

Introduction to Nuclear Security

Outline

- The Threat
- Nuclear Security
- The Global System
 - Challenges
 - Opportunities
- Summary and Discussion
- NTI Nuclear Materials Security Index
 - Motivations
 - NTI Index Goals
 - Framework: Categories and Indicators
- Summary and Discussion

The Threat Is Real

- Terrorists have stated their desire to use nuclear weapons.
- Acquiring weapons-useable nuclear material is the key step in constructing a nuclear weapon.
- Weapons-usable nuclear material exists at hundreds of sites in 25 countries.
- Not all sites are well secured against terrorists or criminals and nuclear security is only as strong as the weakest link.
- Once a terrorist has acquired weapons-useable nuclear materials, countermeasures have limited effectiveness.

Security Lapses Continue

- Over the last 20 years, there have been 1000s of nuclear smuggling incidents, of which ~ 20 involved highly enriched uranium or plutonium.
- It's likely that many more cases were undetected.
- There have been numerous lapses in security that, under different circumstances, could have been catastrophic:
 - Y-12 (U.S.) security breach (2012)
 - Pelindaba (South Africa) break-in (2007)
 - Kurchatov Institute (Russia) accounting problem (2001)

Nuclear Security Definition

As defined by the IAEA, nuclear security is:

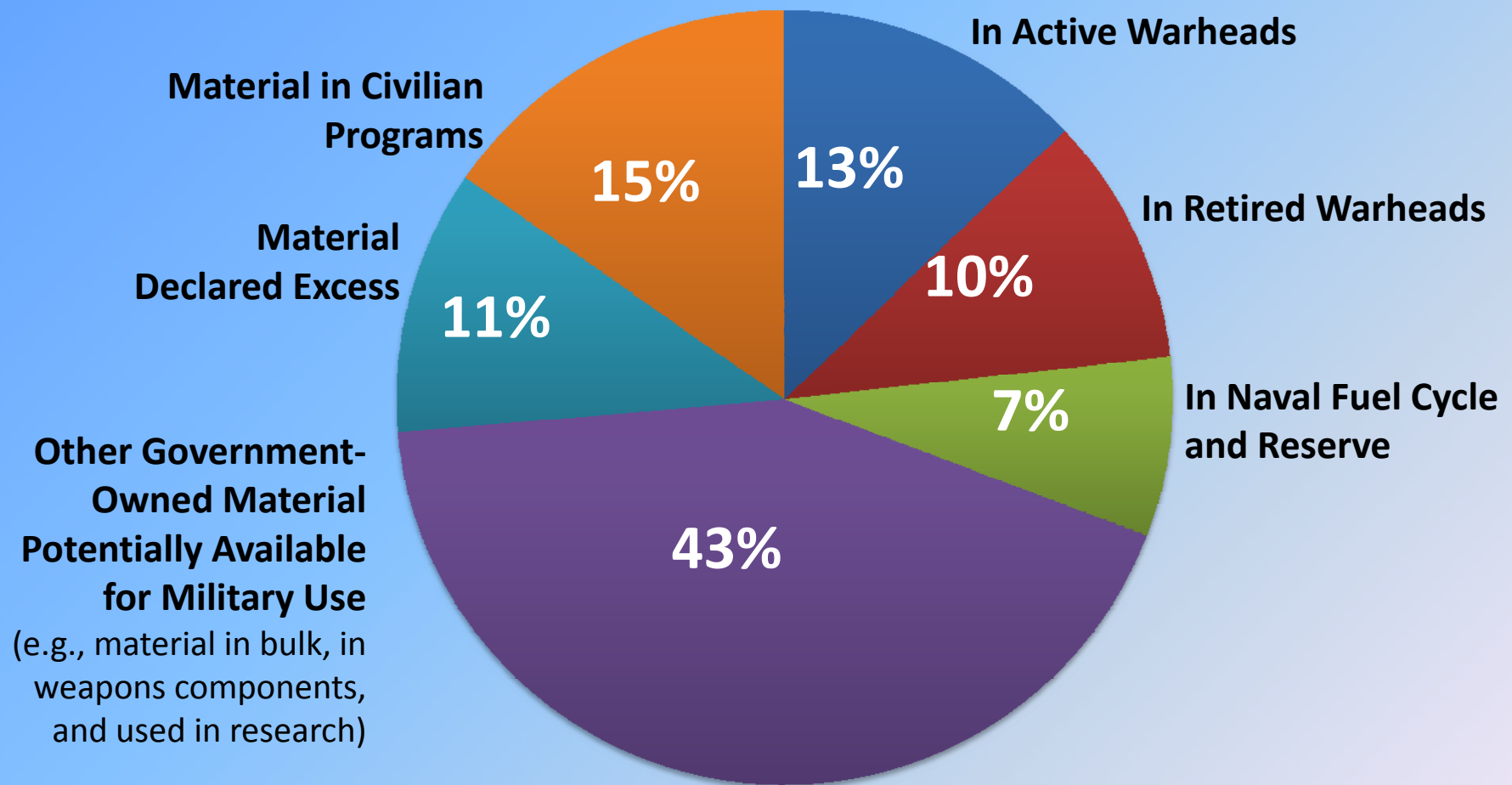
[T]he prevention and detection of, and response to, theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities.

