IAEA Safeguards

Trusted positioning data for IAEA safeguards

Massimo Aparo

IAEA Deputy Director General and Head of the Department of Safeguards

September 2023

Overview

IAEA Safeguards

- Background of IAEA safeguards
- IAEA cooperation with the European Space Agency

IAEA safeguards

IAEA Safeguards

- The IAEA safeguards system is designed to verifying States' legal undertakings to use nuclear material for exclusively peaceful purposes

- The IAEA implements safeguards on the basis of legally binding safeguards agreements and protocols between the State and the IAEA

- Under these instruments, States declare their nuclear material and activities to the IAEA, and the IAEA verifies the correctness and completeness of these declarations

IAEA verification of State declarations

IAEA Safeguards

State-declared information

- Nuclear material inventories
- Nuclear fuel cycle-related activities

Information from Agency verification activities

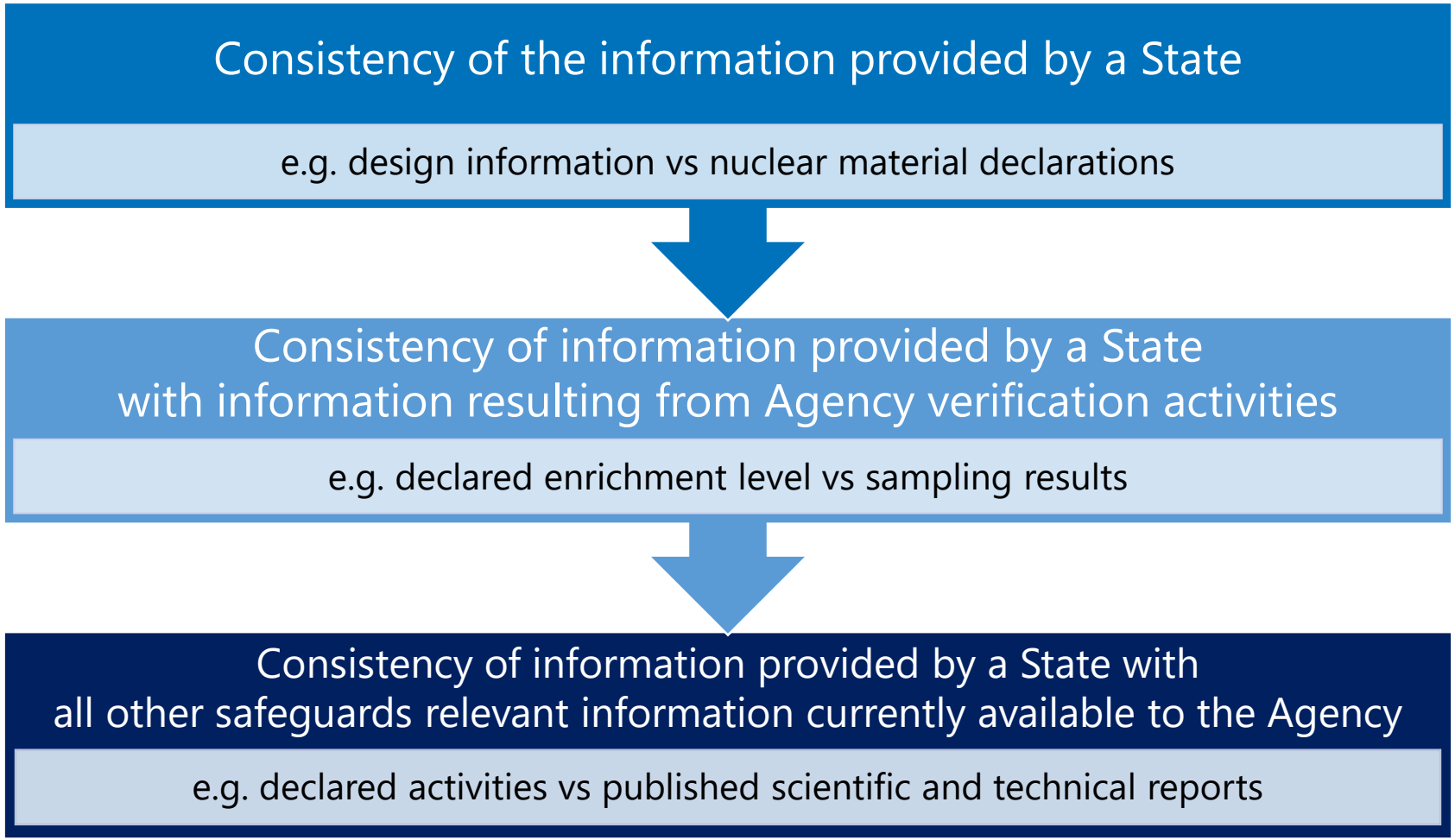
- Inspections
- Design Information Verifications
- Complementary Accesses
- IAEA monitoring systems installed at nuclear facilities

