IMPLEMENTATION OF SAFEGUARDS AND ITS STRATEGIES

BY

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OUTLINE OF THE PRESENTATION

OBLIGATIONS UNDER THE NPT
WHAT IS IAEA SAFEGUARDS
STRENGTHENED SAFEGUARDS
SAFEGUARDS UNDERTAKINGS OF STATES
CONCEPTS AND DEFINITIONS
IAEA VERIFICATIONS
  Specific examples of verification activities
SAFEGUARDS CONCLUSIONS
  Prospects of broader conclusion
CHALLENGES
CONCLUDING REMARKS
OBLIGATIONS UNDER NPT

Under the NPT, governments have committed to three common objectives:

- preventing the proliferation of nuclear weapons
- pursuing nuclear disarmament
- promoting the peaceful uses of nuclear energy

The NPT has made it obligatory for all its non-nuclear weapon State parties to submit all nuclear material in nuclear activities to IAEA safeguards, and to conclude a comprehensive safeguards agreement with the Agency.
WHAT IS IAEA SAFEGUARDS

Safeguards are a set of activities by which the IAEA seeks to verify that a State is living up to its international undertakings not to use nuclear programs for nuclear weapons purposes. The safeguards system is based on assessment of the correctness and completeness of the State’s declarations to the IAEA concerning nuclear material and nuclear-related activities.
WHAT IS IAEA SAFEGUARDS (cont’d)

Purpose of IAEA Safeguards

- Verify Compliance with Safeguards Agreements
- Detection of undeclared Nuclear Material and Activities
- Timely detection of diversion and deterrence through risk of early detection

Assurance about the exclusively Peaceful use of NM and Facilities in States
Strengthened safeguards

The strengthened safeguards system, based on “comprehensive” safeguards agreements and “additional protocols” to those agreements, has established a new and higher standard for effective and efficient cooperative verification of States’ nuclear undertakings.
STRENGTHENED SAFEGUARDS

Integrated Safeguards -
Optimum combination of all SG measures available to achieve maximum effectiveness and efficiency within available resources.
WHY STRENGTHENED SAFEGUARDS (Infcirc153 + Infcirc 540)

There is a need for Infcirc 540(corrected) because Infcirc 153(corrected) alone, has the following limitations:

• Provides assurance mainly regarding the correctness of State’s declaration but not completeness
• Limited monitoring coverage
• Focus is on declared materials at strategic points in declared facilities
WHY STRENGTHENED SAFEGUARDS (Infcirc153 + Infcirc 540)

• Assumes a State declares everything
• Does not prevent a State from under-declaring its initial inventory
• Does not prevent a State from building secret facilities
  
  Full implementation of measures of infcircs 153(corrected) and 540(corrected) leads to broader conclusion and integrated safeguards
UNDERTAKINGS OF STATES UNDER THE SAFEGUARDS AGREEMENTS

- The Agreement should provide that the State shall:
  - Establish and maintain a State System of Accounting for Control of all nuclear material (SSAC) subject to Safeguards under the Agreement and
  - Assign SSAC the authority and responsibility for
    - establishing provisions for possessing, transfer and use of nuclear material
    - ensuring that the State’s nuclear material accounting and control objectives are met
    - enabling the State to discharge its obligations under the IAEA Safeguards Agreement.
UNDERTAKINGS OF STATES UNDER THE SAFEGUARDS AGREEMENTS

INFCIRC 153(corrected)

• Precise and complete declarations on nuclear material and facilities including defining Material Balance Areas and Key Measurement Points
• Provide reports to the IAEA e.g. Inventory Change Reports, Material Balance Reports etc
• Provide design information to the IAEA including early design information
• Facilitated the IAEA inspections and visits including providing the designations of inspectors, the required access and notifications, the inspection activities and use and installation of equipment etc
UNDERTAKINGS OF STATES UNDER THE SAFEGUARDS AGREEMENTS (cont’d)

INFCIRC 540 (corrected)
Provide expanded declarations to the IAEA:
• Fuel Cycle-related R&D not involving NM
• Nuclear “Sites”
• Manufacturing of equipment
• Uranium Mines and Uranium and Thorium Concentration Plants
• Stocks of source material
• NM exempted from SG
• Nuclear waste on which SG has been Terminated
• Exports of specified equipment and non-nuclear material
• Future plans for nuclear fuel cycle development
EXPANDED LEGAL AUTHORITY

Safeguards coverage under a Comprehensive Safeguards Agreement

Expanded coverage with an Additional Protocol
UNDERTAKINGS OF STATES UNDER THE SAFEGUARDS AGREEMENTS (cont’d)

INFCIRC540 (corrected)