- Note: This is distinct from nuclear *safety* and international nuclear *safeguards*.

Global Nuclear Security System

- Nuclear security is historically viewed as the sovereign responsibility of individual states.
- Each country's regulatory systems were often developed independently.
 - Often variable
- There is no comprehensive global system for tracking, protecting, and managing nuclear materials in a way that builds confidence.
 - The existing international system is a patchwork of agreements, guidelines, and multilateral engagement mechanisms.
 - It encompasses only civilian materials (15% of total weapons-useable nuclear materials).

Categories of Weapons-Usable Nuclear Materials Globally (Estimated Percentages)



Note: The total weapons-usable nuclear material inventory is estimated at 1,440 metric tons of HEU and 495 metric tons of separated plutonium. Of this, 1,400 metric tons of HEU and 240 metric tons of plutonium are estimated to be outside of civilian programs. The estimated range of uncertainty regarding the total quantity of materials is +/- 140 metric tons.

Sources: Material quantities are estimates based on *Global Fissile Material Report 2011: Nuclear Weapon and Fissile Material Stockpiles and Production—Sixth Annual Report of the International Panel on Fissile Material* (Princeton, NJ: IPFM, 2012), 2–3.

IAEA's Security Role

- The principle objective is to “accelerate and enlarge the contribution of atomic energy...”
- It administers a *safeguards* system to detect diversion for military purposes.
- Nuclear *security* is a relatively new mission.
- IAEA develops nuclear security guidelines and provides numerous nuclear security advisory services.
- The scope of responsibility is *civilian* materials, largely outside the five nuclear weapons states.

Nuclear Security Summits

- Nuclear Security Summits were held in Washington (2010) and Seoul (2012).
- They focused high-level attention on the issue.
- They led to a non-binding communiqué, a work plan, and commitments by states and groups of states.
- The third summit planned for 2014 in the Netherlands, and fourth in the U.S. in 2016.

What Type of Global System Is Needed?

- The system should be **comprehensive**; it should cover all weapons-usable nuclear materials and facilities in which they might be present, at all times.
- The system should **employ international standards and best practices, consistently and globally.**
- At a national level, each state's system should have **internal assurance and accountability mechanisms.**
- Globally, the system should facilitate a state's ability to provide **international assurances** that all nuclear materials and facilities are secure.
- The system should work to reduce risk through **minimizing** or, where feasible, **eliminating weapons-usable material stocks** and the number of locations where they are found.

What Is Limiting Progress?

- There are differing views on the magnitude of the threat and how best to secure materials.
- There is the view that nuclear security is a sovereign responsibility.
- There are sensitivities regarding sharing of security arrangements.
- There exists regional and other nuclear (e.g., nonproliferation) issues.

Summary and Discussion

- Nuclear security is a cornerstone of preventing nuclear terrorism.
- An attack anywhere would be an attack everywhere.
- Currently, nuclear materials security largely depends on actions by individual states.
- A comprehensive global system is needed to provide confidence in each state's materials security.