Other Safeguards relevant information

- Open source information
- Satellite imagery
- Trade information
- Third party information

Three levels of consistency analysis

to assess State declarations



Safeguards at a glance

IAEA Safeguards

2022

safeguards implemented in **188 States** of which **140 States** had additional protocols in force

1,353

nuclear facilities & locations outside facilities under safeguards

Offices

HQ Vienna, laboratories in Seibersdorf, regional offices in Canada & Japan

230,754

significant quantities of nuclear material under safeguards

858

staff from 95 countries

Safeguards at a glance

IAEA Safeguards

2022

1,240
non-destructive assay systems deployed

159
facilities with remote monitoring systems

2,975
in-field verifications involving
14,066 days
and
271 days
under quarantine in country

1,120
samples collected

25,600
seals verified

1,414
surveillance cameras

Scenario for accessing a remote location of interest

Short-notice access to a new location

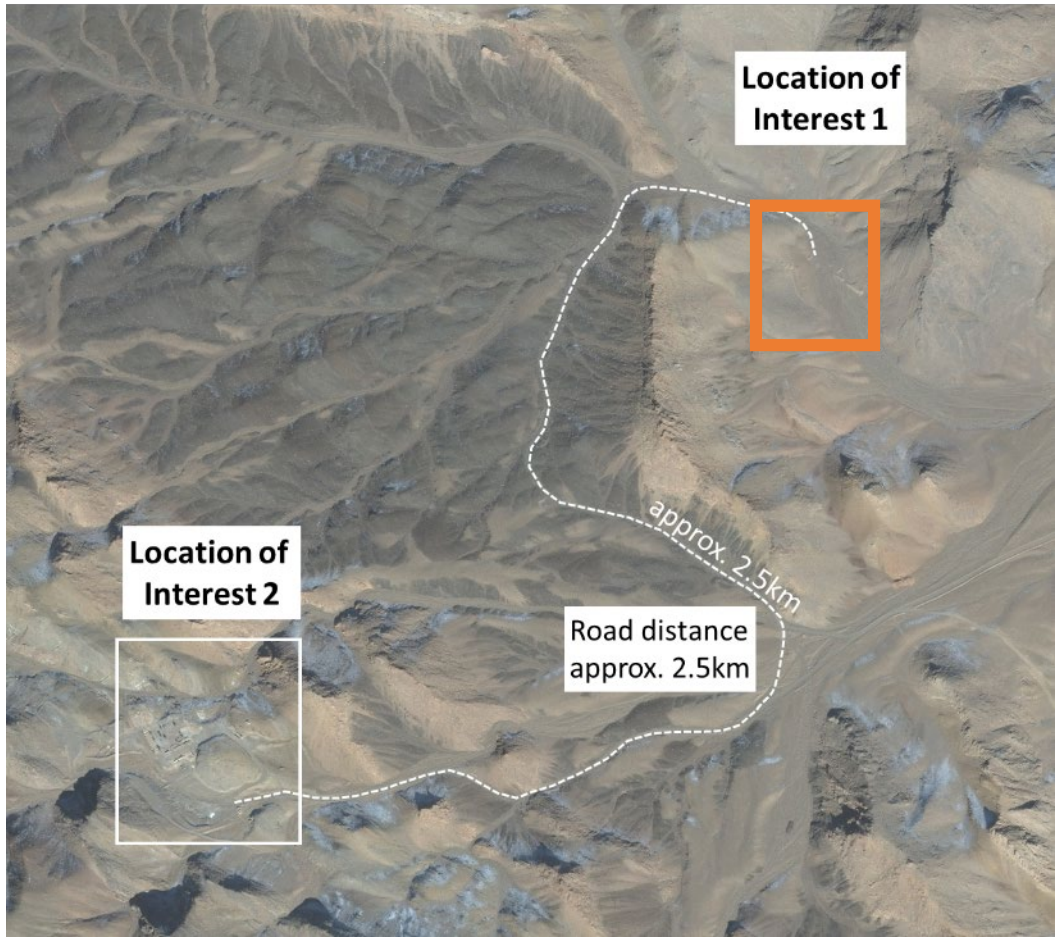
- Preparation at IAEA HQ, based on satellite imagery and open source information (GPS coordinates, images, descriptions, etc.)

- The location, possibly in a remote area, has not been visited by the IAEA before

- Access is organized by the State, assumed by principle as a non-cooperative party

How can the IAEA independently confirm a visit to the location of interest (GPS spoofing)?

IAEA Safeguards



Scenario for remote data collection

Remote access and data transmission

- Secure data is transmitted from unattended monitoring systems to IAEA HQ
- Unattended measurements are performed by a third party

How can the IAEA authenticate the location of remote measurements?