Enhanced inspector access (Complementary Access (CA))

• on a site in conjunction with any inspection with 2-hour notice;
• on a site in conjunction with any DIV visit with 2-hour notice;
• independently from inspections or visits on sites or locations with 24-hour notice
Complementary access is:

- the right to go to certain additional locations in a State for specific reasons as provided for by an additional protocol
- exercised by the Agency on a selective basis

Complementary access is **not**:

- an inspection
- a right to go anywhere in a State for any reason whatsoever
UNDEARTAKINGS OF STATES UNDER THE SAFEGUARDS AGREEMENTS (cont’d)

INFCIRC 540 (corrected)

• Agree on the use of New technical measures e.g. Collection of environmental samples beyond declared sites

• Administrative arrangements
  ✓ Improved inspector designation process
  ✓ Granting of Visas
  ✓ Access to communication systems
STATUS OF ADDITION PROCOLS FOR STATES WITH SAFEGUARDS AGREEMENT IN FORCE

DPRK is not included.
CONCEPTS AND DEFINITIONS

Material Category and Form

Material Form

– According to physical form:
  • Item material - Identifiable unit (e.g. fuel assembly, rod, plate)
  • Bulk material - In loose form (e.g. liquid, powder, pellets)
  • Other nuclear material (non-fuel)
CONCEPTS AND DEFINITIONS

Table of Significant Quantities

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SIGNIFICANT QUANTITY (SQ)</th>
<th>SAFEGUARDS APPLY TO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct-use nuclear material</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pu (Pu with Pu(^{238} &lt; 80%))*</td>
<td>8 kg</td>
<td>Total element</td>
</tr>
<tr>
<td>U(^{233})</td>
<td>8 kg</td>
<td>Total isotope</td>
</tr>
<tr>
<td>HEU (U(^{235} &gt; 20%))</td>
<td>25 kg</td>
<td>U(^{235}) contained</td>
</tr>
<tr>
<td><strong>Indirect-use nuclear material</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEU (U(^{235} &lt; 20%))</td>
<td>75 kg</td>
<td>U(^{235}) contained</td>
</tr>
<tr>
<td>Th</td>
<td>20 t</td>
<td>Total element</td>
</tr>
<tr>
<td>NU</td>
<td>10 t</td>
<td>Total element</td>
</tr>
<tr>
<td>DU</td>
<td>20 t</td>
<td>Total element</td>
</tr>
</tbody>
</table>

* Pu\(^{238}\) SG Exemption - SMR SG Policy Series #17 para 1.c
CONCEPTS AND DEFINITIONS

Timeliness Goal

Period of timely detection of a diversion

– Unirradiated direct-use material: 1 month
  (Pu or HEU fresh fuel)

– Irradiated direct-use material: 3 months
  (Core fuel or Spent fuel)

– Indirect-use material: 12 months
  (LEU fresh fuel)

– Direct-use material types less 12 months than 1 SQ:
CONCEPTS AND DEFINITIONS

GENERIC TECHNICAL OBJECTIVES AT STATE LEVEL

**Objective A**
To detect undeclared nuclear material and activities

**Objective B**
To detect undeclared production or processing of nuclear material

**Objective C**
To detect diversion of declared nuclear material

**STATE AS A WHOLE**
This objective is achieved through evaluating State declarations and all safeguards-relevant information available to the Agency and performing activities in the field.

**DECLARED FACILITIES AND LOFS**
This objective is achieved through evaluation and performing activities at declared facilities and LOFs.

This objective is achieved through evaluating State accounting reports and performing activities at declared nuclear facilities and LOFs to verify inventories and flows of declared nuclear material.

**Activity common to the three Objectives**
Follow-up on questions, discrepancies, anomalies and inconsistencies identified when performing activities necessary to meet the above objectives.

Follow-up activities are defined and carried out in order to ascertain whether the identified discrepancies, anomalies and inconsistencies indicate the possible presence of undeclared nuclear material or activities or diversion of nuclear material from peaceful activities.
CONCEPTS AND DEFINITIONS
ACQUISITION PATHS ANALYSIS

- Physical model: Indicators for each step of the nuclear fuel cycle
- Comparison of the capabilities of the State’s actual nuclear fuel cycle and infrastructure with what would be needed to acquire a nuclear weapon
- Identification of potential pathways for the state to acquire/produce nuclear material for use in nuclear weapon
- Identify indicators for each step of the potential pathways
CONCEPTS AND DEFINITIONS