**NTI Nuclear
Materials Security Index (NTI Index)**

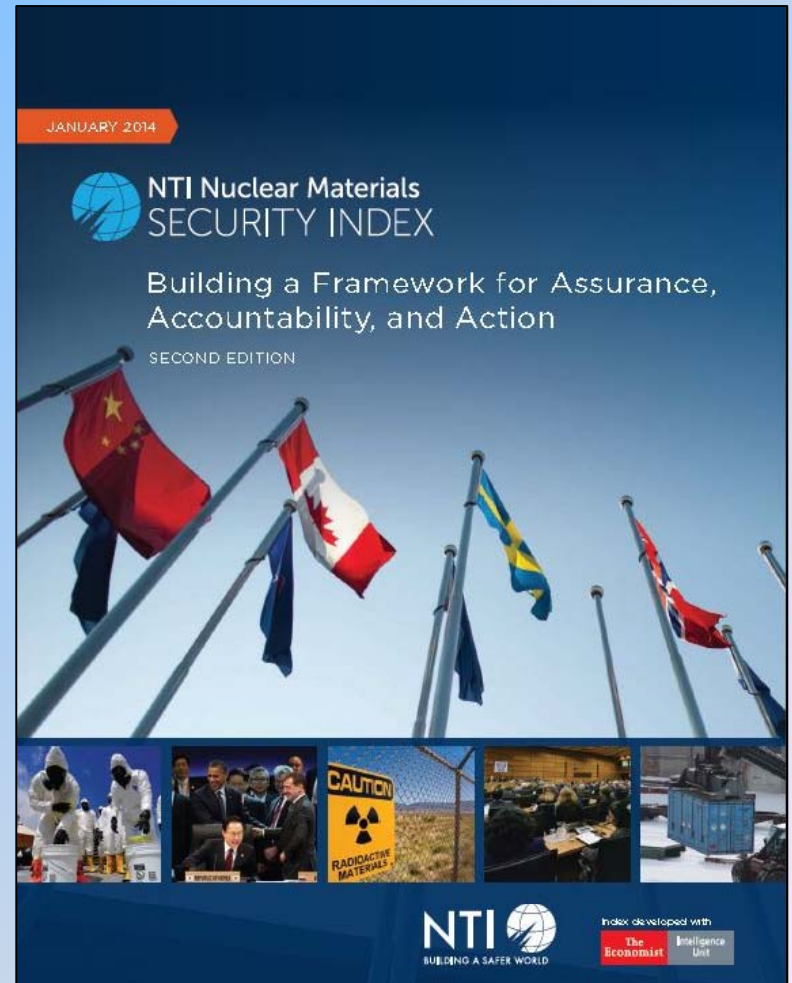
Motivations

- The threat of nuclear terrorism and that an attack “anywhere” would be an attack “everywhere.”
- No consensus on what it would mean to secure all materials and no means to track progress.

The NTI Index Has Several Important Goals

It provides a country-by-country assessment of global nuclear materials security conditions.

- Identifies needed improvements and tracks progress
- Promotes action to improve nuclear materials security
- Serves as a basis for dialogue on priorities for preventing theft of nuclear materials



The NTI Index Assesses Country Actions and Progress

- An index is a structured way of assessing country actions and enables tracking over time.
 - Simplifies complex issues
 - Provides a framework for discussion
 - Permits objective, standardized evaluation
- Several index characteristics are critical:
 - Broad framework
 - International perspective
 - Transparent

Index Scope and Constraints

- The Index scope is countries with weapons-useable nuclear materials (25 countries), with other (151) countries evaluated separately. It does not consider radiological sources or LEU.
- It assesses indicators related to potential for theft, not sabotage.
- It uses publically available information: laws, regulations, government reports, and international organizations
- It is an assessment at the country, not facility, level.

The NTI Index Framework Has Five Categories

How much weapons-usable material does the state have and at how many locations?

1. Quantities & Sites

What kind of requirements for protection are in place?

2. Security & Control Measures

What international commitments related to materials security has the state made?

3. Global Norms

Could a given country's risk environment—such as corruption—undermine its security commitments and practices?

5. Risk Environment

What is the ability of that state to fulfill those international commitments?

4. Domestic Commitments & Capacity

INDEX



Countries with weapons-usable nuclear materials



Countries without weapons-usable nuclear materials

NTI Index Indicators

- Quantities of Nuclear Materials
- Sites and Transportation
- Material Production/Elimination Trends

1. Quantities & Sites

2. Security & Control Measures

- On-Site Physical Protection
- Control and Accounting Procedures
- Insider Threat Prevention
- Physical Security During Transport
- Response Capabilities

5. Risk Environment

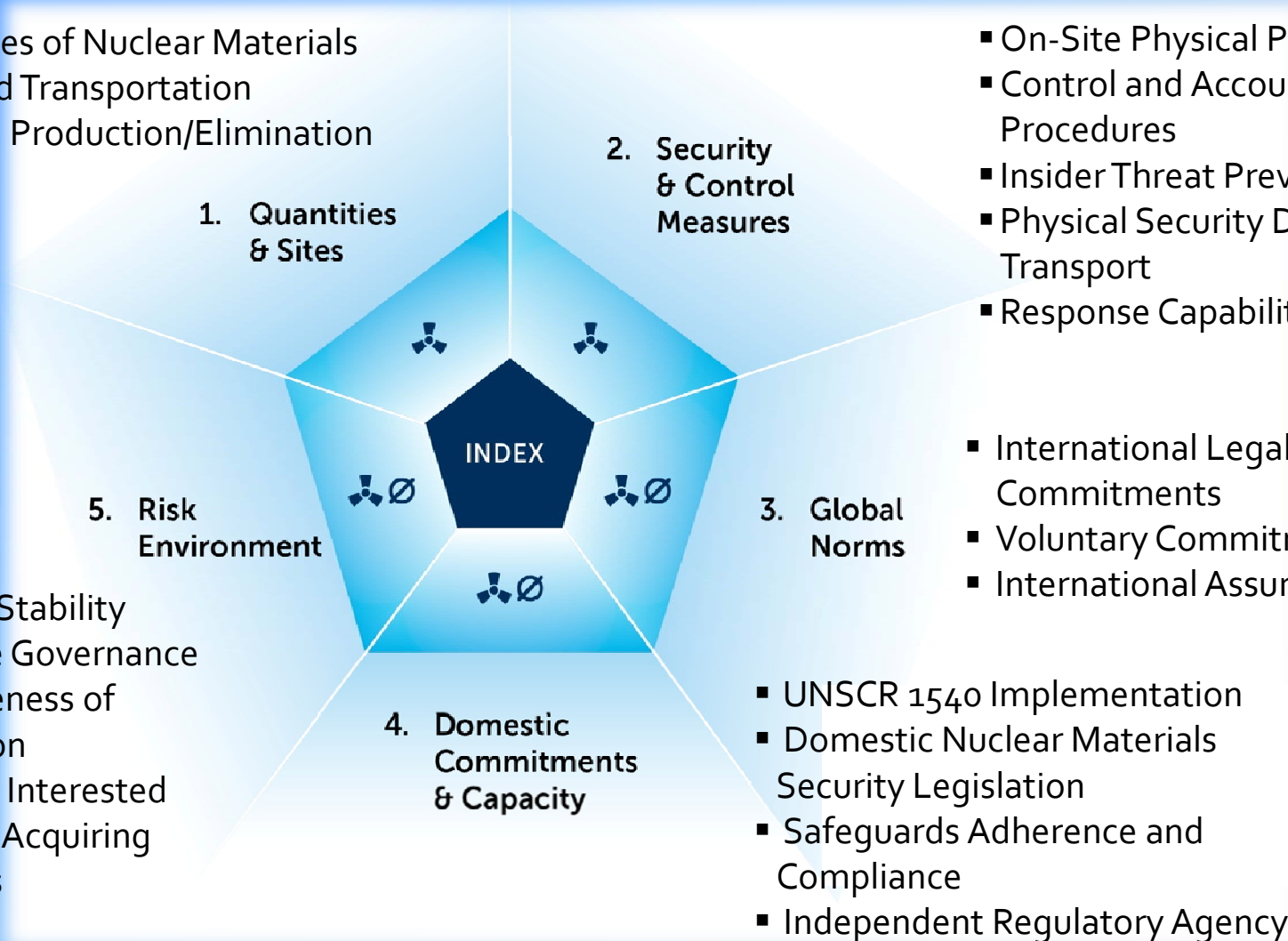
- Political Stability
- Effective Governance
- Pervasiveness of Corruption
- Group(s) Interested in Illicitly Acquiring Materials

