EIU METHODOLOGY

CONTENTS

SUMMARY

To gain a better understanding of current global nuclear security conditions and the changes that have occurred since the Nuclear Threat Initiative (NTI) released the first two editions of the NTI Nuclear Security Index in January 2012 (2012 NTI Index) and in January 2014 (2014 NTI Index), NTI commissioned the Economist Intelligence Unit (EIU) to construct the third edition of the NTI Index (2016 NTI Index). The updated 2016 NTI Index provides a country-by-country assessment of nuclear security conditions in three groups of countries.

The first model in the 2016 NTI Index assesses nuclear materials security conditions in 24 countries with one kilogram or more of weapons-usable nuclear materials (theft ranking for countries with materials). A second model in the 2016 NTI Index assesses nuclear materials security conditions in 152 countries with less than one kilogram of or no weapons-usable nuclear materials but that could serve as safe havens, staging grounds, or transit points for illicit nuclear activities (theft ranking for countries without materials). The first two models also provide a comparison of each country's nuclear materials security conditions since 2012. Finally, a third model was constructed for the first time to assess nuclear security conditions in 45 countries where an act of sabotage against a nuclear facility could result in a significant radiological release with serious off-site health consequences (sabotage ranking).

To address the need for an objective, country-level benchmarking of nuclear security, the EIU developed a multidimensional analytical framework, commonly known as a benchmarking index. A multidimensional framework is a useful way of measuring performance that cannot be directly observed—for example, a country's economic competitiveness or, in this case, a country's nuclear security conditions.

Nuclear security is particularly difficult to observe, both because of the legacy of secrecy associated with the subject and because of the absence of quantitative performance indicators. Indices, in such cases, have been shown to be effective in several ways: (a) they can aggregate a wide range of related data and evaluate it in a consistent manner; (b) they can track outcomes over time; and (c) they can spur countries to improve performance, especially relative to other countries in the index. In that way, indices can be useful tools for public policy reforms. The goal of the NTI Index, then, is not only to prompt improvements in national nuclear security policies and programs but also to encourage international debate on the factors that affect the likelihood of a country's either losing control of its weapons-usable nuclear materials or being subject to an act of sabotage.

The 2016 NTI Index is again the result of collaboration between NTI and the EIU. The 2012 NTI Index theft ranking for countries with materials assessed 32 countries with weapons-usable nuclear materials across 18 indicators, whereas the 2014 NTI Index theft ranking for countries with materials assessed 25 countries across 19 indicators. The 2016 NTI Index theft ranking for countries with materials assesses 24 countries with weapons-usable nuclear materials—reflecting the removal of all or most of such materials from the territories of 8 countries since 2012[1]—across 20 indicators.

The EIU researched every metric captured in the NTI Index, paying particularly close attention to any changes to regulations or licensing conditions in a country. As a result of changes to the NTI Index theft ranking framework, direct year-on-year comparisons between the theft rankings in the 2016 NTI Index, the 2014 NTI Index, and the 2012 NTI Index would not have been possible. To allow for such comparisons, the EIU rescored countries in the 2012 and 2014 NTI Index theft rankings using the new framework and the data that would have been available in 2011 and 2013, respectively, when research for the 2012 and 2014 NTI Index theft rankings was conducted.

In addition, the results from the 2012 and 2014 NTI Indices were thoroughly reviewed and researched again to ensure accuracy. In a limited number of cases, research or responses to the data review and confirmation process indicated that new information had become available, a relevant law or regulation had not been captured, or researchers disagreed on a score. In those instances, the EIU revised the 2012 and 2014 scores to reflect the most accurate data. Rescoring the 2012 and 2014 data was necessary so that the 2016 NTI Index theft rankings could capture accurate year-on-year comparisons. Most of the

[1] Austria, the Czech Republic, Hungary, Mexico, Sweden, Ukraine, and Vietnam removed all or most of their materials between the release of the 2012 NTI Index and the release of the 2014 NTI Index. Uzbekistan eliminated its stock of weapons-usable nuclear materials following the release of the 2014 NTI Index.

research was conducted between January and July 2015, although data were updated as new information became available until November 1, 2015.

For the first time, the 2016 NTI Index includes a separate assessment of nuclear security conditions in 45 countries where an act of sabotage against a nuclear facility could lead to a significant radiological release (the sabotage ranking). To date, the scope of the NTI Index has been restricted to the potential theft of weapons-usable nuclear materials; however, given the widespread danger of the threat of sabotage and the serious consequences that could result from a large radiological release, NTI and the EIU decided to include the new sabotage ranking in the 2016 NTI Index. Countries were selected for inclusion in this new sabotage ranking if they possessed nuclear facilities, the sabotage of which could result in a significant radiological release with serious off-site health consequences. Twenty-two of the 45 countries have one kilogram or more of weapons-usable nuclear materials and are therefore also in the theft ranking for countries with materials; 23 of the 45 countries have less than one kilogram of or no weapons-usable nuclear materials and are therefore also in the theft ranking for countries without materials.

NTI and the EIU once again drew on the expertise of highly respected nuclear security experts (the International Panel of Experts) from nuclear-weapon states and non–nuclear-weapon states, from countries with and without materials, and from developed and developing nations, to provide input on options for strengthening the 2016 NTI Index and for constructing the sabotage ranking. As a result of a comprehensive review of the 2014 NTI Index theft ranking framework, some changes were made to the framework for this third edition.

The categories in the theft ranking for countries with materials are (a) Quantities and Sites, which captures the quantity of nuclear materials, the number of sites, and the frequency of transport in a particular country, all related to the risk that materials could be stolen; (b) Security and Control Measures, which encompasses the core activities related to the physical protection and accounting of weapons-usable nuclear materials, as well as personnel and security infrastructure and cybersecurity; (c) Global Norms, which includes actions that contribute to an international consensus on improved security; (d) Domestic Commitments and Capacity, which indicates how well a country has implemented its international commitments and a country's capacity to do so; and (e) Risk Environment,[2] which examines issues that can undermine nuclear materials security at the national level, such as political instability, absence of effective governance, corruption, or the presence of groups interested in illicitly acquiring materials. The theft ranking for countries without materials includes only the latter three categories. The sabotage ranking includes a modified set of all five categories.

The research for both the theft ranking for countries with materials and the sabotage ranking primarily considered regulatory requirements for security. Taking a so-called bottom-up approach and reviewing security at the facility or site level within each country was impossible, not least because of national security concerns. Researching domestic regulations also posed a challenge: some countries do not make public the majority of their nuclear security regulations, and two countries in particular, Israel and North Korea, do not make any regulations public. Owing to those research challenges, the EIU used a variety of techniques to score certain countries (see "Research behind Selected Indicators").

To limit the degree of subjectivity in those indicators, the EIU created subindicators that were, whenever possible, framed as a binary choice (yes or no; or 1 or 0). For example, the EIU asked whether a country has a national authority for implementing the Convention on the Physical Protection of Nuclear Material. If a country does, it is awarded one point; if it does not, it scores a zero. A binary approach limits the risk of subjectivity and increases the likelihood that the same scores would be obtained by another set of researchers, a key measure of objectivity and analytical rigor. If a binary approach was not appropriate, the research team provided specific scoring options that were based on publicly available information.

Despite the care taken in designing those measures, no index of this kind can ever be perfect. Some countries are particularly non-transparent in matters of nuclear security. In such cases, the EIU scored indicators using expert judgment or relied on proxy measures, such as the sophistication of a country's military operations (in cases in

[2] This category was named Societal Factors in the 2012 NTI Index.

which the EIU was confident that weapons-usable nuclear materials and nuclear facilities vulnerable to sabotage were protected by the armed forces).

The indicators in the 2016 NTI Index rankings are embedded in three models (available as an Excel workbook at www.ntiindex.org) that offer a wide range of analytical tools, thereby allowing a deeper investigation of measures of nuclear security globally. For example, users can filter countries by region or by membership in international organizations or multilateral initiatives. A user can compare any two countries directly and can examine correlations between indicators.

Individual country profiles are also included in the 2016 NTI Index models, thus permitting a deeper dive into the nuclear security conditions in a given country. The weights assigned to each indicator can be changed to reflect different assumptions about the importance of categories and indicators. A user can also change individual subindicator scores to see how a country's overall scores would have been different if it had, for example, ratified a treaty or taken some other action captured in the 2016 NTI Index.

Finally, the models allow the final scores to be benchmarked against external factors that may potentially influence nuclear security. For example, the results of the theft ranking for countries with materials correlate well with regulatory quality (as measured by the World Bank's Worldwide Governance Indicators) and with those that are most at peace (as measured by the 2015 Global Peace Index).

SCORING CRITERIA AND CATEGORIES

The 2016 NTI Index includes three separate rankings. The first model assesses the nuclear materials security conditions in 24 countries with one kilogram or more of weapons-usable nuclear materials (theft ranking for countries with materials). This model has 60 subindicators used to construct 20 indicators across five categories. The scope of the theft ranking for countries with materials includes highly enriched uranium (HEU), including spent fuel; separated plutonium; and plutonium content in unirradiated mixed oxide (MOX) fuel.

A second, separate model assesses the nuclear materials security conditions in 152 countries with less than one kilogram of or no weapons-usable nuclear materials, but that could serve as safe havens, staging grounds, or transit routes (theft ranking for countries without materials).[3] The number of countries in the theft ranking for countries without materials was determined by the scope of the EIU's Risk Briefing service. Countries without materials are evaluated across a smaller subset of three categories and nine indicators.

Finally, the 2016 NTI Index includes for the first time a third model to assess nuclear security conditions in 45 countries with nuclear facilities, the sabotage of which could lead to a significant radiological release with serious off-site health consequences (sabotage ranking).[4] The sabotage ranking scores 16 indicators and 51 subindicators across five categories.

Note that the NTI Index does not address proliferation risks, disarmament, or nuclear safety.

Theft Ranking for Countries with Materials

The overall score (0–100) for each country in the theft ranking for countries with materials is a weighted sum of the five categories. Each category is scored on a scale of 0–100, in which 100 represents the most favorable nuclear materials security conditions and 0 represents the least favorable conditions. A score of 100 in the theft ranking does not indicate that a country has perfect nuclear materials security conditions; likewise, a score of 0 does not mean that a country has no security. Instead, the scores of 100 and 0 represent the highest and lowest possible scores, respectively, as measured by the NTI Index criteria. Each category is normalized on the basis of the sums of underlying indicators and subindicators, and a weight is then applied. Weights are based on input from the International Panel of Experts and reflect the relative

[3] NTI recognizes that some states may have gram quantities of weapons-usable nuclear materials in multiple locations which, added together, may bring totals to more than one kilogram. For the purposes of the NTI Index and the need to rely on publicly available information, those states are grouped with states that have no weapons-usable nuclear materials.

[4] Those nuclear facilities are (a) operating nuclear power reactors or nuclear power reactors that have been shut down within the last five years; (b) research reactors with a capacity of two megawatts or greater; (c) reprocessing facilities; and (d) spent fuel pools, only if the fuel has been discharged in the last five years and if not associated with an operating reactor.

importance and relevance of each indicator and category. Weights in the model, however, are dynamic and can be changed by users.

The five categories of the theft ranking for countries with materials are as follows:

1. **Quantities and Sites.** This category comprises three indicators: Quantities of Nuclear Materials, Sites and Transportation, and Material Production and Elimination Trends.
2. **Security and Control Measures.** This category comprises six indicators: On-Site Physical Protection, Control and Accounting Procedures, Insider Threat Prevention, Physical Security during Transport, Response Capabilities, and Cybersecurity.
3. **Global Norms.** This category comprises three indicators: International Legal Commitments, Voluntary Commitments, and International Assurances.
4. **Domestic Commitments and Capacity.** This category comprises four indicators: UN Security Council Resolution (UNSCR) 1540 Implementation, Domestic Nuclear Materials Security Legislation, Safeguards Adherence and Compliance, and Independent Regulatory Agency.
5. **Risk Environment.** This category comprises four indicators: Political Stability, Effective Governance, Pervasiveness of Corruption, and Group(s) Interested in Illicitly Acquiring Materials.

Each indicator within the five categories contains up to eight underlying subindicators. Principal components analysis (PCA) was also conducted on the model to ensure relevance and robustness of the chosen indicators and categories. The use of PCA is described on page 25.