PHYSICAL MODEL TEMPLATE OF STATE’S NUCLEAR ACTIVITIES

MINING & MILLING
- U
- Th

CONVERSION
- CONV.1
- CONV.2

RESEARCH CENTER AND LABORIES

FUEL FABRICATION
- U metal
- UO₂
- MOX
- experiment

HEAVY WATER PRODUCTION

ENRICHMENT
- GAS CENT
- GAS DIFF
- AERO
- MLIS
- EMIS
- CHEMEX
- IONEX
- AVLIS
- PLASMA

RESEARCH REACTORS & CRITICAL ASSEMBLIES
- Research Reactor
- Critical Assem
- Pu Production
- Naval

POWER REACTORS
- GCR
- AGR
- HTGR
- LWGR
- LWR
- HWR
- FAST

SPENT FUEL STORAGE & DISPOSITION

NUCLEAR WASTE

REPROCESSING
- Non-Aqueous
- Aqueous
IAEA ACTIVITIES

Design and Implementation of Safeguards Approach

- Field Operations
- Inspection Reports, Samples, etc.
- State Reports
- Statements
- Evaluation Conclusions
- Effectiveness Evaluation
- Safeguards Implementation Report
Verification

• Routine inspections **Routine inspections**
  – Inspections performed by Agency at a facility or location outside facility after a Subsidiary Arrangement has entered into force

• Special inspections
  – Inspections that are either additional to the routine inspection effort or if they involve access to information or location in addition to the access specified for ad hoc and routine inspections, or both
IAEA ACTIVITIES (cont’d)

• Complementary access is:
  – the right to go to certain additional locations in a State for specific reasons as provided for by an additional protocol
  – exercised by the Agency on a selective basis
FACILITIES AND LOCATIONS OUTSIDE FACILITIES UNDER SAFEGUARDS
SIGNIFICANT QUANTITIES OF NUCLEAR MATERIAL UNDER SAFEGUARDS
SAFEGUARDS BUDGET

*Expenditures at budget exchange rate of €1.0 to $1.00*
IAEA ACTIVITIES (cont’d)

VERIFICATION

• Examination of records and reports
• Physical inventory verification
• Verification of domestic and international transfers (inventory change verification)
• Confirmation of absence of unrecorded production of direct-use material
• Verification activities at interim inspections for timely detection
• Design information Verification (Early Provision of Design Information)
IAEA ACTIVITIES (cont’d)

- VERIFICATION
- Visual observation
- Environmental sampling
- Radiation detection and measurement devices
- Placement of seals, and other identifying and tamper-indicating devices
- Information analysis and evaluation
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

NUCLEAR MATERIAL ACCOUNTANCY (NMA)

Records Examination, Book Auditing

Item Identification and Counting
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

WEIGHING OF NUCLEAR MATERIAL

Load-Cell

To measure large quantities of material, e.g., uranium, particularly UF$_6$ mass in cylinders (“weight”)
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

CONTAINMENT AND SURVEILLANCE (C/S)

Sealing

Containment

Surveillance

Cameras
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

SEALING
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

Containment and surveillance

PWR
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

SEALS VERIFICATION

Seals (E-type)
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

SPENT FUEL VERIFICATION

ICVD

To verify spent fuel assemblies at Nuclear Power Plants
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

DCVD Use
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

Fuel Element Lowered into UNCL
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)
PLUTONIUM ISOTOPE MEASUREMENTS

HLNC
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

RM Data Flow

Remote site

Internet

Remote Monitoring Data Center (RMDC)

SG-LAN

SQL Server

Inspector Review

Web Host

RMS Storage

Status

Firewall

Satellite Network

Vienna RM-DMZ

Job Control

Temp Storage

Network Monitoring
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

Design Information Verification

- Examined and verified according to established Agency procedures.
- Re-examined at least once a year for:
  - any facility modifications or changes in operating conditions; and
  - Developments in SG technology or experience on verification methodologies;
- Periodic verification to confirm validity of SG approach (procedures).
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

DESIGN INFORMATION

Design information is verified to assure that appropriate safeguards measures are applied and to detect potential misuse of a facility.
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

ENVIRONMENTAL SAMPLING

Swipe Sampling from Vegetation

Sampling of Surface Soil

Swipe Sampling from Process Equipment

High Volume Water Sampling with a Special Filter
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)
ENVIROMENTAL SAMPLES TOOLS

Swipe Sampling Kit

- Labels
- Pen
- Working Papers
- Gloves
- Outer Bag
- Aluminum Foil
- Bag with cotton swipe
- Large bag for double bagging
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)
IAEA CLEAN LABORATORY IN SEIBERSDORF
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