3. Global Norms

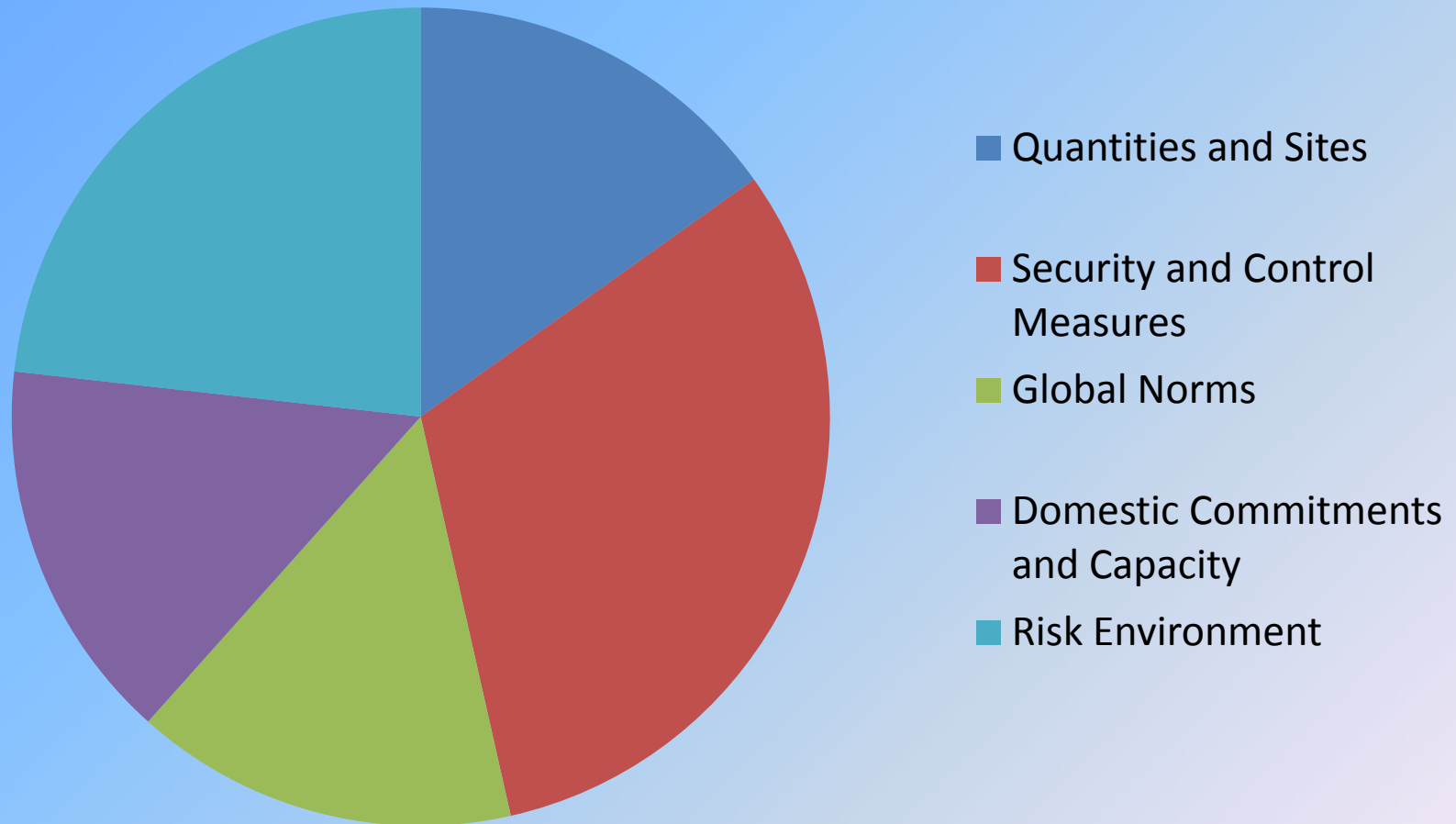
- International Legal Commitments
- Voluntary Commitments
- International Assurances