The categories, indicators, and subindicators are as follows:

1	**QUANTITIES AND SITES**
1.1	**Quantities of Nuclear Materials**
1.1.1	Quantities of nuclear materials
1.2	**Sites and Transportation**
1.2.1	Number of sites
1.2.2	Bulk processing facility
1.2.3	Frequency of materials transport
1.3	**Material Production and Elimination Trends**
1.3.1	Material production/elimination trends
2	**SECURITY AND CONTROL MEASURES**
2.1	**On-Site Physical Protection**
2.1.1	Mandatory physical protection
2.1.2	On-site reviews of security
2.1.3	Design Basis Threat
2.1.4	Security responsibilities and accountabilities
2.1.5	Performance-based program
2.2	**Control and Accounting Procedures**
2.2.1	Legal and regulatory basis for material control and accounting
2.2.2	Measurement methods
2.2.3	Inventory record
2.2.4	Material Balance Area(s)
2.2.5	Control measures
2.3	**Insider Threat Prevention**
2.3.1	Personnel vetting
2.3.2	Frequency of personnel vetting
2.3.3	Reporting
2.3.4	Surveillance
2.4	**Physical Security during Transport**
2.4.1	Physical security during transport

2.5	**Response Capabilities**
2.5.1	Emergency response capabilities
2.5.2	Armed response capabilities
2.5.3	Law enforcement response training*
2.5.4	Nuclear infrastructure protection plan
2.6	**Cybersecurity***
2.6.1	Mandatory cybersecurity*
2.6.2	Critical digital asset protection*
2.6.3	Cybersecurity Design Basis Threat*
2.6.4	Cybersecurity assessments*
3	**GLOBAL NORMS**
3.1	**International Legal Commitments**
3.1.1	Convention on the Physical Protection of Nuclear Material (CPPNM)
3.1.2	2005 Amendment to the CPPNM
3.1.3	International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT)
3.2	**Voluntary Commitments**
3.2.1	International Atomic Energy Agency (IAEA) membership
3.2.2	Proliferation Security Initiative (PSI) membership
3.2.3	Global Initiative to Combat Nuclear Terrorism (GICNT) membership
3.2.4	Global Partnership Against the Spread of Weapons and Materials of Mass Destruction membership
3.2.5	World Institute for Nuclear Security (WINS) contributions
3.2.6	IAEA Nuclear Security Fund contributions
3.2.7	Bilateral or multilateral assistance
3.2.8	Centers of Excellence
3.3	**International Assurances**
3.3.1	Published regulations and reports
3.3.2	Public declarations and reports about nuclear materials
3.3.3	Review of security arrangements*

4	**DOMESTIC COMMITMENTS AND CAPACITY**
4.1	**UN Security Council Resolution (UNSCR) 1540 Implementation**
4.1.1	UNSCR 1540 reporting
4.1.2	Extent of UNSCR 1540 implementation*
4.2	**Domestic Nuclear Materials Security Legislation**
4.2.1	CPPNM implementation authority
4.2.2	National legal framework for CPPNM
4.3	**Safeguards Adherence and Compliance**
4.3.1	IAEA safeguards agreement (excluding Additional Protocol)
4.3.2	IAEA Additional Protocol
4.3.3	Facility exclusion from safeguards
4.3.4	Safeguards violations
4.4	**Independent Regulatory Agency**
4.4.1	Independent regulatory agency
5	**RISK ENVIRONMENT**
5.1	**Political Stability**
5.1.1	Social unrest
5.1.2	Orderly transfers of power
5.1.3	International disputes or tensions
5.1.4	Armed conflict
5.1.5	Violent demonstrations or violent civil or labor unrest
5.2	**Effective Governance**
5.2.1	Effectiveness of the political system
5.2.2	Quality of the bureaucracy
5.3	**Pervasiveness of Corruption**
5.3.1	Pervasiveness of corruption
5.4	**Group(s) Interested in Illicitly Acquiring Materials**
5.4.1	Group(s) interested in illicitly acquiring materials

* Indicates new or revised indicator or subindicator. See section titled "Comparison between the 2014 Theft Ranking for Countries with Materials and the 2016 Theft Ranking for Countries with Materials" for more detail on the new and revised indicators and subindicators.

Theft Ranking for Countries without Materials

Countries without weapons-usable nuclear materials are assessed against a subset of the categories, indicators, and subindicators used for research on the countries that possess such materials. The overall score (0–100) for countries in this second ranking is a weighted sum of the three categories, where each is scored on a scale of 0–100, where 100 represents the most favorable and 0 represents the least favorable nuclear materials security conditions possible as measured by the NTI Index criteria. Each category is normalized on the basis of sums of underlying indicators and subindicators, and a weight is then applied. Weights reflect the relative importance and relevance of each indicator and category based on input from the International Panel of Experts. Weights in the model are dynamic and can be changed by users.

The three categories of the theft rankings for countries without materials are as follows:

- **Global Norms.** This category comprises two indicators: International Legal Commitments and Voluntary Commitments.
- **Domestic Commitments and Capacity.** This category comprises three indicators: UNSCR 1540 Implementation, Domestic Nuclear Materials Security Legislation, and Safeguards Adherence and Compliance.
- **Risk Environment.** This category comprises four indicators: Political Stability, Effective Governance, Pervasiveness of Corruption, and Group(s) Interested in Illicitly Acquiring Materials.

Each indicator within the three categories contains one to eight underlying subindicators.

The categories, indicators, and subindicators are as follows:

3	**GLOBAL NORMS**
3.1	**International Legal Commitments**
3.1.1	Convention on the Physical Protection of Nuclear Material (CPPNM)
3.1.2	2005 Amendment to the CPPNM
3.1.3	International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT)
3.2	**Voluntary Commitments**
3.2.1	International Atomic Energy Agency (IAEA) membership
3.2.2	Proliferation Security Initiative (PSI) membership
3.2.3	Global Initiative to Combat Nuclear Terrorism (GICNT) membership
3.2.4	Global Partnership Against the Spread of Weapons and Materials of Mass Destruction membership
3.2.5	World Institute for Nuclear Security (WINS) contributions
3.2.6	IAEA Nuclear Security Fund contributions
3.2.7	Bilateral or multilateral assistance
3.2.8	Centers of Excellence
4	**DOMESTIC COMMITMENTS AND CAPACITY**
4.1	**UN Security Council Resolution (UNSCR) 1540 Implementation**
4.1.1	UNSCR 1540 reporting
4.1.2	Extent of UNSCR 1540 implementation*
4.2	**Domestic Nuclear Materials Security Legislation**
4.2.1	CPPNM implementation authority
4.2.2	National legal framework for CPPNM
4.3	**Safeguards Adherence and Compliance**
4.3.1	IAEA safeguards agreement (excluding Additional Protocol)
4.3.2	IAEA Additional Protocol
4.3.3	Safeguards violations

5	RISK ENVIRONMENT
5.1	**Political Stability**
5.1.1	Social unrest
5.1.2	Orderly transfers of power
5.1.3	International disputes or tensions
5.1.4	Armed conflict
5.1.5	Violent demonstrations or violent civil or labor unrest
5.2	**Effective Governance**
5.2.1	Effectiveness of the political system
5.2.2	Quality of the bureaucracy
5.3	**Pervasiveness of Corruption**
5.3.1	Pervasiveness of corruption
5.4	**Group(s) Interested in Illicitly Acquiring Materials**
5.4.1	Group(s) interested in illicitly acquiring materials

* Indicates new or revised indicator or subindicator. See section titled "Comparison between the 2014 Theft Ranking for Countries with Materials and the 2016 Theft Ranking for Countries with Materials" for more detail on the new and revised indicators and subindicators.

Sabotage Ranking

The overall score (0–100) for each country in the sabotage ranking is a weighted sum of the five categories. Each category is scored on a scale of 0–100, where 100 represents the most favorable and 0 represents the least favorable nuclear security conditions possible in the sabotage ranking. A score of 100 in the sabotage ranking does not indicate that a country has perfect nuclear security conditions; likewise, a score of 0 does not mean that a country has no security. Instead, the scores of 100 and 0 represent the highest and lowest possible scores, respectively, as measured by the NTI Index criteria. Each category is normalized on the basis of the sums of underlying indicators and subindicators, and a weight is then applied. Weights are based on input from the International Panel of Experts and reflect the relative importance and relevance of each indicator and category. Weights in the model, however, are dynamic and can be changed by users.

The five categories of the sabotage rankings are as follows:

1. **Number of Sites.** This category comprises one indicator: Number of Sites.
2. **Security and Control Measures.** This category comprises five indicators: On-Site Physical Protection, Control and Accounting Procedures, Insider Threat Prevention, Response Capabilities, and Cybersecurity.
3. **Global Norms.** This category comprises three indicators: International Legal Commitments, Voluntary Commitments, and International Assurances.
4. **Domestic Commitments and Capacity.** This category comprises three indicators: UN Security Council Resolution (UNSCR) 1540 Implementation, Domestic Nuclear Security Legislation, and Independent Regulatory Agency.
5. **Risk Environment.** This category comprises four indicators: Political Stability, Effective Governance, Pervasiveness of Corruption, and Group(s) Interested in Committing Acts of Nuclear Terrorism.

Each indicator within the five categories contains up to seven underlying subindicators. Principal components analysis (PCA) was also conducted on the model to ensure relevance and robustness of the chosen indicators and categories. The use of PCA is described on page 25.

The categories, indicators, and subindicators are as follows:[5]

1	**NUMBER OF SITES**
1.1	**Number of Sites***
1.1.1	Number of sites*
2	**SECURITY AND CONTROL MEASURES**
2.1	**On-Site Physical Protection**
2.1.1	Mandatory physical protection
2.1.2	On-site reviews of security
2.1.3	Design Basis Threat
2.1.4	Security responsibilities and accountabilities
2.1.5	Performance-based program
2.2	**Control and Accounting Procedures**
2.2.1	Legal and regulatory basis for material control and accounting
2.2.2	Radiological consequences (materials)†
2.2.3	Radiological consequences (equipment, systems, and devices)†
2.2.4	Control measures*
2.2.5	Access control†
2.3	**Insider Threat Prevention**
2.3.1	Personnel vetting
2.3.2	Frequency of personnel vetting
2.3.3	Reporting
2.3.4	Surveillance*
2.4	**Response Capabilities**
2.4.1	Emergency response capabilities
2.4.2	Armed response capabilities*
2.4.3	Law enforcement response training
2.4.4	Nuclear infrastructure protection plan
2.5	**Cybersecurity**
2.5.1	Mandatory cybersecurity
2.5.2	Critical digital asset protection
2.5.3	Cybersecurity Design Basis Threat
2.5.4	Cybersecurity assessments
3	**GLOBAL NORMS**
3.1	**International Legal Commitments**
3.1.1	Convention on the Physical Protection of Nuclear Material (CPPNM)
3.1.2	2005 Amendment to the CPPNM
3.1.3	International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT)
3.1.4	Convention on Nuclear Safety†
3.2	**Voluntary Commitments**
3.2.1	International Atomic Energy Agency (IAEA) membership
3.2.2	Global Initiative to Combat Nuclear Terrorism (GICNT) membership
3.2.3	Global Partnership Against the Spread of Weapons and Materials of Mass Destruction membership
3.2.4	World Institute for Nuclear Security (WINS) contributions
3.2.5	IAEA Nuclear Security Fund contributions
3.2.6	Bilateral or multilateral assistance
3.2.7	Centers of Excellence
3.3	**International Assurances**
3.3.1	Published regulations and reports
3.3.2	Review of security arrangements
4	**DOMESTIC COMMITMENTS AND CAPACITY**
4.1	**UN Security Council Resolution (UNSCR) 1540 Implementation**
4.1.1	UNSCR 1540 reporting
4.1.2	Extent of UNSCR 1540 implementation*

[5] There are differences between the theft ranking for countries with materials framework and the sabotage ranking framework. In some cases, though indicators in both models have the same names, different aspects of nuclear security are being measured (e.g., the number of sites subindicator defines sites differently). Additionally, some indicators and subindicators have the same indicator question and the same scoring criteria, but owing to differences in the theft ranking framework and the sabotage ranking framework, they have different indicator and subindicator numbers. For a more extensive discussion of the differences between the theft ranking and the sabotage ranking, please see the section titled "The Inclusion of Sabotage in 2016" and the indicator frameworks at the end of this EIU Methodology appendix.

4.2	**Domestic Nuclear Security Legislation**
4.2.1	CPPNM implementation authority
4.2.2	National legal framework for CPPNM
4.2.3	Convention on Nuclear Safety report†
4.3	**Independent Regulatory Agency**
4.3.1	Independent regulatory agency
5	**RISK ENVIRONMENT**
5.1	**Political Stability**
5.1.1	Social unrest
5.1.2	Orderly transfers of power
5.1.3	International disputes or tensions
5.1.4	Armed conflict
5.1.5	Violent demonstrations or violent civil or labor unrest
5.2	**Effective Governance**
5.2.1	Effectiveness of the political system
5.2.2	Quality of the bureaucracy
5.3	**Pervasiveness of Corruption**
5.3.1	Pervasiveness of corruption
5.4	**Group(s) Interested in Committing Acts of Nuclear Terrorism***
5.4.1	Group(s) interested in committing acts of nuclear terrorism*

* Denotes indicators and subindicators that are also in the theft ranking but that have been altered.