EXAMPLES OF IAEA NETWORK OF ANALYTICAL LABORATORIES

- **QinetiQ**, UK
- **AWE**, UK
- **NRG**, Netherlands
- **STUK**, Finland
- **KRI**, Russia
- **NBL**, USA
- **DOE**, USA
- **AFTAC**, USA
- **IRMM**, EC, Belgium
- **ITU**, EC, Germany
- **ANSTO**, Australia
- **STUK**, Finland
- **KFKI**, Hungary
- **CEA**, France
- **QinetiQ**, UK
- **NBL**, USA
- **DOE**, USA
- **Anatomi**, Russia
- **JAERI**, Japan
- **NRI Rez**, Czech Rep.
- **ANSTO**, Australia

Activities:
- Analysis of nuclear materials
- Analysis of heavy water
- Analysis of environmental samples
- Provision of reference materials
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

EXAMPLES OF SATELLITES

IKONOS
Landsat
IRS
Radarsat

Space Imaging
Primary Operations Center
Remote Operations Center
Transportable Ground Station
Regional Operations Center
Regional Operations Center
Regional Operations Center
Aerial Imagery
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)
EXAMPLE OF SATELITE IMAGERY
SPECIFIC EXAMPLES OF VERIFICATION ACTIVITIES (cont’d)

EXAMPLE OF SATELLITE IMAGERY
SAFEGUARDS CONCLUSIONS

• States with comprehensive Safeguards Agreements (CSA) and Additional Protocol (AP) in force and broader conclusion drawn:
  implementation of Integrated Safeguards (IS) under approved State Level Approach (SLP)

• States with CSA and AP but no broader conclusion:
  implementation of Safeguards Criteria and AP measures

• States with CSA and no AP:
  implementation of safeguards criteria

• For all states the production of State Evaluation reports
No evidence of undeclared nuclear material

No evidence of diversion of declared nuclear material

BROADER CONCLUSION

Draw Safeguards Conclusions

Resolve Open Issues

Evaluate State
Questions, Follow-up Actions, Assessment

Analyze and Evaluate Information

State Declared Information
- Inventory Reports
- Material Balance Reports
- Design Information
- Operating Records
- Universal (Voluntary) Reporting
- Additional Protocol (Art. 2, etc.)

Safeguards Verification Information
- Inspection Data Analyses
- Material Balance Evaluations
- Inspector Observations
- DA, NDA, ES Analysis Results
- Seals, Surveillance Data

Other Information Sources
- Agency Databases
- Scientific and Technical Literature
- Newspapers/Radio/TV/Trade Press
- Internet
- Commercial Overhead Imagery
- Any other information
PROSPECTS OF BROADER CONCLUSION

- Effectiveness and Efficiency
- Credibility and Confidence
- Transparency
- Broader Conclusion

Venn Diagram:
- Technical
- Political
- Commercial Trade

Broader Conclusion
CHALLENGES

- Spread of sensitive nuclear technologies
- Security and proliferation risks, including proliferation networks
- Emerging trend in the use of nuclear energy
- Bringing all non-nuclear weapon states (NNWS) into Comprehensive Safeguards Agreement (CSA) and Additional Protocol (AP) - universalisation
- Budgetary constraints
- Disarmament initiatives
CHALLENGES

What is needed

- Better control of access to nuclear fuel cycle technology
- Support for effective nuclear verification
- Latest verification technology
- A real commitment to disarmament
- Revisit how to deal with the three countries that remain outside of the Non-Proliferation Treaty
CHALLENGES

What is needed

- Establishing mechanisms that would assure the supply of fuel for nuclear power plants
- Developing similar assurances for acquisition of nuclear power reactors
- Facilitating the conversion of enrichment and reprocessing facilities from national to multilateral operations
- Encouraging countries to limit future enrichment and reprocessing to multilateral operations
CHALLENGES

What is needed

- Bringing all NNWS to sign CSA and AP and together become universal standard for how nuclear non-proliferation commitments are verified

- A better funding mechanism for the IAEA
CHALLENGES

What is needed

- New safeguards approaches for new challenges, new facility types and new operating conditions
- Optimizing safeguards equipment and technology development will improve present detection capability
- R&D on novel technologies for detection of undeclared activities
- Enhancing environmental sample analysis capabilities
- Enhancing satellite imagery acquisition and analysis capabilities
- Broaden and intensify information collection and analysis capabilities
- Efficient and secure safeguards information infrastructure
The IAEA plays a crucial role in building international trust and confidence by providing independent credible conclusions that States are honouring their safeguards obligations.
CONCLUDING REMARKS

As we explore application of multinational approaches, assurances of fuel supply, strengthening universal standards for the application of safeguards, and utilizing the latest available verification technologies, we look to the international community for support in the continued evolution of nuclear verification.
THANK YOU
Q&A