Overview of Safeguards, Security, and Treaty Verification

Matthew R. Sternat, Ph.D.
Sandia National Laboratories

Outline

- Introduction
- Safeguards concepts
  - Radiation measurement applications
- Security concepts
  - Radiation measurement applications
- Treaties and treaty verification
  - Radiation measurement applications
Different Strategies for Dealing with Proliferation

Stages in Proliferation

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Development</th>
<th>Achievement</th>
<th>Retirement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reduce Demand</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Security assurances</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- arms control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- regional security</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- penalties for violating norms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- minimize utility of WMD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control Supply</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- export control regimes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- IAEA safeguards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- protection of weapons and tech</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- limit production of weapons material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Respond to Threat</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- diplomacy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- offensive military and covert activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- emergency response</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- threat assessment / detection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dismantle Weapons</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- arms control / transparency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- international verification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- safe, secure material disposition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- environmental restoration</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Strategies to prevent, rollback, or mitigate consequences of proliferation

―“3S” Integration – Safeguards and Security―

**Nuclear Safety**
Operating conditions, prevention of accidents/mitigation of consequences, resulting in the protection of workers, the public, and the environment from undue radiological hazards

**Nuclear Safeguards**
Prevention and detection of theft or diversion of special nuclear material from civilian facilities through the use of material control and accountancy

**Nuclear Security**
Prevention and detection of, and response to sabotage/theft, unauthorized access, or other malicious acts involving nuclear material, other radioactive substances or their associated facilities
“3S” Integration - Safeguards

- Definition:

**Nuclear Safeguards:** “A set of measures implemented to verify that States comply with their international (i.e. Treaty) obligations not to use nuclear materials for nuclear explosives.”

- Measures include:
  - Nuclear Material Accountancy
  - Containment and Surveillance
  - Design Verification
  - Reports & Inspections

- Consider impacts on – and synergies with – nuclear safety and security...

Objectives of IAEA Safeguards

- **Objective 1:**
  - Timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or of other nuclear explosive devices or for purposes unknown, and deterrence of such diversion by the risk of early detection

- **Objective 2:**
  - The detection of undeclared nuclear material and activities in a State
Timeline of nonproliferation response

Security Outline

1. Why is there an international nuclear security regime?

2. What is the international nuclear security regime?

3. How is the international nuclear security regime implemented?
What is the International Nuclear Security Regime

- 2010-current - IAEA Nuclear Security Plan:
  - WHY?
  - WHAT?
  - HOW?

What is the International Nuclear Security Regime

- 2010-current - IAEA Nuclear Security Plan:
  - WHY?
    - “The risk that nuclear or other radioactive material could be used in malicious acts remains high and is regarded as a serious threat to international peace and security”
What is the International Nuclear Security Regime

- 2010-current - IAEA Nuclear Security Plan:
  - **WHAT?** – (1) Contribute to global efforts to secure nuclear & other radiological material in use/storage/transport and (2) assist states in implementing full range of international legal instruments for nuclear security

<table>
<thead>
<tr>
<th>Fundamental Nuclear Security Documents</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Convention on the Physical Protection of Nuclear Material</td>
<td>Only legally binding undertaking in the area of physical protection of nuclear material used for peaceful purposes</td>
</tr>
<tr>
<td>2005 Amendment to the Convention on the Physical Protection of Nuclear Material</td>
<td>Extends above protection measures to nuclear facilities/materials in peaceful domestic use, storage, or transport; expands cooperation among states regarding locating/recovering/mitigating missing material</td>
</tr>
<tr>
<td>International Convention for the Suppression of Acts of Nuclear Terrorism</td>
<td>Seeks to criminalize unlawful/intentional possession or use of nuclear materials or nuclear facility sabotage</td>
</tr>
<tr>
<td>Security Council Resolutions 1373 (2001) and 1540 (2004)</td>
<td>1373 – calls all states to become party all international instruments for nuclear security</td>
</tr>
<tr>
<td></td>
<td>1540 - calls all states to become party to the CPPNM (and amendment) and IAEA Code of Conduct</td>
</tr>
<tr>
<td>Nuclear Security Recommendations on Physical Protection of Nuclear Materials and Nuclear Facilities (INFCIRC/225/Rev.5)</td>
<td>See next slide</td>
</tr>
<tr>
<td>Code of Conduct on Safety and Security of Radioactive Sources</td>
<td>Non-binding agreement prevent unauthorized use of and minimize damage from malicious radioactive release</td>
</tr>
</tbody>
</table>