†Denotes indicators and subindicators that are new to the sabotage ranking.

INDEX CONSTRAINTS AND OTHER IMPORTANT FACTORS

In creating the NTI Index, the EIU relied on publicly available sources, such as laws and regulations. That research approach has the benefit of creating a fully transparent and repeatable methodology, but it also presents some challenges. For example, regulations and codes of practice for nuclear security are sometimes classified. In cases where a country was particularly non-transparent, scores were assigned based on a proxy indicator. The absence of information on nuclear security reduces public and international understanding of the security measures that countries are taking; thus, it is appropriate for those countries that do not make their regulations publicly available to receive low scores.

Although facility-level assessments would provide important "ground truth" information, that level of granularity is not currently possible because of the sensitive nature of specific security arrangements. As a result, the NTI Index relies instead on the assumption that a country with the appropriate laws and regulations in place is more likely to have sound security procedures at each nuclear facility than is a country without appropriate laws and regulations.

Finally, it should be noted that the NTI Index includes "indicators" of security conditions and not the complete set of good security practices that nuclear facilities should employ to protect against theft of weapons-usable nuclear materials or sabotage. For example, information regarding the types of locking mechanisms, surveillance systems, thickness of walls, and so forth is not publicly available for security reasons. The exclusion of specific security practices from the NTI Index does not reflect their lack of importance, but instead reflects the research constraints of the NTI Index.

METHODOLOGY

General

The NTI Index comprises categories that are related to the nuclear security conditions for each country. The NTI Index differentiates among three sets of countries: (a) countries with one kilogram or more of weapons-usable nuclear materials (countries with materials), (b) countries with less than one kilogram of or no weapons-usable nuclear materials (countries without materials), and (c) countries with nuclear facilities, the sabotage of which could result in a significant radiological release with serious off-site health consequences. Twenty-two of the countries in the theft ranking for countries with materials and 23 of the countries in the theft ranking for countries without materials are included in the sabotage ranking.

The scope of the NTI Index theft rankings is limited to highly enriched uranium (HEU), including spent fuel; separated plutonium; and plutonium content in unirradiated

mixed oxide (MOX) fuel. Countries with materials are assessed across five categories, countries without materials are assessed across three categories, and countries with nuclear facilities at risk of sabotage are assessed across five categories.

To score the indicators for the 2016 NTI Index, the research team gathered data from the following sources:

- Primary legal texts and legal reports
- Government publications and reports
- Academic publications and reports
- Websites of government authorities, international organizations, and non-governmental organizations
- Interviews with experts
- EIU proprietary country rankings and reports (specifically "Risk Briefing" and the "Business Environment Ranking")
- Local and international news media reports.

See "Selected Bibliography" for more information on central sources.

By reviewing recent reports pertaining to quantities of nuclear materials and taking into account recent developments, the EIU identified the following 24 countries (listed alphabetically) as having one kilogram or more of highly enriched uranium (HEU), including spent fuel, separated plutonium, or plutonium content in unirradiated mixed oxide (MOX) fuel:

Argentina
Australia
Belarus
Belgium
Canada
China
France
Germany
India
Iran
Israel
Italy
Japan
Kazakhstan
Netherlands
North Korea
Norway
Pakistan
Poland
Russia
South Africa
Switzerland
United Kingdom
United States

The 2016 NTI Index also assesses the following 152 countries (listed alphabetically) that have less than one kilogram of weapons-usable nuclear materials or no weapons-usable nuclear materials:

Afghanistan
Albania
Algeria
Angola
Armenia
Austria
Azerbaijan
Bahamas
Bahrain
Bangladesh
Barbados
Belize
Benin
Bhutan
Bolivia
Bosnia and Herzegovina
Botswana
Brazil
Brunei
Bulgaria
Burkina Faso
Burundi
Cambodia
Cameroon
Cape Verde
Central African Republic
Chad
Chile
Colombia
Comoros
Congo, (Democratic Republic of)
Congo (Brazzaville)
Costa Rica
Côte d'Ivoire
Croatia
Cuba
Cyprus
Czech Republic
Denmark
Djibouti
Dominican Republic
Ecuador
Egypt
Libya
Lithuania
Luxembourg
Macedonia
Madagascar
Malawi
Malaysia
Mali
Malta
Mauritania
Mauritius
Mexico
Moldova
Mongolia
Montenegro
Morocco
Mozambique
Myanmar
Namibia
Nepal
New Zealand
Nicaragua
Niger
Nigeria
Oman
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Portugal
Qatar
Romania
Rwanda
Samoa
São Tomé and Principe
Saudi Arabia
Senegal
Serbia
Seychelles
Sierra Leone
Singapore
Slovakia

El Salvador
Equatorial Guinea
Eritrea
Estonia
Ethiopia
Fiji
Finland
Gabon
Gambia
Georgia
Ghana
Greece
Guatemala
Guinea
Guinea-Bissau
Guyana
Haiti
Honduras
Hungary
Iceland
Indonesia
Iraq
Ireland
Jamaica
Jordan
Kenya
Kuwait
Kyrgyz Republic
Laos
Latvia
Lebanon
Lesotho
Liberia
Slovenia
Solomon Islands
Somalia
South Korea
Spain
Sri Lanka
Sudan
Suriname
Swaziland
Sweden
Syria
Taiwan
Tajikistan
Tanzania
Thailand
Timor-Leste
Togo
Tonga
Trinidad and Tobago
Tunisia
Turkey
Turkmenistan
Uganda
Ukraine
United Arab Emirates
Uruguay
Uzbekistan
Vanuatu
Venezuela
Vietnam
Yemen
Zambia
Zimbabwe

Finally, the 2016 NTI Index also assesses the following 45 countries (listed alphabetically) with nuclear facilities, the sabotage of which could result in a significant radiological release with serious off-site health consequences:

Algeria
Argentina
Armenia
Australia
Bangladesh
Belgium
Brazil
Bulgaria
Canada
Chile
China
Czech Republic
Egypt
Finland
France
Germany
Hungary
India
Indonesia
Iran
Israel
Japan
Kazakhstan
Mexico
Morocco
Netherlands
North Korea
Norway
Pakistan
Peru
Poland
Romania
Russia
Slovakia
Slovenia
South Africa
South Korea
Spain
Sweden
Switzerland
Taiwan
Ukraine
United Kingdom
United States
Uzbekistan

Note that 22 of the countries in the theft ranking for countries with materials and 23 of the countries in the theft ranking for countries without materials are also included in the sabotage ranking.

Data Review and Confirmation Process

After researching the 20 indicators in the theft ranking for countries with materials and the 16 indicators in the sabotage ranking and gathering all relevant information, NTI and the EIU provided all 47 countries that are included in the theft ranking for countries with materials, the sabotage ranking, or both with an opportunity to review and comment on the EIU's preliminary results. The purpose of the data review and confirmation process was to ensure the accuracy of the 2016 NTI Index data, given that much of the research involved subjects for which information is not always publicly available. The research team also recognized that some countries might be willing, upon

request, to provide the EIU with more detailed information than is readily available to the public.

To make that process as simple as possible, the EIU developed documents that presented the data for most of the 2016 NTI Index indicators. Not all indicators, however, were subjected to the confirmation process. For instance, the EIU did not include data that were easily verifiable from publicly available sources (e.g., treaty ratification status) or that were drawn from proprietary EIU databases assessing political stability, effective governance, and corruption. The EIU created three different data review and confirmation forms: (a) one for countries that are included in both the theft ranking for countries with materials and the sabotage ranking (41 subindicators), (b) one for countries that are included in the sabotage ranking only (30 subindicators), and (c) one for countries that are included in the theft ranking for countries with materials only (37 subindicators).

The data review and confirmation form listed the range of possible answers for each subindicator and identified the answer the EIU assigned for the country. The forms allowed the reviewer to either agree or disagree with the answer and provided a comment box in which the reviewer could offer an alternative answer and justification. The EIU used the submitted responses to reevaluate its scores. In some cases, respondents provided information that resulted in the EIU's lowering a country's score, whereas in other cases, scores were raised. When the responses were unclear, the EIU contacted individuals for clarification. Country representatives had five months—from mid-June to November 1, 2015—to respond to the data review and confirmation request.

Of the 47 countries, 25 responded to the data review and confirmation request. Those countries were Australia, Belarus, Belgium, Bulgaria, Canada, Chile, the Czech Republic, Finland, France, Germany, Hungary, Italy, Japan, Mexico, the Netherlands, Norway, Poland, Slovakia, Slovenia, South Korea, Sweden, Switzerland, Taiwan, the United Kingdom, and the United States.[6]

[6] Of the 25 countries that responded to the data confirmation, 12 were included in both the theft ranking for countries with materials and the sabotage ranking: Australia, Belgium, Canada, France, Germany, Japan, the Netherlands, Norway, Poland, Switzerland, the United Kingdom, and the United States. The two countries that are included in only the theft ranking for countries with materials are Belarus and Italy. The remaining 11 responses were from countries that are included in only the sabotage ranking: Bulgaria, Chile, the Czech Republic, Finland, Hungary, Mexico, Slovakia, Slovenia, South Korea, Sweden, and Taiwan.

Technical Advisors

In addition to the International Panel of Experts, the EIU received expert guidance from technical advisors throughout the research process. Those technical advisors helped the EIU modify and refine indicators to capture key elements of nuclear security and then provided insights into the more technical parts of the research. The following technical advisors were consulted throughout the research process:

- **Clifford Glantz**, project manager and senior staff scientist with Pacific Northwest National Laboratory. His research teams focus on issues related to cybersecurity, information security, risk assessment, and emergency management.
- **Dmitry Kovchegin**, independent consultant with experience in nuclear industry and related security issues.
- **Lonnie Moore**, senior security specialist for the Centerra Group; independent consultant and analyst; former manager at Lawrence Livermore National Laboratory; and project leader and subject-matter expert for several U.S. Department of Energy Materials Protection, Control, and Accounting and Global Threat Reduction Initiative program teams.

Data Modeling

Data were collected across 60 subindicators for the theft ranking for countries with materials, 27 subindicators for the theft ranking for countries without materials, and 51 subindicators for countries in the sabotage ranking. The subindicators range from binomial observations (0, 1) to subindicators with nine possible scoring options. Each subindicator is constructed such that a higher value is associated with more favorable nuclear security conditions. For example, for the Number of Sites subindicator in the theft ranking for countries with materials, a country with 100 or more sites with nuclear materials is assigned a value of 0, whereas a country with one site is assigned a value of 3. The sum of the subindicator values determines the value of the indicator. Countries in the theft ranking for countries with materials are assessed across 20 indicators, countries in the theft ranking for countries without materials are assessed across 9 indicators, and countries in the sabotage ranking are assessed across 16 indicators.

Theft Ranking for Countries with Materials

The scoring scheme for each component of the theft ranking for countries with materials is listed in the following table:

1	**QUANTITIES AND SITES**	**Scored 0–100 (where 100 = most favorable nuclear materials security conditions)**
1.1	**Quantities of Nuclear Materials**	**Scored 0–8 (where 8 = most favorable nuclear materials security conditions)**
1.1.1	Quantities of nuclear materials	Scored 0–8
1.2	**Sites and Transportation**	**Scored 0–6 (where 6 = most favorable nuclear materials security conditions)**
1.2.1	Number of sites	Scored 0–3
1.2.2	Bulk processing facility	Scored 0–1
1.2.3	Frequency of materials transport	Scored 0–2
1.3	**Material Production and Elimination Trends**	**Scored 0–4 (where 4 = most favorable nuclear materials security conditions)**
1.3.1	Material production/elimination trends	Scored 0–4
2	**SECURITY AND CONTROL MEASURES**	**Scored 0–100 (where 100 = most favorable nuclear materials security conditions)**
2.1	**On-Site Physical Protection**	**Scored 0–5 (where 5 = most favorable nuclear materials security conditions)**
2.1.1	Mandatory physical protection	Scored 0–1
2.1.2	On-site reviews of security	Scored 0–1
2.1.3	Design Basis Threat	Scored 0–1
2.1.4	Security responsibilities and accountabilities	Scored 0–1
2.1.5	Performance-based program	Scored 0–1
2.2	**Control and Accounting Procedures**	**Scored 0–7 (where 7 = most favorable nuclear materials security conditions)**
2.2.1	Legal and regulatory basis for material control and accounting	Scored 0–2
2.2.2	Measurement methods	Scored 0–1
2.2.3	Inventory record	Scored 0–1
2.2.4	Material Balance Area(s)	Scored 0–1
2.2.5	Control measures	Scored 0–2
2.3	**Insider Threat Prevention**	**Scored 0–9 (where 9 = most favorable nuclear materials security conditions)**
2.3.1	Personnel vetting	Scored 0–3
2.3.2	Frequency of personnel vetting	Scored 0–3