4. Domestic Commitments & Capacity

- UNSCR 1540 Implementation
- Domestic Nuclear Materials Security Legislation
- Safeguards Adherence and Compliance
- Independent Regulatory Agency



Index Categories Are Weighted to Reflect Their Relevance



Country Scores and Rankings (2014)

OVERALL SCORE		
Rank / 25	Score / 100	Δ
1	Australia	92 +2
2	Canada	88 +6
3	Switzerland	87 -
4	Germany	85 +3
5	Norway	83 +1
6	Poland	82 +1
=7	France	81 +2
=7	Netherlands	81 -
9	Belarus	80 +5
10	Belgium	79 +7
=11	United Kingdom	77 -1
=11	United States	77 -1
=13	Argentina	76 +4
=13	Japan	76 +6
15	Kazakhstan	73 -
16	South Africa	71 -1
17	Italy	70 -1
=18	Russia	66 -
=18	Uzbekistan	66 +5
20	China	64 +1
21	Israel	57 +2
22	Pakistan	46 +3
23	India	41 +1
24	Iran	39 -
25	North Korea	30 -

1) QUANTITIES AND SITES		
Rank / 25	Score / 100	Δ
=1	Argentina	100 +5
=1	Australia	100 +5
3	Uzbekistan	95 +5
4	Iran	89 -
=5	Belarus	84 -
=5	Poland	84 +6
7	Norway	83 -5
8	South Africa	79 +6
9	Italy	73 -
10	Switzerland	72 -
11	Canada	67 -
=12	Belgium	62 +6
=12	Germany	62 -
=12	Netherlands	62 -5
15	North Korea	60 -
16	Kazakhstan	57 -6
17	Israel	44 -
=18	China	34 -
=18	France	34 -
=20	Russia	23 -
=20	United States	23 -
=22	India	22 -
=22	Japan	22 -
=22	Pakistan	22 -
25	United Kingdom	11 -

2) SECURITY AND CONTROL MEASURES		
Rank / 25	Score / 100	Δ
1	United States	98 -
=2	Canada	93 +10
=2	United Kingdom	93 -
=4	Belarus	90 +12
=4	France	90 -
=6	Germany	88 +10
=6	Switzerland	88 -
8	Australia	86 -
=9	Kazakhstan	80 -
=9	Russia	80 -
11	Japan	79 +3
12	Netherlands	78 +5
13	Poland	74 -
14	Belgium	73 +17
15	China	72 -
16	Italy	68 -
17	Norway	67 -
18	South Africa	64 -
=19	Argentina	59 -
=19	Israel	59 -
21	Uzbekistan	51 +4
22	North Korea	43 -
=23	Iran	40 -
=23	Pakistan	40 +9
25	India	37 -

3) GLOBAL NORMS		
Rank / 25	Score / 100	Δ
=1	Australia	100 +8
=1	France	100 +17
=1	Russia	100 -
=1	United Kingdom	100 -
=5	Canada	94 +17
=5	Germany	94 -
=7	Belgium	88 +9
=7	China	88 +5
=7	Kazakhstan	88 +6
=7	Netherlands	88 -
=7	Switzerland	88 -
12	Japan	85 -
13	United States	83 -
=14	Poland	82 -
=14	Uzbekistan	82 +14
16	Argentina	80 +22
17	Norway	73 -
18	India	71 +6
19	Belarus	68 -
20	Pakistan	63 -
21	Italy	58 -
22	South Africa	57 -5
23	Israel	55 +8
24	Iran	18 -
25	North Korea	0 -

4) DOMESTIC COMMITMENTS AND CAPACITY		
Rank / 25	Score / 100	Δ
=1	Australia	100 -
=1	Belgium	100 -
=1	Germany	100 -
=1	Italy	100 -
=1	Japan	100 +27
=1	Netherlands	100 -
=1	Norway	100 -
=1	Poland	100 -
=1	South Africa	100 -
=1	Switzerland	100 -
=11	Canada	96 -
=11	France	96 -
=11	Kazakhstan	96 -
=11	United Kingdom	96 -
=15	Argentina	92 -
=15	Belarus	92 -
=17	Russia	89 -
=17	United States	89 -3
19	Uzbekistan	88 -
20	Pakistan	85 -
21	China	81 -
22	Israel	66 -
23	India	47 -
24	Iran	19 -
25	North Korea	4 -