Scenario of a field visit by IAEA inspectors

Use of the **Multi Component Inspector Kit (MCIK)**

- MCIK is a modular set of instruments used in the field by IAEA safeguards inspectors for Complementary Access visits
- All data collected in the field are timestamped and geotagged for analysis and archiving by the IAEA

How can the IAEA authenticate time and position for each measurement point?

Back Pack Radiation Monitoring

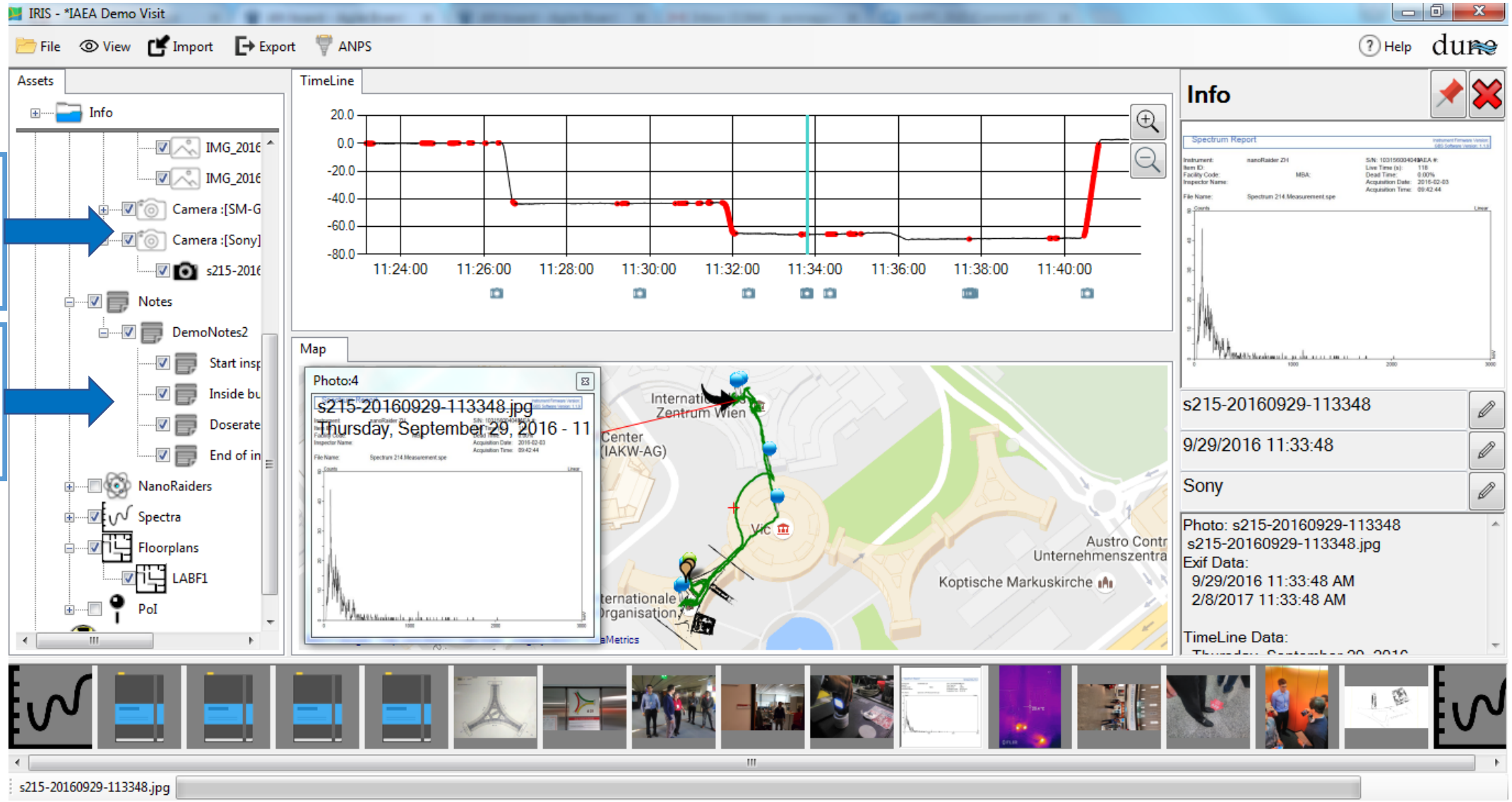
Indoor inertial positioning

Gamma camera

Thermal/visible camera

Instruments

Authenticated PNT device



Instrument data collected and organized in the IAEA's IRIS system

(Instrument Record Integrator for Safeguards)

IAEA and ESA cooperative project

- Set of contextual usage scenarios prepared by the IAEA for NAVISP
  - Confirmation of a site location
  - Authentication of outdoor data
  - Geolocation for outdoor survey
- Trust but verify
  - Trusted positioning, navigation, and timing data generated by field instruments strengthen the IAEA's ability to draw credible, impartial and technically sound safeguards conclusions about the peaceful use of nuclear material

IAEA Safeguards

Questions?