2.3.3	Reporting	Scored 0–1
2.3.4	Surveillance	Scored 0-2
2.4	**Physical Security during Transport**	**Scored 0–2 (where 2 = most favorable nuclear materials security conditions)**
2.4.1	Physical security during transport	Scored 0–2
2.5	**Response Capabilities**	**Scored 0–7 (where 7 = most favorable nuclear materials security conditions)**
2.5.1	Emergency response capabilities	Scored 0–3
2.5.2	Armed response capabilities	Scored 0–1
2.5.3	Law enforcement response training	Scored 0–1
2.5.4	Nuclear infrastructure protection plan	Scored 0–2
2.6	**Cybersecurity**	**Scored 0–4 (where 4 = most favorable nuclear materials security conditions)**
2.6.1	Mandatory cybersecurity	Scored 0–1
2.6.2	Critical digital asset protection	Scored 0–1
2.6.3	Cybersecurity Design Basis Threat	Scored 0–1
2.6.4	Cybersecurity assessments	Scored 0–1
3	**GLOBAL NORMS**	**Scored 0–100 (where 100 = most favorable nuclear materials security conditions)**
3.1	**International Legal Commitments**	**Scored 0–5 (where 5 = most favorable nuclear materials security conditions)**
3.1.1	Convention on the Physical Protection of Nuclear Material (CPPNM)	Scored 0–2
3.1.2	2005 Amendment to the CPPNM	Scored 0–1
3.1.3	International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT)	Scored 0–2
3.2	**Voluntary Commitments**	**Scored 0–5 (where 5 = most favorable nuclear materials security conditions)**
3.2.1	International Atomic Energy Agency (IAEA) membership	Scored 0–1
3.2.2	Proliferation Security Initiative (PSI) membership	Scored 0–1
3.2.3	Global Initiative to Combat Nuclear Terrorism (GICNT) membership	Scored 0–1
3.2.4	Global Partnership Against the Spread of Weapons and Materials of Mass Destruction membership	Scored 0–1
3.2.5	World Institute for Nuclear Security (WINS) contributions	Scored 0–1
3.2.6	IAEA Nuclear Security Fund contributions	Scored 0–1
3.2.7	Bilateral or multilateral assistance	Scored 0–1
3.2.8	Centers of Excellence	Scored 0–1

3.3	**International Assurances**	**Scored 0–5 (where 5 = most favorable nuclear materials security conditions)**
3.3.1	Published regulations and reports	Scored 0–2
3.3.2	Public declarations and reports about nuclear materials	Scored 0–1
3.3.3	Review of security arrangements	Scored 0–2
4	**DOMESTIC COMMITMENTS AND CAPACITY**	**Scored 0–100 (where 100 = most favorable nuclear materials security conditions)**
4.1	**UN Security Council Resolution (UNSCR) 1540 Implementation**	**Scored 0–5 (where 5 = most favorable nuclear materials security conditions)**
4.1.1	UNSCR 1540 reporting	Scored 0–1
4.1.2	Extent of UNSCR 1540 implementation	Scored 0–4
4.2	**Domestic Nuclear Materials Security Legislation**	**Scored 0–2 (where 2 = most favorable nuclear materials security conditions)**
4.2.1	CPPNM implementation authority	Scored 0–1
4.2.2	National legal framework for CPPNM	Scored 0–1
4.3	**Safeguards Adherence and Compliance**	**Scored 0–6 (where 6 = most favorable nuclear materials security conditions)**
4.3.1	IAEA safeguards agreement (excluding Additional Protocol)	Scored 0–2
4.3.2	IAEA Additional Protocol	Scored 0–1
4.3.3	Facility exclusion from safeguards	Scored 0–1
4.3.4	Safeguards violations	Scored 0–2
4.4	**Independent Regulatory Agency**	**Scored 0–1 (where 1 = most favorable nuclear materials security conditions)**
4.4.1	Independent regulatory agency	Scored 0–1
5	**RISK ENVIRONMENT**	**Scored 0–100 (where 100 = most favorable nuclear materials security conditions)**
5.1	**Political Stability**	**Scored 0–20 (where 20 = most favorable nuclear materials security conditions)**
5.1.1	Social unrest	Scored 0–4
5.1.2	Orderly transfers of power	Scored 0–4
5.1.3	International disputes or tensions	Scored 0–4
5.1.4	Armed conflict	Scored 0–4
5.1.5	Violent demonstrations or violent civil or labor unrest	Scored 0–4
5.2	**Effective Governance**	**Scored 0–8 (where 8 = most favorable nuclear materials security conditions)**
5.2.1	Effectiveness of the political system	Scored 0–4
5.2.2	Quality of the bureaucracy	Scored 0–4

5.3	**Pervasiveness of Corruption**	**Scored 0–4 (where 4 = most favorable nuclear materials security conditions)**
5.3.1	Pervasiveness of corruption	Scored 0–4
5.4	**Group(s) Interested in Illicitly Acquiring Materials**	**Scored 0–2 (where 2 = most favorable nuclear materials security conditions)**
5.4.1	Group(s) interested in illicitly acquiring materials	Scored 0–2

Theft Ranking for Countries without Materials

The scoring scheme for each component of the theft ranking for countries without materials is listed in the following table:

3	**GLOBAL NORMS**	**Scored 0–100 (where 100 = most favorable nuclear materials security conditions)**
3.1	**International Legal Commitments**	**Scored 0–5 (where 5 = most favorable nuclear materials security conditions)**
3.1.1	Convention on the Physical Protection of Nuclear Material (CPPNM)	Scored 0–2
3.1.2	2005 Amendment to the CPPNM	Scored 0–1
3.1.3	International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT)	Scored 0–2
3.2	**Voluntary Commitments**	**Scored 0–5 (where 5 = favorable nuclear materials security conditions)**
3.2.1	International Atomic Energy Agency (IAEA) membership	Scored 0–1
3.2.2	Proliferation Security Initiative (PSI) membership	Scored 0–1
3.2.3	Global Initiative to Combat Nuclear Terrorism (GICNT) membership	Scored 0–1
3.2.4	Global Partnership Against the Spread of Weapons and Materials of Mass Destruction membership	Scored 0–1
3.2.5	World Institute for Nuclear Security (WINS) contributions	Scored 0–1
3.2.6	IAEA Nuclear Security Fund contributions	Scored 0–1
3.2.7	Bilateral or multilateral assistance	Scored 0–1
3.2.8	Centers of Excellence	Scored 0–1
4	**DOMESTIC COMMITMENTS AND CAPACITY**	**Scored 0–100 (where 100 = most favorable nuclear materials security conditions)**
4.1	**UN Security Council Resolution (UNSCR) 1540 Implementation**	**Scored 0–5 (where 5 = most favorable nuclear materials security conditions)**
4.1.1	UNSCR 1540 reporting	Scored 0–1
4.1.2	Extent of UNSCR 1540 implementation	Scored 0–4

4.2	**Domestic Nuclear Materials Security Legislation**	**Scored 0–2 (where 2 = most favorable nuclear materials security conditions)**
4.2.1	CPPNM implementation authority	Scored 0–1
4.2.2	National legal framework for CPPNM	Scored 0–1
4.3	**Safeguards Adherence and Compliance**	**Scored 0–6 (where 6 = most favorable nuclear materials security conditions)**
4.3.1	IAEA safeguards agreement (excluding Additional Protocol)	Scored 0–3
4.3.2	IAEA Additional Protocol	Scored 0–1
4.3.3	Safeguards violations	Scored 0–2
5	**RISK ENVIRONMENT**	**Scored 0–100 (where 100 = most favorable nuclear materials security conditions)**
5.1	**Political Stability**	**Scored 0–20 (where 20 = most favorable nuclear materials security conditions)**
5.1.1	Social unrest	Scored 0–4
5.1.2	Orderly transfers of power	Scored 0–4
5.1.3	International disputes or tensions	Scored 0–4
5.1.4	Armed conflict	Scored 0–4
5.1.5	Violent demonstrations or violent civil or labor unrest	Scored 0–4
5.2	**Effective Governance**	**Scored 0–8 (where 8 = most favorable nuclear materials security conditions)**
5.2.1	Effectiveness of the political system	Scored 0–4
5.2.2	Quality of the bureaucracy	Scored 0–4
5.3	**Pervasiveness of Corruption**	**Scored 0–4 (where 4 = most favorable nuclear materials security conditions)**
5.3.1	Pervasiveness of corruption	Scored 0–4
5.4	**Group(s) Interested in Illicitly Acquiring Materials**	**Scored 0–2 (where 2 = most favorable nuclear materials security conditions)**
5.4.1	Group(s) interested in illicitly acquiring materials	Scored 0–2

Sabotage Ranking

The scoring scheme for each component of the sabotage ranking is listed in the following table:

1	**NUMBER OF SITES**	**Scored 0–100 (where 100 = most favorable nuclear security conditions)**
1.1	**Number of Sites**	**Scored 0–5 (where 5 = most favorable nuclear security conditions)**
1.1.1	Number of sites	Scored 0–5
2	**SECURITY AND CONTROL MEASURES**	**Scored 0–100 (where 100 = most favorable nuclear security conditions)**
2.1	**On-Site Physical Protection**	**Scored 0–5 (where 5 = most favorable nuclear security conditions)**
2.1.1	Mandatory physical protection	Scored 0–1
2.1.2	On-site reviews of security	Scored 0–1
2.1.3	Design Basis Threat	Scored 0–1
2.1.4	Security responsibilities and accountabilities	Scored 0–1
2.1.5	Performance-based program	Scored 0–1
2.2	**Control and Accounting Procedures**	**Scored 0–7 (where 7 = most favorable nuclear security conditions)**
2.2.1	Legal and regulatory basis for material control and accounting	Scored 0–2
2.2.2	Radiological consequences (materials)	Scored 0–1
2.2.3	Radiological consequences (equipment, systems, and devices)	Scored 0–1
2.2.4	Control measures	Scored 0–2
2.2.5	Access control	Scored 0–1
2.3	**Insider Threat Prevention**	**Scored 0–9 (where 9 = most favorable nuclear security conditions)**
2.3.1	Personnel vetting	Scored 0–3
2.3.2	Frequency of personnel vetting	Scored 0–3
2.3.3	Reporting	Scored 0–1
2.3.4	Surveillance	Scored 0–2
2.4	**Response Capabilities**	**Scored 0–7 (where 7 = most favorable nuclear security conditions)**
2.4.1	Emergency response capabilities	Scored 0–3
2.4.2	Armed response capabilities	Scored 0–1
2.4.3	Law enforcement response training	Scored 0–1
2.4.4	Nuclear infrastructure protection plan	Scored 0–2

2.5	**Cybersecurity**	**Scored 0–4 (where 4 = most favorable nuclear security conditions)**
2.5.1	Mandatory cybersecurity	Scored 0–1
2.5.2	Critical digital asset protection	Scored 0–1
2.5.3	Cybersecurity Design Basis Threat	Scored 0–1
2.5.4	Cybersecurity assessments	Scored 0–1
3	**GLOBAL NORMS**	**Scored 0–100 (where 100 = most favorable nuclear security conditions)**
3.1	**International Legal Commitments**	**Scored 0–7 (where 7 = most favorable nuclear security conditions)**
3.1.1	Convention on the Physical Protection of Nuclear Material (CPPNM)	Scored 0–2
3.1.2	2005 Amendment to the CPPNM	Scored 0–1
3.1.3	International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT)	Scored 0–2
3.1.4	Convention on Nuclear Safety	Scored 0–2
3.2	**Voluntary Commitments**	**Scored 0–5 (where 5 = most favorable nuclear security conditions)**
3.2.1	International Atomic Energy Agency (IAEA) membership	Scored 0–1
3.2.2	Global Initiative to Combat Nuclear Terrorism (GICNT) membership	Scored 0–1
3.2.3	Global Partnership Against the Spread of Weapons and Materials of Mass Destruction membership	Scored 0–1
3.2.4	World Institute for Nuclear Security (WINS) contributions	Scored 0–1
3.2.5	IAEA Nuclear Security Fund contributions	Scored 0–1
3.2.6	Bilateral or multilateral assistance	Scored 0–1
3.2.7	Centers of Excellence	Scored 0–1
3.3	**International Assurances**	**Scored 0–4 (where 4 = most favorable nuclear security conditions)**
3.3.1	Published regulations and reports	Scored 0–2
3.3.2	Review of security arrangements	Scored 0–2