5) RISK ENVIRONMENT		
Rank / 25	Score / 100	Δ
1	Norway	100 +13
2	Japan	86 -1
3	Canada	83 -
4	Switzerland	82 +1
5	Australia	79 -
6	Netherlands	78 -
7	Germany	77 +1
=8	Belgium	75 -
=8	France	75 -1
=10	Poland	74 -
=10	United States	74 -
12	United Kingdom	69 -2
13	Argentina	61 -
=14	Belarus	58 +6
=14	South Africa	58 -2
16	Israel	55 -
17	Italy	51 -1
18	North Korea	42 -
19	China	38 +2
20	Kazakhstan	37 -
21	Iran	35 +1
22	India	32 -
23	Uzbekistan	24 -
24	Russia	21 -
25	Pakistan	19 +6

Example Country Profile: Netherlands

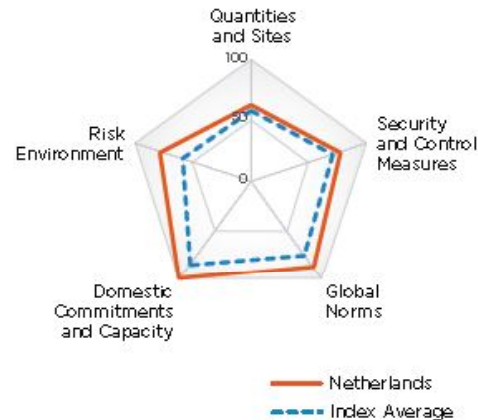


	Score / 100	Δ Score	Rank / 25
OVERALL SCORE	81	-	=7
Quantities and Sites	62	5	-12
Security and Control Measures	78	+5	12
Global Norms	88		-7
Domestic Commitments and Capacity	100		-1
Risk Environment	78		6

= denotes tie in rank

Δ denotes change in score between 2012 and 2014

Scores are normalized (0-100, where 100=most favorable nuclear materials security conditions)



ABOVE AVERAGE (Indicator scores greater than 66)

Quantities and Sites

- Sites and Transportation
- Material Production / Elimination Trends

Security and Control Measures

- On site Physical Protection
- Control and Accounting Procedures
- Response Capabilities

Global Norms

- International Legal Commitments
- Voluntary Commitments

Domestic Commitments and Capacity

- UNSCR 1540 Implementation
- Domestic Nuclear Materials Security Legislation
- Safeguards Adherence and Compliance
- Independent Regulatory Agency

Risk Environment

- Political Stability
- Effective Governance
- Pervasiveness of Corruption

AVERAGE (Indicator scores between 34 and 66)

Quantities and Sites

- Quantities of Nuclear Materials

Security and Control Measures

- Insider Threat Prevention
- Physical Security During Transport

Global Norms

- International Assurances

Risk Environment

- Group(s) Interested in Illicitly Acquiring Materials

BELOW AVERAGE (Indicator scores less than 34)

Synopsis:

Overall excellence—biggest challenges is materials quantities.

Opportunities to improve in:

- Security during transport
- Insider threat prevention
- International assurances
- Reducing materials quantities

Key Index Findings

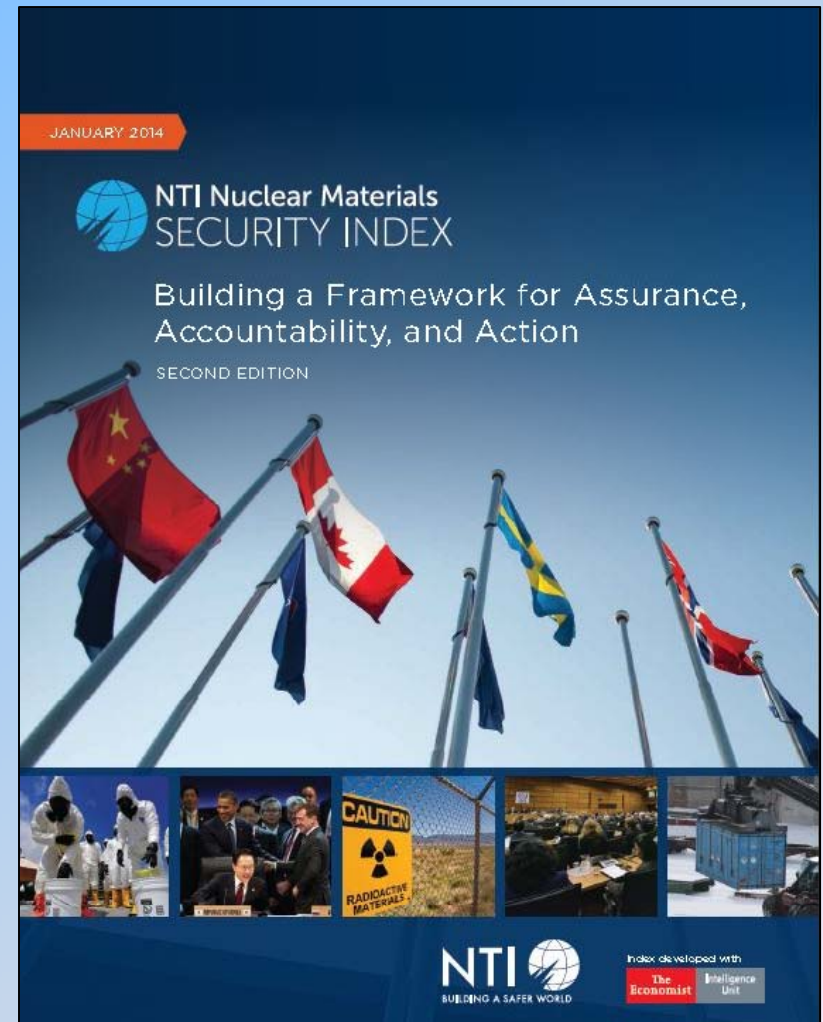
- Governments are more aware of the threat and are engaged.
- The consensus on priorities is lacking.
- The lack of openness impedes confidence and accountability.
- Several states are more vulnerable to insider threats.
- Stocks of weapons-usable nuclear materials continue to increase.
- More states could eliminate their stocks.
- Many states lag on joining international agreements.