Nuclear Security International Legal Instruments

- Cornerstone for physical protection:
  - **Nuclear Security Recommendations on Physical Protection of Nuclear Materials and Nuclear Facilities (INFCIRC/225/Rev.5)**
    - Per INFCIRC/225/Rev/5: the **objective** of the nuclear security regime is “to protect persons, property, society, and environment from malicious acts involving nuclear material and other radioactive material”
    - …[and] the **goal** of physical protection is to:
      - Protect against theft or other unauthorized removal of nuclear material
      - Locate and recover missing nuclear material,
      - Protect material and facilities against sabotage,
      - Mitigate and minimize the radiological consequences of sabotage
What is the International Nuclear Security Regime

- 2010-current - IAEA Nuclear Security Plan:
  - WHAT? – An effective nuclear security infrastructure requires a multi-disciplinary approach with:
    - Clearly defined legal & regulatory systems
    - Human resource development
    - Established procedures and functions
    - Technical support at regional/national/facility levels

### Nuclear Security Summits

<table>
<thead>
<tr>
<th>Summit</th>
<th>Location</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear Security Summits</td>
<td>Washington, D.C., USA</td>
<td>2010</td>
</tr>
<tr>
<td></td>
<td>Seoul, Republic of Korea</td>
<td>2012</td>
</tr>
<tr>
<td></td>
<td>The Netherlands</td>
<td>2014</td>
</tr>
</tbody>
</table>

Nuclear Security International Guidelines

- **Nuclear Security Guidelines:**
  - Comprehensive guides on all aspects of nuclear security and physical protections
  - Include: recommendations, technical guidance, implementing guidelines

- **Nuclear Security Series**
  - Technical and Functional Specifications for Border Monitoring Equipment
  - Nuclear Forensics Support
  - Monitoring for Radioactive Material in International Mail Transported by Public Postal Operators
  - Engineering Safety Aspects of the Protection of Nuclear Power Plants Against Sabotage
  - Identification of Radioactive Sources and Devices
  - Combating Illicit Trafficking in Nuclear and Other Radioactive Material
  - Nuclear Security Culture
  - Preventive and Protective Measures Against Insider Threats
  - Security in the Transport of Radioactive Material
  - Development, Use and Maintenance of the Design Basis Threat
  - Security of Radioactive Sources
  - Educational Programme in Nuclear Security
  - Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities
  - Nuclear Security Recommendations on Radioactive Material and Associated Facilities
  - Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control
What is the International Nuclear Security Regime

- **2010-current - IAEA Nuclear Security Plan:**
  - **HOW?** – Four Elements of the IAEA Nuclear Security Program

<table>
<thead>
<tr>
<th>Needs Assessment, Information Collation &amp; Analysis</th>
<th>(1) develop/maintain information platform; (2) update threat analysis for global nuclear security needs; (3) assist in prioritizing nuclear security improvement; (4) facilitate international cooperation/collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contributing to the Enhancement of a Global Nuclear Security Framework</td>
<td>(1) Provide set of nuclear security recommendations/guidance (INFCIRC 225/Rev5); (2) facilitate adherence/implementation of international legal instruments; (3) provide useful, up to date nuclear security guidance to implement a global framework</td>
</tr>
<tr>
<td>Providing Nuclear Security Services</td>
<td>(1) Provide peer reviews/assessments and provide upgrade recommendations; (2) assist states in human and infrastructure capacity building in nuclear security</td>
</tr>
<tr>
<td>Risk Reduction and Security Improvement</td>
<td>(1) Support states’ requests in reducing the risk of nuclear material in use/storage/transport; (2) support states’ requests in meeting international obligations</td>
</tr>
</tbody>
</table>