4	**DOMESTIC COMMITMENTS AND CAPACITY**	**Scored 0–100 (where 100 = most favorable nuclear security conditions)**
4.1	**UN Security Council Resolution (UNSCR) 1540 Implementation**	**Scored 0–5 (where 5 = most favorable nuclear security conditions)**
4.1.1	UNSCR 1540 reporting	Scored 0–1
4.1.2	Extent of UNSCR 1540 implementation	Scored 0–4
4.2	**Domestic Nuclear Security Legislation**	**Scored 0–3 (where 3 = most favorable nuclear security conditions)**
4.2.1	CPPNM implementation authority	Scored 0–1
4.2.2	National legal framework for CPPNM	Scored 0–1
4.2.3	Convention on Nuclear Safety report	Scored 0–1
4.3	**Independent Regulatory Agency**	**Scored 0–1 (where 1 = most favorable nuclear security conditions)**
4.3.1	Independent regulatory agency	Scored 0–1
5	**RISK ENVIRONMENT**	**Scored 0–100 (where 100 = most favorable nuclear security conditions)**
5.1	**Political Stability**	**Scored 0–20 (where 20 = most favorable nuclear security conditions)**
5.1.1	Social unrest	Scored 0–4
5.1.2	Orderly transfers of power	Scored 0–4
5.1.3	International disputes or tensions	Scored 0–4
5.1.4	Armed conflict	Scored 0–4
5.1.5	Violent demonstrations or violent civil or labor unrest	Scored 0–4
5.2	**Effective Governance**	**Scored 0–8 (where 8 = most favorable nuclear security conditions)**
5.2.1	Effectiveness of the political system	Scored 0–4
5.2.2	Quality of the bureaucracy	Scored 0–4
5.3	**Pervasiveness of Corruption**	**Scored 0–4 (where 4 = most favorable nuclear security conditions)**
5.3.1	Pervasiveness of corruption	Scored 0–4
5.4	**Group(s) Interested in Committing Acts of Nuclear Terrorism**	**Scored 0–2 (where 2 = most favorable nuclear security conditions)**
5.4.1	Group(s) interested in committing acts of nuclear terrorism	Scored 0–2

Calculating the 2016 NTI Nuclear Security Index

Modeling the subindicators, indicators, and categories in the NTI Index results in overall scores of 0–100 for each country, in which 100 represents the most favorable and 0 the least favorable nuclear security conditions possible. A score of 100 in the NTI Index does not indicate that a country has perfect nuclear security, and a score of 0 does not mean that a country has no security. Instead, scores of 100 and 0 represent the highest and lowest possible scores, respectively, as measured by the NTI Index criteria. The subindicators listed are classified into indicators, and their values are summed to determine the value of the indicator:

indicator score = ∑ individual subindicators

For the theft ranking for countries with materials, the indicators are classified into five categories: Quantities and Sites (three indicators), Security and Control Measures (six indicators), Global Norms (three indicators), Domestic Commitments and Capacity (four indicators), and Risk Environment (four indicators). For the theft ranking for countries without materials, the indicators are classified into three categories: Global Norms (two indicators), Domestic Commitments and Capacity (three indicators), and Risk Environment (four indicators). For the sabotage ranking, the indicators are classified into five categories: Number of Sites (one indicator), Security and Control Measures (five indicators), Global Norms (three indicators), Domestic Commitments and Capacity (three indicators), and Risk Environment (four indicators). The category values are a weighted total of the indicators in the category:

category score = ∑ weighted individual indicators

The category values have been normalized on the basis of the following equation:

$$x = (x - \text{Min}(x)) / (\text{Max}(x) - \text{Min}(x)),$$

where Min(x) and Max(x) are, respectively, the lowest and highest values in the NTI Index (i.e., out of the 24 countries with materials, out of the 152 countries without materials, or out of the 45 countries with nuclear facilities at risk of sabotage) for any given indicator. The normalized value (i.e., a score of 0–100) makes it directly comparable with other normalized indicator scores.

The following is an example of calculating the category score:

		Normalized Score (0–100)	Weight	Weighted Score	
1.1	Quantities of Nuclear Materials	100	42%	42% of 100	42
1.2	Sites and Transportation	50	35%	35% of 50	18
1.3	Material Production and Elimination Trends	100	23%	23% of 100	23

The overall score for each country is the weighted sum of the category scores, as determined by the weighting profile:

Overall score = ∑ weighted category scores

The following is an example of calculating the overall score:

		Normalized Score (0–100)	Weight	Weighted Score	
1	Quantities and Sites	55	16%	16% of 55	9
2	Security and Control Measures	38	29%	29% of 38	11
3	Global Norms	88	17%	17% of 88	15
4	Domestic Commitments and Capacity	44	20%	20% of 44	9
5	Risk Environment	58	18%	18% of 58	10

The countries with materials, countries without materials, and countries with nuclear facilities at risk of sabotage can then be ranked according to those parameters.

Model Weights

The weights assigned to each category and indicator can be changed in the NTI Index data models to reflect different assumptions about their relative importance. Three sets of weights are provided in all of the data models. The weights defined by NTI and the EIU are the default setting. They are based on extensive discussions between NTI, the EIU, the International Panel of Experts, and others on the relative value of each category and indicator. The second weighting option, called neutral weights, assumes equal importance of all categories and evenly distributes weights on that basis. The third option, equal weights, assigns an identical weight to each indicator rather than to each category.

The first option, which is used for the NTI and EIU default weights, uses expert judgment to assign weights to indicators and brings a real-world perspective to an index, which is important if an index is to guide policy actions. The second and third options—in which all categories or indicators, respectively, are weighted equally—have the advantage of simplicity and do not involve subjective judgment. A disadvantage of those options is that they assume that all indicators or categories, respectively, are equally significant.

A fourth weighting option, which is included in the theft ranking for countries with materials and sabotage ranking data models, is principal components analysis (PCA) weights. PCA weights are derived through a mathematical process that takes into account the covariance between indicators and the importance of a particular element in maximizing the variation in the index scores. It aims to minimize redundancy between variables and maximize the variance within the index, but it does not consider indicators' perceived importance.

Weight Profile Defined by NTI and the EIU for the Theft Ranking for Countries with Materials

CATEGORY	WEIGHT
Quantities and Sites	16%
Security and Control Measures	29%
Global Norms	17%
Domestic Commitments and Capacity	20%
Risk Environment	18%

	INDICATOR	WEIGHT
1	**Quantities and Sites**	
1.1	Quantities of Nuclear Materials	42%
1.2	Sites and Transportation	35%
1.3	Material Production and Elimination Trends	23%
2	**Security and Control Measures**	
2.1	On-Site Physical Protection	20%
2.2	Control and Accounting Procedures	15%
2.3	Insider Threat Prevention	19%
2.4	Physical Security during Transport	18%
2.5	Response Capabilities	18%
2.6	Cybersecurity	10%
3	**Global Norms**	
3.1	International Legal Commitments	42%
3.2	Voluntary Commitments	27%
3.3	International Assurances	31%
4	**Domestic Commitments and Capacity**	
4.1	UN Security Council Resolution (UNSCR) 1540 Implementation	20%
4.2	Domestic Nuclear Materials Security Legislation	31%
4.3	Safeguards Adherence and Compliance	22%
4.4	Independent Regulatory Agency	27%
5	**Risk Environment**	
5.1	Political Stability	26%
5.2	Effective Governance	25%
5.3	Pervasiveness of Corruption	22%
5.4	Group(s) Interested in Illicitly Acquiring Materials	27%

Weight Profile Defined by NTI and the EIU for the Theft Ranking for Countries without Materials

CATEGORY	WEIGHT*
Global Norms	31%
Domestic Commitments and Capacity	39%
Risk Environment	31%

	INDICATOR	WEIGHT
3	**Global Norms**	
3.1	International Legal Commitments	64%
3.2	Voluntary Commitments	36%
4	**Domestic Commitments and Capacity**	
4.1	UN Security Council Resolution (UNSCR) 1540 Implementation	33%
4.2	Domestic Nuclear Materials Security Legislation	41%
4.3	Safeguards Adherence and Compliance	26%
5	**Risk Environment**	
5.1	Political Stability	24%
5.2	Effective Governance	25%
5.3	Pervasiveness of Corruption	26%
5.4	Group(s) Interested in Illicitly Acquiring Materials	25%

* Category weights do not sum to 100% due to rounding.

Weight Profile Defined by NTI and the EIU for the Sabotage Ranking

CATEGORY	WEIGHT
Number of Sites	5%
Security and Control Measures	33%
Global Norms	19%
Domestic Commitments and Capacity	23%
Risk Environment	20%

	INDICATOR	WEIGHT
1	**Number of Sites**	
1.1	Number of Sites	100%
2	**Security and Control Measures**	
2.1	On-Site Physical Protection	22%
2.2	Control and Accounting Procedures	17%
2.3	Insider Threat Prevention	21%
2.4	Response Capabilities	20%
2.5	Cybersecurity	20%
3	**Global Norms**	
3.1	International Legal Commitments	42%
3.2	Voluntary Commitments	27%
3.3	International Assurances	31%
4	**Domestic Commitments and Capacity**	
4.1	UN Security Council Resolution (UNSCR) 1540 Implementation	27%
4.2	Domestic Nuclear Security Legislation	38%
4.3	Independent Regulatory Agency	35%
5	**Risk Environment**	
5.1	Political Stability	26%
5.2	Effective Governance	25%
5.3	Pervasiveness of Corruption	22%
5.4	Group(s) Interested in Committing Acts of Nuclear Terrorism	27%

Principal Components Analysis

The goal of principal components analysis (PCA) is to define quantitatively a weighting scheme for the indicators that are used to create a composite index or ranking of overall nuclear security. PCA is a method for removing redundant information shared across indicators by specifying a weighting that explains the most variance in the data.

The PCA-weights feature within the NTI Index models has been provided for those experts who may wish to explore the behavior of the model in more depth. They should not be considered (a) an alternative to the NTI/EIU weights or (b) a means of understanding country rankings and scores, because they do not consider the intrinsic significance of an indicator in the context of the NTI Index.

PCA assigns each element in an index a weight that takes into account the covariance between indicators and the importance of a particular element in maximizing the variation in the index outcome (nuclear security conditions); in other words, it aims to minimize redundancy between variables and to maximize the variance with respect to the outcome. The weight is calculated by taking the principal component (eigenvector) associated with the highest explained variance (eigenvalue).

PCA is a way of decomposing the data into independent components ordered by informational content and, according to economist Rati Ram,[7] is a natural choice for an index weighting. Important assumptions for valid PCA are (a) that variance is meaningful and not the result of data with large measurement error and (b) that the dynamics of interest (nuclear security conditions) are along the direction with the largest variance.

A one-stage PCA analysis solves for the weights that maximize the variance across all of the indicators, irrespective of category membership:

1. Perform PCA analysis on all of the indicators at once, ignoring category membership.
2. Take the principal component associated with the highest eigenvalue.
3. Set negative components to zero (if positive weights are required).
4. Normalize within indicator weights so that the sum of the weights is 1.
5. Normalize the category weights so that the sum across categories is 1.
    - Take the sum of the non-normalized subindicator weights and use it as the indicator weight for that category.
    - Then, renormalize top-level indicator weights across indicators so that they also sum to 1.

Variation within indicator weights is a sign of redundancy in the elements or that some elements are not as relevant in explaining the variation in the overall index once all of the other variables are considered. Finding equal weights across indicators is a sign of very little redundancy across subgroups and similar relevance in explaining variation in the index, which suggests that the index was appropriately divided into subgroups.

[7] Rati Ram, "Composite Indices of Physical Quality of Life, Basic Needs Fulfillment, and Income: A 'Principal Component' Representation," *Journal of Development Economics* 11, no. 2 (1982): 227–47.