Recommendations

- **Collectively:**
 - Reach consensus on the key principles of a global system
 - Cover all weapons-usable materials, military and civilian
 - Apply international standards and best practices
 - Build confidence and accountability
 - Become parties to nuclear security treaties
 - Strengthen voluntary mechanisms
 - Secure military and other non-civilian materials to same or higher standards as civilian materials
- **Each country:**
 - Decrease stocks of weapons-usable nuclear materials
 - Improve measures to protect weapons-usable nuclear materials from theft
 - Establish and strengthen independent regulatory agencies
 - Deliver on Nuclear Security Summit commitments

Summary and Discussion

- Second edition of Index released in January 2014.
- NTI Index will continue to be used to promote dialogue and actions.



NTI Index on the web:

www.ntiindex.org

Index updates on Twitter:

@NTI_WMD

#NTIINDEX



Supplemental Slides

Existing Mechanisms: Benefits and Limitations

BENEFITS

- Binding treaties provide the foundation for nuclear security.
- Guidelines and recommendations help states to implement security measures.
- Informal engagement mechanisms provide ways for states to cooperate.
- Informal engagement mechanisms help states match resources to need.
- The IAEA has technical knowledge/expertise relevant to security.
- Organizations like WINS help promote sharing and development of best practices.

LIMITATIONS

- Treaties are not universal; some important provisions are not in force.
- Treaties do not provide guidance on implementation .
- Treaties have no enforcement or verification mechanisms.
- Guidelines and recommendations are non-binding.
- Engagement mechanisms are voluntary.
- Variable implementation across states may compromise achievement of objectives.
- Best practices are non-binding.
- No standardized system to provide international assurance or domestic accountability.

Convention for the Physical Protection of Nuclear Material (CPPNM)

Binding treaty requiring states to apply **physical protection measures** to nuclear material, primarily during **international transportation**.

2005 Amendment expanded the CPPNM's scope to require protection of nuclear materials in **use, storage, and domestic transit, and protection of nuclear facilities from sabotage**.

- Not universal
- 2005 Amendment not in force
- No mechanism to enforce/monitor implementation
- No consequences for non-compliance
- No mechanism for verification/assurances
- No guidance on implementation
- Variable implementation across states may compromise achievement of objectives

UNSCR 1540

Only **universal legally binding** instrument **requiring physical security measures** for nuclear material. Requires states to establish laws to prohibit non-state actors from acquiring, possessing, or using WMD, and implement appropriate controls over related materials, including security and accounting, to prevent WMD proliferation.

1540 Committee is responsible for managing implementation. Countries must report progress to the committee.

- No enforcement mechanism
- No consequences for non-compliance
- No guidance on implementation
- Reporting requirements are weak
- Lack of committee resources means no strong mechanism to monitor implementation or for verification/assurances
- Variable implementation across states may compromise achievement of objectives

International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT)

Requires states to **criminalize** and **prosecute** offenses related to the **use or possession of radioactive material and use or damage of a nuclear facility**. Establishes a legal framework for cooperation among states to detect, prevent, suppress, and investigate offenses and institute criminal proceedings.

- Not universal
- No mechanism to enforce/monitor implementation
- No consequences for non-compliance
- No mechanism for verification/assurances
- Variable implementation across states may compromise achievement of objectives

INFCIRC/225/Rev. 5

This IAEA document provides **guidelines and recommendations** for the **physical protection** of nuclear material and facilities, **measures against unauthorized removal** of nuclear materials, and protection of nuclear material and facilities from **sabotage**. INFCIRC/225 provides **basic international guidance** for physical protection of nuclear material and facilities.

- Non-binding
- No clear performance objectives/performance criteria
- No mechanism for verification/assurances
- Variable implementation across states may compromise achievement of objectives

IAEA Fundamental Principles

A set of principles adopted by the IAEA Board of Governors and meant as a step toward **strengthening the physical security regime** and **promoting the effective implementation and improvement** of physical protection worldwide. They have been incorporated into the 2005 Amendment to the CPPNM.

