclear community (new build, transportable/relocatable NPPs, small modular reactors, GEN IV, …). The new emerging technologies (big data, digitization, virtual/augmented realities (AR/VR), blockchain, …) will play an important for the coming needs.

- ✓ Networking at regional and international level enhance cooperation for a global capacity building not only in safeguards but in 3S as a whole.

- ✓ Last and not least, education, training and knowledge management, human resources development (human, finance, infrastructure) are important pillars for safeguards new capabilities building.

Thank you for your attention!