Weight Profile Defined by PCA for the Theft Ranking for Countries with Materials

	INDICATOR	WEIGHT
1	**Quantities and Sites**	
1.1	Quantities of Nuclear Materials	0%
1.2	Sites and Transportation	12%
1.3	Material Production and Elimination Trends	88%
2	**Security and Control Measures**	
2.1	On-Site Physical Protection	22%
2.2	Control and Accounting Procedures	21%
2.3	Insider Threat Prevention	19%
2.4	Physical Security during Transport	11%
2.5	Response Capabilities	15%
2.6	Cybersecurity	12%
3	**Global Norms**	
3.1	International Legal Commitments	35%
3.2	Voluntary Commitments	36%
3.3	International Assurances	28%
4	**Domestic Commitments and Capacity**	
4.1	UN Security Council Resolution (UNSCR) 1540 Implementation	27%
4.2	Domestic Nuclear Materials Security Legislation	26%
4.3	Safeguards Adherence and Compliance	26%
4.4	Independent Regulatory Agency	21%
5	**Risk Environment**	
5.1	Political Stability	38%
5.2	Effective Governance	30%
5.3	Pervasiveness of Corruption	29%
5.4	Group(s) Interested in Illicitly Acquiring Materials	2%

Weight Profile Defined by PCA for the Sabotage Ranking

	INDICATOR	WEIGHT
1	**Number of Sites**	
1.1	Number of Sites	100%
2	**Security and Control Measures**	
2.1	On-Site Physical Protection	25%
2.2	Control and Accounting Procedures	23%
2.3	Insider Threat Prevention	21%
2.4	Response Capabilities	18%
2.5	Cybersecurity	13%
3	**Global Norms**	
3.1	International Legal Commitments	36%
3.2	Voluntary Commitments	33%
3.3	International Assurances	31%
4	**Domestic Commitments and Capacity**	
4.1	UN Security Council Resolution (UNSCR) 1540 Implementation	43%
4.2	Domestic Nuclear Security Legislation	40%
4.3	Independent Regulatory Agency	17%
5	**Risk Environment**	
5.1	Political Stability	37%
5.2	Effective Governance	28%
5.3	Pervasiveness of Corruption	25%
5.4	Group(s) Interested in Committing Acts of Nuclear Terrorism	10%

Model Correlations

Correlating the 2016 theft ranking for countries with materials to other data sets reveals some potentially interesting associations. Correlations measure the strength of a relationship between two variables. Scatter plots, which can be found on the "Correlation–Scatter Plot" worksheet in the theft ranking data model for countries with materials, show the correlations between the 2016

theft ranking and a number of variables. Correlation analysis for three of those variables follows:

1. **Global Peace Index.** The 2015 Global Peace Index (GPI) gauges ongoing domestic and international conflict, safety and security in society, and levels of militarization. The GPI is scored from 1 to 5, where countries that are most at peace receive a score of 1, and countries with lower levels of peace receive a higher value. In the 2016 theft ranking for countries with materials, the GPI scale is inverted so that countries that are most at peace receive a score of 5, and those that are less peaceful receive lower scores. The results indicate a high positive correlation (0.84) between a country's GPI score and its 2016 theft ranking score for countries with materials. This result has a certain logic because a high GPI score corresponds to a higher level of peace and implies a higher level of nuclear materials security. The correlation is positive because as GPI decreases (meaning a country is less at peace), the 2016 theft ranking for countries with materials decreases (meaning nuclear materials security conditions are less favorable).

2. **Regulatory quality.** The regulatory quality indicator is a qualitative assessment capturing perceptions of the ability of a government to formulate and implement sound policies and regulations and is taken from the World Bank's Worldwide Governance Indicators. Countries are ranked from –2.5 to 2.5, where –2.5 is "very low" and 2.5 is "very high." There is a strong positive correlation of 0.8 between the regulatory quality variable and the 2016 theft ranking for countries with materials. The correlation shows that countries with higher regulatory quality tend to have better nuclear materials security conditions.

3. **Gross domestic product (GDP) per head.** This quantitative indicator is a measure of GDP per head in nominal U.S. dollar terms and allows for a basic comparison of countries with regard to standard of living. For countries with weapons-usable nuclear materials, the correlation between GDP per capita and the 2016 theft ranking score for countries with materials is 0.68. The correlation shows that as GDP per capita increases, a country's overall NTI Index score is likely to increase as well.

COMPARISON BETWEEN THE 2014 AND 2016 THEFT RANKINGS FOR COUNTRIES WITH MATERIALS

NTI and the EIU made a number of changes to the NTI Index framework for the theft ranking for countries with materials between 2014 and 2016. The goal of the changes was to refine the 2016 framework to capture a country's nuclear materials security conditions more rigorously, while still maintaining the integrity of the 2014 framework for comparability. The 2014 theft ranking for countries with materials was made up of 19 indicators and 56 subindicators. One indicator and 4 subindicators were added to the 2016 ranking, leading to a total of 20 indicators and 60 subindicators. Three other subindicators were slightly altered. In addition, the weights used in the 2014 theft ranking were refined for the 2016 theft ranking with input from the International Panel of Experts. This section provides greater detail on those changes, as well as on how countries were compared and the methodology used to facilitate the comparison between the 2014 and 2016 theft rankings.

New Indicators and Revised Methodology for Measuring Indicators

The Response Capabilities indicator comprises four subindicators, one of which was modified from the 2014 NTI Index. Next is a summary of the revised subindicator:

2.5.3 Law enforcement response training

In 2014, this subindicator assessed whether a country's law enforcement was trained to respond specifically to an event of theft of nuclear materials. In 2016, the indicator asks whether law enforcement is trained to respond in the event of a security incident at a nuclear facility. This change reflects the addition of the sabotage ranking to the 2016 NTI Index. Both the theft of nuclear materials and the sabotage of facilities are included in the definition of a "security incident." Therefore, countries included in both the theft ranking for countries with materials and the sabotage ranking receive the same score in both models for this subindicator.

The Cybersecurity indicator is a new indicator that assesses requirements to protect nuclear facilities against cyber attacks. It comprises four subindicators. Next is a description of each new subindicator:

2.6.1 Mandatory cybersecurity

This subindicator captures whether nuclear facilities are required to be protected against cyber attacks. It specifically considers whether countries require facilities to have a cybersecurity program or plan. In a case where critical infrastructure protection plans are required to have a cybersecurity component, nuclear facilities must specifically be mentioned for countries to receive credit.

2.6.2 Critical digital asset protection

The critical digital asset protection subindicator assesses whether protection from cyber attacks is mandated for critical digital assets. Critical digital assets encompass digital computer and communication systems and networks, which include safety-related, security, and emergency preparedness functions, as well as support systems and equipment related to the previous functions.

2.6.3 Cybersecurity Design Basis Threat

This subindicator asks whether countries consider cybersecurity in their threat assessments or design basis threat (DBT). A country receives credit if the responsible state authority periodically issues a threat evaluation, including threats to the security of computer systems and information about current attack vectors related to the security of computer systems used at nuclear facilities.

2.6.4 Cybersecurity assessments

This subindicator determines whether nuclear facilities are required to have a performance-based program with tests and assessment of cybersecurity. Countries receive credit if licensees are mandated to conduct periodic inspections, audits, and reviews of the computer security.

The International Assurances indicator comprises three subindicators, one of which was revised from the 2014 NTI Index. Next is a summary of the changes:

3.3.3 Review of security arrangements

In the 2014 NTI Index, this subindicator asked whether the country had invited one of the eligible International Atomic Energy Agency (IAEA) missions or other peer review. In the 2016 NTI Index, this subindicator was revised to assess whether a country has hosted a review of security arrangements. In addition, scoring guidance was revised to clarify that credit is given for IAEA Integrated Regulatory Review Service missions only if those missions include a security component and are not safety-related reviews only.

The UN Security Council Resolution (UNSCR) 1540 Implementation indicator comprises two subindicators. One of those subindicators was revised in both the theft ranking for countries with materials and the theft ranking for countries without materials. Next is a description of the revised subindicator:

4.1.2 Extent of UNSCR 1540 implementation

In the 2014 NTI Index for countries with materials, this indicator considered 121 elements of the UNSCR 1540 matrix; the indicator considered 91 elements in the 2014 NTI Index for countries without materials. Four elements are no longer counted in the two theft rankings, because they were deemed irrelevant to nuclear materials security. The ranking for countries with materials now considers 117 elements of the UNSCR 1540 matrix, whereas the ranking for countries without materials considers 87 elements.

Comparability between 2014 and 2016

To ensure an accurate year-on-year comparison, the EIU required identical data sets for 2012, 2014, and 2016. The new and revised indicators described earlier posed a challenge, because they were not scored for 2014 or 2012. The EIU undertook research to rescore the 2014 and 2012 theft rankings—using the revised 2016 framework—as if it were 2013 (when research for the 2014 NTI Index was conducted) and 2011 (when research for the 2012 NTI Index was conducted).

In some cases, the scores that would have been assigned for 2014 and 2012 were obvious based on the date of the relevant regulatory document. For example, if the regulation describing cybersecurity measures was published in 2007, then the researcher would assign the appropriate score for the previous rankings on the basis of that document, because it would have been available

when the research was undertaken in 2011 and 2013. When it could not confirm whether a requirement had been in place during the previous research period, the EIU either queried the governments or—when that was not possible—made measured assumptions on the basis of whether regulatory changes relevant to nuclear security had been instituted in recent years.

In addition to rescoring the 2012 and 2014 data for the new and revised indicators, in a limited number of cases, the EIU adjusted previous scores on the basis of new evidence. In all cases, if a previous score was deemed to be inaccurate, the EIU corrected the score to reflect the most up-to-date information available. Those adjustments helped ensure that no artificial improvements or declines in scores are captured in the 2016 theft ranking.

In a few instances, the response to the 2016 data review and confirmation request contradicted the 2014 response. In those cases, the EIU first queried the government about the discrepancy. If the EIU did not receive a response to the query, additional research was undertaken; in some cases, reasonable assumptions were made on the basis of available sources. In other cases, a previous score was adjusted on the basis of (a) the more recent 2016 data review and confirmation responses and (b) the evidence provided by a government.

Once the EIU had three comparable data sets, a year-on-year comparison could highlight where scores had improved, remained the same, or declined on the basis of actions taken by countries. The scores and rankings for the rescored 2012 and 2014 theft rankings and the 2016 theft rankings were calculated using the same framework, methodology, and weights, as described in the section titled "Calculating the 2016 NTI Nuclear Security Index."

Owing to the methodological changes described, the normalized scores and ranks in the originally published 2012 and 2014 NTI Index models and reports are comparable neither to the normalized scores and ranks in the newly rescored 2012 and 2014 data nor to those in the 2016 models. To understand changes in scores between 2012, 2014, and 2016 resulting from actions taken by countries, people should use the 2016 models and their comparison tools, rather than the 2012 and 2014 models.

The two 2016 theft ranking models include a new summary of the scores and ranks for the rescored 2012 and 2014 data. The original 2012 and 2014 NTI Index models have been archived for reference only.

THE INCLUSION OF SABOTAGE IN 2016

Since its inception in 2012, the scope of the NTI Nuclear Security Index has been restricted to the potential theft of weapons-usable nuclear materials. However, given the widespread danger of the threat of sabotage and the serious consequences that could result from a large radiological release, NTI and the EIU decided to include an assessment of sabotage in the 2016 NTI Index. Countries were selected for inclusion in the new sabotage ranking if they possess nuclear facilities, the sabotage of which could result in a significant radiological release with serious off-site health consequences.

The following types of nuclear facilities meet the definition: (a) operating nuclear power reactors or nuclear power reactors that have been shut down within the last five years; (b) research reactors with a capacity of two megawatts or greater; (c) reprocessing facilities; and (d) spent fuel pools, only if the fuel has been discharged in the last five years and if not associated with an operating reactor. NTI and the EIU identified 45 countries with such facilities. Of those 45, 22 have one kilogram or more of weapons-usable nuclear materials and are therefore also included in the theft ranking for countries with materials; 23 of the 45 countries have less than one kilogram of or no weapons-usable nuclear materials and are therefore also included in the theft ranking for countries without materials. Belarus and Italy are the only two countries in the theft ranking for countries with materials that are not also in the sabotage ranking because although they have highly enriched uranium in storage, they do not have nuclear power plants, research reactors, or other nuclear facilities that are within the scope of the sabotage ranking.

In consultation with the International Panel of Experts, technical advisors, and several other experts during the development of the 2016 NTI Index, NTI conducted a preliminary review of the existing theft ranking framework to determine which indicators and subindicators were relevant to sabotage of nuclear facilities. That review resulted in some differences between the theft ranking framework and the sabotage ranking framework. Although many of the indicators in the theft ranking framework

and the sabotage ranking framework are the same, the sabotage ranking framework specifically addresses the sabotage of nuclear facilities. Those indicators and subindicators in the theft ranking framework that were deemed irrelevant to sabotage were not included in sabotage ranking framework. Additionally, the experts proposed several new indicators and subindicators relevant to protection of nuclear facilities against sabotage that are included in the sabotage ranking framework.

Finally, several existing subindicators in the theft ranking were slightly altered for inclusion in the sabotage ranking to reflect differences in how nuclear facilities are protected against theft versus sabotage. A summary of the differences between the theft ranking for countries with materials framework and the sabotage ranking framework follows.

The Sabotage Ranking Framework

Many subindicators in the theft ranking for countries with materials were altered slightly for inclusion in the sabotage ranking to specifically address security issues relevant to the sabotage of nuclear materials and facilities. Additionally, 5 new sabotage-specific subindicators were included in the sabotage ranking framework, and 14 subindicators that are included in the theft ranking for countries with materials were deemed to be irrelevant to sabotage and were not included in the sabotage ranking framework.[8]

The following table shows the new sabotage framework and identifies key differences between the theft framework and the sabotage framework.