- Non-binding until 2005 Amendment enters into force
- No mechanism for verification/assurances
- Variable implementation across states may compromise achievement of objectives

Safeguards and Nuclear Material Accounting

IAEA safeguards agreements require states to apply **standard nuclear material accounting systems**. All states with nuclear material (except NK) have safeguards agreements in place, though **coverage depends on whether a state is a NWS, a NNWS, or non-NPT state**.

- Safeguards are not universal
- No guidance on implementation
- Variable implementation across states may compromise achievement of objectives
- Inspections mandate limited to diversion of nuclear material from peaceful uses, not preventing acquisition of nuclear material by unauthorized persons

Nuclear Suppliers Group (NSG)

The NSG was established to ensure that suppliers apply a **uniform approach to nuclear and nuclear-related exports and dual-use items**. NSG guidelines aim to ensure that peaceful nuclear trade does not contribute to proliferation of nuclear weapons. **Suppliers should authorize transfers of trigger list items only where those items will be subject to safeguards**. Guidelines also state that recipients should have physical security measures in place.

- Guidelines are non-binding
- Differences in national law and practice leads to inconsistent implementation

Nuclear Security Summits

Brings together government leaders from states around the world to **focus high-level attention on the threat of nuclear terrorism**. The summit produces a communiqué identifying priority areas. At the close of the 2010 Summit, more than 60 national commitments were made, over 80% of which were achieved by the 2012 Summit. At the 2012 Summit, over 100 commitments were made. The next summit will be held in 2014.

- Voluntary, non-binding, political commitments
- No mechanism for verification/assurances
- Communiqué requires consensus, leading to lowest common denominator outcome
- Sustained high-level attention needed

G8 Global Partnership

A 2002 G8 initiative committed to **preventing terrorists from acquiring or developing WMD**. G8 countries pledged \$20 billion over the first 10 years to fund projects to **secure and dismantle WMD stockpiles** in Russia. Since then the Global Partnership has successfully implemented numerous projects, including outside Russia. The G8 extended the GP for another ten years. Its informal nature allows countries to **match resources to specific projects**.

- Commitments are non-binding
- No mechanism to enforce commitments
- No mechanism for verification/assurances
- Based on voluntary contributions

Global Initiative to Combat Nuclear Terrorism (GICNT)

The GICNT provides another **informal mechanism for state cooperation**. Its mission is to **strengthen global capacity** to prevent, detect, and respond to nuclear terrorism. Partner nations conduct **multilateral activities, workshops, table-top exercises, and field exercises**.

- Membership is voluntary
- Not universal
- No mechanism to enforce commitments/monitor implementation
- No mechanism for verification/assurances
- Based on voluntary contributions

Proliferation Security Initiative (PSI)

An informal grouping of states that have joined together to **prevent trafficking by detecting and intercepting WMD and WMD-related materials**. Countries commit to strengthen national legal authorities to facilitate interdiction, develop procedures to facilitate exchange of information, and take specific actions in support of interdiction efforts. **Shipboarding agreements** give parties permission to board vessels sailing under the other parties' national flag. Several high-profile successes in interdicting or turning back WMD-related shipments have been attributed to PSI.

- Participation is voluntary
- Commitments are non-binding
- No organizing structure
- Not universal

IAEA Nuclear Security Advisory Services

Although the IAEA's mandate is limited to safeguards, recognizing that it has the **technical knowledge and experience** to provide advice and assistance in the security area, the **IAEA provides advisory services**. These services include missions, evaluations, and technical services to **help requesting states assess their nuclear security needs and improve their capabilities** for securing nuclear material.

- Services provided upon state's request
- Unless requested, missions do not assess actual quality of physical protection at facilities
- Outcomes confidential
- States not obligated to respond to conclusions or address deficiencies
- Services primarily supported through voluntary contributions to Nuclear Security Fund

World Institute for Nuclear Security (WINS)

An organization whose purpose is to provide a **forum for nuclear security professionals to share and promote best security practices**. Best practice exchanges can be a valuable tool to enable rapid and dynamic improvements for facilities' security implementation. WINS produces **best practices guides**, including **self-assessment tools**, and is **developing accreditation and training** for nuclear security professionals. WINS is also **developing peer review** offerings.

- Best practices are non-binding
- No mechanism for monitoring implementation
- No mechanism for verification/assurances
- Funded through donations

Existing Nuclear Security System

AGREEMENTS AND GUIDELINES

- CPPNM
- 2005 Amendment
- ICSANT
- UNSCR 1540
- INFCIRC/225/Rev. 5
- IAEA Fundamental Principles
- Safeguards and accounting
- Nuclear Suppliers Group (NSG) guidelines

MULTILATERAL ENGAGEMENT MECHANISMS

- Nuclear Security Summit
- G8 Global Partnership
- GICNT
- Proliferation Security Initiative (PSI)

IMPLEMENTATION SERVICES

- IAEA Advisory Services
 - IPPAS
 - INSServ
 - Others
- World Institute for Nuclear Security (WINS)

The original version of this PowerPoint presentation was created as a resource by the Nuclear Threat Initiative.

For more information, go to
www.nti.org.