Nuclear Security Planning and Depth

- **International Security Regime**
- **State Level Responsibilities**
- **Facility Level Responsibilities**
- **Individual Responsibilities**
Security Takeaways

• Nuclear and radioactive material pose a unique and significant threat to individual, national, regional and international peace and security

• The international security regime is a framework of international legal instruments implemented at a national and facility level to ensure that nuclear materials remain secure in use/storage/transport
  ▪ Binding & non-binding agreements
  ▪ Nuclear Security Summits
  ▪ IAEA Nuclear Security Plan
  ▪ Individual responsibilities

Challenges to the Nuclear Nonproliferation Regime

• Non-state actors seek nuclear material and expertise
• Wider availability of sensitive nuclear technology, material and expertise
• More potential de-facto nuclear weapon states in the future
• Increasing world-wide demand for nuclear energy
• Growing number of NWS outside the NPT
• Dissatisfaction with the NPT
Nuclear Energy and Nonproliferation

• Global energy demand expected to at least double by middle of next century.
• Much of the demand will come from rapidly expanding economies in China and India
• Other developing countries planning nuclear energy programs
  – Indonesia
  – Vietnam
  – Thailand
• Concern: How to expand the use of nuclear energy without risking additional proliferation?

Preventing Misuse: Rules and Verification

International Atomic Energy Agency (1957)

International Atomic Energy Agency
• Premised on the belief that it was possible to establish verifiable rules and conditions
• Promotes peaceful uses
• Authorized to administer safeguards, but only in limited circumstances
• IAEA supplies assistance
• State requests safeguards
• Requested by parties to a bilateral or multilateral agreement

Objective: “To accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world.”
Preventing Misuse: Rules and Verification
The NPT (1968) and Safeguards

NPT
- All non-nuclear weapons state (NNWS) parties must conclude a comprehensive safeguards agreement (CSA) with the IAEA
  - NNWS insisted that safeguards obligations not infringe on NPT Article IV “inalienable right . . . to develop research, production and use of nuclear energy for peaceful purposes”
  - Minimize intrusion and protect commercial interests

Safeguards
- Focus on nuclear material

NPT: General Observations

- **Premise**: Proliferation is bad
  - World is safer if fewer states have NW
  - Freeze and possibly reverse this development
- **Preserved the “Atoms for Peace” vision of nuclear development for peaceful use**
- **Created a “discriminatory” treaty regime**
  - Nuclear weapon states (NWS) parties
  - Non-nuclear weapon states (NNWS)
  - But also a third group: States Outside the NPT

<table>
<thead>
<tr>
<th>Signed</th>
<th>1 July 1968</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>New York, USA</td>
</tr>
<tr>
<td>Effective</td>
<td>5 March 1970</td>
</tr>
<tr>
<td>Condition</td>
<td>Ratification by the UK, the US, and 40 other signatory states</td>
</tr>
<tr>
<td>Parties</td>
<td>189</td>
</tr>
</tbody>
</table>

As of July 2011
International Treaties and Conventions

- Nuclear Non-Proliferation Treaty
- Convention on Early Notification of Nuclear Accident
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency
- Convention on Nuclear Safety
- Convention on Physical Protection of Nuclear Material and Amendment
- Liability conventions

Primary Nuclear Arms Control Treaties
Modern Times

Bilateral → Regional → Global

Bilateral
- Strategic Arms Limitation Talks (SALT)
- Intermediate-Range Nuclear Forces Treaty (INF)
- Strategic Arms Reduction Treaties (START I, START II, and New START)*
- Strategic Offensive Reductions Treaty (SORT)

Regional
- Strategic Arms Reduction Treaties (START I)*

Global
- Limited Test Ban Treaty (LTBT)
- Nuclear Nonproliferation Treaty (NPT)
- Comprehensive Test Ban Treaty (CTBT)
- Fissile Material Cutoff Treaty (FMCT)

*Not in Force
Not Negotiated
Thank you

Questions or comments?