1. NUMBER OF SITES*
~~**Quantities of Nuclear Materials**~~
~~Quantities of nuclear materials~~
Number of Sites*
Number of sites*
~~Bulk processing facility~~
~~Frequency of materials transport~~
~~**Material Production and Elimination Trends**~~
~~Material production/elimination trends~~
2. SECURITY AND CONTROL MEASURES
On-Site Physical Protection
Mandatory physical protection
On-site reviews of security
Design Basis Threat (DBT)
Security responsibilities and accountabilities
Performance-based program
Control and Accounting Procedures
Legal and regulatory basis for material control and accounting (MC&A)
~~Measurement methods~~
~~Inventory record~~
~~Material Balance Area(s)~~
Radiological consequences (materials)°
Radiological consequences (equipment, systems, and devices)°
Control measures*
Access control°
Insider Threat Prevention
Personnel vetting
Frequency of personnel vetting
Reporting
Surveillance*

[8] It is important to note that indicator and subindicator numbers in the theft ranking model are different from those in the sabotage ranking model. Despite different indicator and subindicator numbers, the questions asked and the scoring criteria often remain consistent from the theft ranking model to the sabotage ranking model. Any inconsistencies are explained in this section.

~~Physical Security during Transport~~
~~Physical security during transport~~
Response Capabilities
Emergency response capabilities
Armed response capabilities*
Law enforcement response training
Nuclear infrastructure protection plan
Cybersecurity
Mandatory cybersecurity
Critical digital asset protection
Cybersecurity Design Basis Threat
Cybersecurity assessments
3. GLOBAL NORMS
International Legal Commitments
Convention on the Physical Protection of Nuclear Material (CPPNM)
2005 Amendment to the CPPNM
International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT)
Convention on Nuclear Safety°
Voluntary Commitments
International Atomic Energy Agency (IAEA) membership
~~Proliferation Security Initiative (PSI) membership~~
Global Initiative to Combat Nuclear Terrorism (GICNT) membership
Global Partnership Against the Spread of Weapons and Materials of Mass Destruction membership
World Institute for Nuclear Security (WINS) contributions
IAEA Nuclear Security Fund contributions
Bilateral or multilateral assistance
Centers of Excellence
International Assurances
Published regulations and reports
~~Public declarations and reports about nuclear materials~~
Review of security arrangements

4. DOMESTIC COMMITMENTS AND CAPACITY
UN Security Council Resolution (UNSCR) 1540 Implementation
UNSCR 1540 reporting
Extent of UNSCR 1540 implementation*
Domestic Nuclear Security Legislation
CPPNM implementation authority
National legal framework for CPPNM
Convention on Nuclear Safety report°
~~Safeguards Adherence and Compliance~~
~~IAEA safeguards agreement (excluding Additional Protocol)~~
~~IAEA Additional Protocol~~
~~Facility exclusion from safeguards~~
~~Safeguards violations~~
Independent Regulatory Agency
Independent regulatory agency
5. RISK ENVIRONMENT
Political Stability
Social unrest
Orderly transfers of power
International disputes or tensions
Armed conflict
Violent demonstrations or violent civil or labor unrest
Effective Governance
Effectiveness of the political system
Quality of the bureaucracy
Pervasiveness of Corruption
Pervasiveness of corruption
Group(s) Interested in Committing Acts of Nuclear Terrorism*
Group(s) interested committing acts of nuclear terrorism*

* Denotes categories, indicators, and subindicators that have been altered for inclusion in the sabotage ranking.

~~abe~~ Denotes indicators and subindicators that were not included in the sabotage ranking.

° Denotes subindicators that have been newly developed for the sabotage ranking.

The Sabotage Ranking: New and Revised Indicators

This section provides an in-depth description of the subindicators in the theft ranking for countries with materials that were revised for inclusion in the sabotage ranking and of the subindicators that were newly developed for inclusion in the sabotage ranking.

The Number of Sites category in the sabotage ranking has one indicator, Number of Sites, which has one subindicator. Sites are defined differently in the sabotage ranking from those in the theft ranking. A summary of the changes follows:

Number of sites

In the sabotage ranking, this subindicator measures the number of sites with nuclear facilities, the sabotage of which could result in a significant radiological release with serious off-site health consequence. Such sites include (a) nuclear power reactors or nuclear power reactors that have been shut down in the last five years, (b) research reactors with a capacity of at least two megawatts, (c) reprocessing facilities, and (d) spent fuel pools, only if the fuel has been discharged within the last five years and if not associated with an operating reactor. In the theft ranking for countries with materials, this subindicator measures the number of sites with at least one kilogram of highly enriched uranium (HEU), separated plutonium, or plutonium content in mixed oxide (MOX) fuel. The scoring scheme in the sabotage ranking also differs from the theft ranking scoring scheme. In the theft ranking, scores range from 0 to 3; in the sabotage ranking, scores range from 0 to 5. The concentration of countries with between 3 and 10 facilities in the sabotage ranking resulted in NTI and the EIU devising a more granular scoring scheme for the number of sites subindicator.

The Control and Accounting Procedures indicator has five subindicators that collectively measure the comprehensiveness of a country's controls and accounting practices. Three new, sabotage-specific subindicators were included. Additionally, a fourth existing subindicator was altered. A summary of the changes follows:

Radiological consequences (materials)

This new binary subindicator assesses whether a country requires nuclear facilities to apply a graded approach to the security of nuclear materials, taking into account the potential radiological consequences of an act of sabotage. A graded approach ensures that those materials, the sabotage of which could lead to unacceptable radiological consequences, have the highest levels of physical protection.

Radiological consequences (equipment, systems, and devices)

As with nuclear materials, the sabotage of certain equipment, systems, and devices could lead to unacceptable radiological consequences. In this new binary subindicator, credit is given to those countries that require nuclear facilities to apply a graded approach to the security of equipment, systems, and devices, taking into account the potential radiological consequences of an act of sabotage.

Control measures

The intent of this revised subindicator is to assess whether control measures are required to detect and prevent unauthorized access to restricted areas. The subindicator has been altered for inclusion in the sabotage ranking so that the subindicator now asks whether certain control measures are necessary in "areas with nuclear materials; and/or areas with equipment, systems, and devices the sabotage of which could lead to high radiological consequences (the equivalent of a 'vital area,' as defined by the IAEA)" rather than in protected areas or inner areas, as it does in the theft ranking for countries with materials.

Access control

This new subindicator asks whether countries require access control measures for "areas with nuclear materials; and/or areas with equipment, systems, and devices, the sabotage of which could lead to high radiological consequences (the equivalent of a 'vital area,' as defined by the IAEA)."

Insider Threat Prevention has four subindicators, which collectively assess personnel qualifications, security culture, and surveillance measures to decrease a facility's vulnerability to insider threats. One of those subindicators has been altered for inclusion in the sabotage ranking:

Surveillance
This subindicator asks whether a two-person surveillance system or technological surveillance system is used whenever restricted areas are occupied. As with the control measures subindicator, this subindicator has been altered for inclusion in the sabotage ranking so that it now asks whether surveillance is required for "areas with nuclear materials; and/or areas with equipment, systems, and devices the sabotage of which could lead to high radiological consequences (the equivalent of a 'vital area,' as defined by the IAEA)" rather than in inner areas, as it does in the theft ranking for countries with materials.

Response capabilities are a crucial part of the layered security system that prevents and mitigates acts that threaten nuclear security. The indicator comprises four subindicators, one of which has been altered for inclusion in the sabotage ranking:

Armed response capabilities
This subindicator asks whether a state requires on-site armed response capabilities at nuclear facilities. In the theft ranking for countries with materials, the subindicator applies only to facilities with Category I nuclear materials. In the sabotage ranking, the subindicator applies only to nuclear power reactors and reprocessing facilities.

The International Legal Commitments indicator has four subindicators. Three of those subindicators are also included in the theft rankings. The fourth was newly developed for inclusion in the sabotage ranking. A summary of the addition follows:

Convention on Nuclear Safety
Countries that are party to the Convention on Nuclear Safety commit to defending nuclear installations against potential radiological hazards and to preventing and mitigating radiological accidents. Such steps also minimize the risks associated with acts of sabotage of nuclear facilities that could result in a release with significant radiological consequences. This subindicator is a tertiary scoring scale, where countries that have signed and ratified the convention receive the most credit, whereas those that are not members or that are non-compliant receive no credit.

The UN Security Council Resolution (UNSCR) 1540 Implementation indicator comprises two subindicators. One of those subindicators was revised. Next is a description of the revised subindicator:

Extent of UNSCR 1540 implementation
In the sabotage ranking, this subindicator considers the number of elements of the UNSCR 1540 matrix that are relevant to the threat of sabotage. Compared with the theft ranking for countries with materials, which considers 117 elements, the sabotage ranking considers only 25 elements.

Domestic Nuclear Security Legislation has three subindicators that look at how rooted security measures are in domestic legislation. Two of those subindicators are also included in theft rankings, and a third was newly developed for inclusion in the sabotage ranking. The following summarizes the addition:

Convention on Nuclear Safety report
The IAEA requires a report to be submitted in conjunction with the most recent review meeting on measures taken to implement the Convention on Nuclear Safety. States that have provided a report receive credit on this binary subindicator. Countries that do not have a nuclear power reactor (that have a research reactor only) also receive credit, even if they have not submitted a report.

The presence of terrorist or criminal groups interested in and capable of committing nuclear terrorism raises the risk of acts or attempted acts of sabotage of facilities. The Group(s) Interested in Committing Acts of Nuclear Terrorism indicator, which has one subindicator, measures

the presence and capabilities of such groups in a country. The existing subindicator has been altered for inclusion in the sabotage ranking:

Group(s) interested in committing acts of nuclear terrorism
In the theft ranking, this subindicator specifically addresses groups interested in the theft of nuclear material. Given that an act of sabotage does not necessarily require an intent to steal materials, the subindicator was altered to look at whether there are groups present in a country that are interested in and capable of undertaking acts of nuclear terrorism, of which theft could be a component.

RESEARCH BEHIND SELECTED INDICATORS

This section focuses on the research behind selected indicators, and it includes an explanation for the scoring framework for several of the more complex variables created by the EIU. Scoring criteria for all of the indicators are included in the sections titled "Sources and Definitions of Indicators: Theft Ranking" and "Sources and Definitions of Indicators: Sabotage Ranking."

Approach

The EIU employed country experts and regional specialists with a wide variety of necessary linguistic skills to undertake the research from its global network of more than 350 analysts and contributors. Researchers were asked to gather data from primary legal texts; government and academic publications; and websites of government authorities, international organizations, and non-governmental organizations. Researchers also contacted government officials and subject-matter specialists and reviewed local and international news and media reports. The EIU research was constrained by a lack of publicly available information in some cases and a general lack of openness in the area of nuclear security. The research process proved challenging, both because of the difficulty in sourcing data and official information related to nuclear security and, in some cases, because of a lack of publicly available information.

Challenging Indicators

1.1 Quantities of Nuclear Materials (Theft Ranking for Countries with Materials)

This indicator seeks to capture each country's combined total quantity of highly enriched uranium (HEU), separated plutonium, and plutonium content in unirradiated mixed oxide (MOX) fuel. Materials that are owned by one state but are present in another state are accounted for under the latter's total. Plutonium content in MOX fuel is either reported as such by a state or calculated as 5 percent to 8 percent of total MOX quantities. Quantities include materials in weapons components.

The key challenge in researching quantities of weapons-usable nuclear materials is the general lack of publicly available information in this area, particularly for nuclear-armed states. The majority of states do not declare all of their nuclear materials (including materials in weapon components). The EIU relied primarily on four sources for data: (a) the Institute for Science and International Security, (b) the International Atomic Energy Agency (IAEA) and its INFCIRC 549 declarations (civilian plutonium, civilian MOX, civilian HEU), (c) the James Martin Center for Nonproliferation Studies (civilian HEU), and (d) the International Panel on Fissile Materials and its Global Fissile Material Report 2013 (military HEU and plutonium). In many cases, the sources use estimates or ranges of quantities that are based on the latest available information. Where quantities were provided in a range, the EIU used the midpoint (e.g., a range of 5–10 kilograms would be reported by the EIU as 7.5 kilograms).

Owing to the uncertainties associated with quantities, the EIU banded the data into eight groups. Banding the data implies that precise figures could not be ascertained and should increase confidence in the accuracy of scores.

1.2.1 Number of Sites (Theft Ranking for Countries with Materials)

This indicator seeks to capture how many sites (both military and civilian) with one kilogram or more of HEU (including spent fuel), separated plutonium, or unirradiated MOX fuel are present in a country. Significant challenges arose in researching this indicator. Unsurprisingly, many states do not publish the number or the locations of facilities with weapons-usable nuclear materials. There are sound national security reasons for not publicizing specific information on quantities and sites. Nevertheless, the lack of transparency in this area meant that the EIU had to estimate the number of sites on the basis of the limited information that was publicly available. Owing to the uncertainty associated with those estimates, the EIU again determined that banding the number of sites was advisable, thus implying that precise figures could not be ascertained.

2.2.2–2.2.3 Radiological Consequences (Sabotage Ranking)

These two subindicators assess whether states require the use of a graded approach to security for nuclear materials and equipment, systems, and devices, the sabotage of which could result in high radiological consequences. The EIU encountered many challenges when scoring this indicator. Those challenges centered primarily on the distinction between safety and security. The subindicators in the NTI Index are designed to address security measures at nuclear facilities. Radiological consequences, however, are relevant to both safety and security concerns. The intersection between safety and security made the research challenging, particularly with regard to the protection of nuclear materials.

In many cases, the regulations referenced protection that was based on common categories of nuclear materials that are used by the IAEA in the context of designing protection of materials against theft (e.g., Category I, Category II. Those categories are not applied by the IAEA in the context of sabotage, although some countries appear to do so. Ultimately, the EIU decided to give credit for those two subindicators only when the regulations specifically mentioned a graded approach to physical protection or increased levels of security for nuclear materials or equipment, systems, and devices, taking into account the radiological consequences of an act of sabotage.

2.6/2.5 Cybersecurity (Theft Ranking for Countries with Materials and Sabotage Ranking)

The Cybersecurity indicator encompasses four subindicators on mandatory cyber protection, protection of critical digital assets against cyber attacks, cybersecurity Design Basis Threat (DBT), and performance-based assessments of cybersecurity at nuclear facilities. Cybersecurity has only recently become an area of focus, especially in the area of nuclear security, which means that very little publicly available information exists. Although some countries address cybersecurity comprehensively in their national regulations and although many countries are working to update their legislation to include cybersecurity, most countries that have weapons-usable nuclear materials or nuclear facilities at risk of sabotage do not yet have regulations that require cybersecurity at nuclear facilities.

NTI and the EIU made the decision to be strict when assigning credit for the cybersecurity subindicators. For example, some countries include cybersecurity requirements in their protection plans for critical infrastructure generally, but they did not receive credit unless those critical infrastructure cybersecurity plans specifically mentioned nuclear facilities. The decision to use a strict definition of cybersecurity makes the subindicators somewhat aspirational: as cybersecurity continues to be a priority, more states will likely incorporate components of cybersecurity at nuclear facilities into their regulatory regimes.

5.1–5.3 Risk Environment: Political Stability; Effective Governance; Pervasiveness of Corruption (Theft Rankings and Sabotage Ranking)

The Risk Environment category comprises four indicators, three of which are described in this section. The Political Stability, Effective Governance, and Pervasiveness of Corruption indicators are scored on the basis of proprietary information contained in the EIU's Risk Briefing and Business Environment Ranking reports.

5	RISK ENVIRONMENT	
5.1	**Political Stability**	**Source**
5.1.1	Social unrest	Economist Intelligence Unit, Risk Briefing
5.1.2	Orderly transfers of power	Economist Intelligence Unit, Risk Briefing
5.1.3	International disputes or tensions	Economist Intelligence Unit, Risk Briefing
5.1.4	Armed conflict	Economist Intelligence Unit, Risk Briefing
5.1.5	Violent demonstrations or violent civil or labor unrest	Economist Intelligence Unit, Risk Briefing
5.2	**Effective Governance**	
5.2.1	Effectiveness of the political system	Economist Intelligence Unit, Business Environment Ranking
5.2.2	Quality of the bureaucracy	Economist Intelligence Unit, Risk Briefing
5.3	**Pervasiveness of Corruption**	
5.3.1	Pervasiveness of corruption	Economist Intelligence Unit, Risk Briefing

In the Risk Briefing and Business Environment Ranking assessments, which are updated once per quarter, the EIU takes into account present conditions and the EIU's expectations for the future. The EIU forecasts future risk and business environment conditions rather than simply extrapolating present trends into the future. The comparability of the qualitative assessments is made more rigorous by the extensive guidance provided to the EIU's team of 130 country analysts who undertake the research for each indicator. Analysts are able to constantly view the scoring for other countries, which enables consistency across countries, and additional oversight is provided by the editorial team, which includes risk heads for every region.

The EIU also conducts an annual global audit of all the scores. Ultimately, the ratings and scores rely on the expert opinion of the EIU's analysts who are working in regional teams and who have extensive knowledge of events and conditions in both the countries and the region. Those analysts have a wide range of open and closed sources at their disposal, as discussed in the next paragraph.

Risk Briefing Sources: One of the main closed sources is the EIU's extensive network of more than 250 in-country expert contributors, who are based in virtually every country throughout the world. The EIU's contributors analyze recent market developments and forecast political, economic, and business trends in addition to providing detailed, regular information about conditions within a country. The analysts also draw on the existing analytic work already developed at the EIU. The use of open sources is extensive. International open sources include publications from the United Nations, Central Intelligence Agency, International Monetary Fund, World Bank, Heritage Foundation, International Institute for Management Development, International Labor Organization, and Interpol.

Business Environment Ranking Sources: The main sources used for the historical period scores include *The World Factbook* (Central Intelligence Agency); the EIU's Country Risk Service; *The Annual Survey of Political Rights and Civil Liberties* (Freedom House); *Index of Economic Freedom* (Heritage Foundation); *Human Development Report* (UN Development Program); *World Development Report, World Development Indicators, and Doing Business* (World Bank); and *The Global Competitiveness Report* (World Economic Forum).

5.4 Group(s) Interested in Illicitly Acquiring Materials (Theft Rankings)/Group(s) Interested in Committing Acts of Nuclear Terrorism (Sabotage Ranking)

This indicator seeks to understand whether any terrorist or criminal groups interested in illicitly acquiring weapons-usable nuclear materials or interested in committing acts of nuclear terrorism more generally are present in a country and are capable of carrying out their goals.

First, the EIU accessed various databases (see the "Selected Bibliography" for more information) and other secondary sources to ascertain which terrorist groups or criminal organizations have a stated interest in acquiring nuclear materials or engaging in another form of nuclear terrorism. The EIU then undertook research to determine the countries in which those groups have members or a base of operations. Details as to the extent of a group's presence in a given country could not be ascertained. Owing to the nature of this topic, which has serious national security implications for states, the publicly available information is limited.

Once a list of countries with groups present was established, the EIU used a gradient scale that assessed the relative capabilities and intent of groups in each country to make a distinction between the following two scores:

- A score of 0 means that such groups exist and are thought to have the capabilities to carry out their goals when acting alone or with the assistance of a capable third party.
- A score of 1 means that such groups exist but are unlikely capable of carrying out their aims.

Challenging Countries

Each country posed unique research challenges. Iran, Israel, North Korea, and Pakistan were particularly complicated, and the following methods were applied to those four countries to score the theft ranking for countries with materials and the sabotage ranking.

Use of Military Proxy

Iran, Israel, and North Korea were particularly difficult to score for the On-Site Physical Protection indicator (2.1). Those countries are distinct among the countries for which the EIU could not find publicly available information in that they rely primarily on military (or, in the case of Israel, civil defense force) protection for nuclear sites. For indicator 2.1, therefore, the EIU used a proxy indicator—military capability or sophistication—to score those countries. The military capability or sophistication indicator is scored as follows:

- A score of 0 means "very low": no investment in military research and development (R&D). Principal equipment is very old or obsolete.
- A score of 1 means "low": minimal investment in military R&D. A high percentage of equipment is old and unsophisticated.
- A score of 2 means "moderate": investment of a small part of military expenditure in R&D. Principal equipment is a mixture of new and old and is moderately sophisticated.
- A score of 3 means "high": substantial investment in military R&D and in maintenance. Principal equipment is relatively modern and sophisticated and is well maintained.
- A score of 4 means "very high": huge investment in military R&D and armament production projects. Principal equipment is new and highly sophisticated.

The maximum score that the three countries could receive for indicator 2.1 was 4, where 4 represented the most favorable nuclear materials security conditions. The absence of information on nuclear security reduces public and international understanding of the security measures countries are taking. Therefore, receiving the highest possible score of 5 for indicator 2.1 was not appropriate for states that were scored using a proxy. Because a proxy indicator was used for those countries, they did not receive separate scores for each of the subindicators in 2.1. Instead, those countries received an overall score for the indicator.

Assumptions Based on Military Control of Materials

For the following subindicators, the scores for Iran, Israel, North Korea, and Pakistan are based on the assumption that the military imposes a strict regime under direct control of the state:

- 2.4.1 Physical security during transport (Iran and Israel only)
- 2.5.1 Emergency response capabilities (Iran, Israel, and North Korea only)
- 2.5.2 Armed response capabilities
- 2.5.3 Law enforcement response training

Expert Input Used

For the following indicators and subindicators, expert input or other secondary expert sources were used to score a country:

- Israel: 2.3.1 Personnel vetting
- North Korea: 2.2 Control and Accounting Procedures, 2.3.1 Personnel vetting, and 2.4.1 Physical security during transport

Israel

Israel posed a unique research challenge because it maintains a policy of opacity with regard to its nuclear program. Israel does not publish any nuclear security–related laws or regulations that could be used in this research. Moreover, the EIU was unable to elicit expert opinion on Israel's nuclear security conditions as it was for the other challenging countries. As already noted, owing to the lack of publicly available information, the EIU used proxies as a scoring technique for some indicators.

The EIU did not use a proxy (military sophistication) or an assumption based on military (or similar body) protection of nuclear sites to score the Control and Accounting Procedures indicator (2.2). Materials control and accounting (MC&A) is typically not in the purview of security personnel responsible for protecting nuclear materials. The EIU and its experts acknowledge that it is more than likely that Israel has regulations regarding MC&A. However, there is an unusual lack of transparency regarding nuclear materials in Israel; thus, the EIU erred on the conservative side in its scoring. The burden of proof is on Israel to demonstrate that it has systems in place. The absence of information is not a positive; it is a negative.

Impact of Proxies on Scores and Ranks

Recognizing the challenges in scoring Iran, Israel, and North Korea in the Security and Control Measures category, the EIU examined the sensitivity of the overall scores and ranking to changes in scores for the Security and Control Measures indicators. The results are telling: if Iran, Israel, and North Korea received the highest possible scores for indicators 2.1 and 2.2 in the theft ranking for countries with materials, each country's category score and ranking would see the following changes:

Security and Control Measures				
	Current Score	Potential Score	Current Rank	Potential Rank
Iran	36	61 (+25)	23	17 (+6)
Israel	56	75 (+19)	19	15 (+4)
North Korea	38	61 (+23)	22	17 (+5)

Nevertheless, each country's overall ranking and score in the theft ranking for countries with materials would see only a minor change:

Overall				
	Current Score	Potential Score	Current Rank	Potential Rank
Iran	35	43 (+8)	23	22 (+1)
Israel	55	61 (+6)	20	19 (+1)
North Korea	24	31 (+7)	24	24 (no change)

Treatment of Taiwan in the NTI Index

Taiwan is included in the theft ranking for countries without nuclear materials and the sabotage ranking. Taiwan posed a unique research challenge, because it is not currently a member of the IAEA or a party to most international conventions owing to its status in the international community. However, it has well-established and publicly available regulations. Therefore, for the Security and Control Measures category, the EIU reviewed Taiwan's publicly available nuclear regulations and Atomic Energy Council (AEC) legislation. The EIU also determined that for select indicators, it was appropriate to score Taiwan on the basis of relevant domestic regulations and other considerations, as detailed next:

3.1.1 Convention on the Physical Protection of Nuclear Material (CPPNM)

Taiwan is not a party to the CPPNM. The EIU assigned credit to Taiwan on the basis of provisions in its domestic regulations.

3.1.2 2005 Amendment to the CPPNM

Taiwan is not a party to the 2005 Amendment to the CPPNM. The EIU has given Taiwan credit on this subindicator on the basis of its domestic regulations and the U.S.-Taiwan 123 Agreement for Peaceful Cooperation, which legally binds Taiwan to follow the CPPNM and the 2005 Amendment. The U.S.-Taiwan 123 Agreement came into force on June 22, 2014. Therefore, Taiwan receives credit for the 2005 CPPNM Amendment in the 2016 NTI Index, but not in the 2012 or 2014 editions because there is no evidence that the provisions of the 2005 CPPNM Amendment were legally binding before the 123 Agreement.

3.2.1 IAEA Membership

Taiwan is not currently a member of the International Atomic Energy Agency. The EIU has given Taiwan a score of 1 on this subindicator on the basis of its previous membership status.

4.1.1 UNSCR 1540 Reporting

Because Taiwan is not a member of the United Nations, it is not obliged to—and in fact cannot—provide a UNSCR 1540 report to the 1540 Committee. Despite that fact, the EIU assigned credit to Taiwan for a report it has drafted and distributed, which is modeled on 1540 reports and which is publicly available on the AEC's website.

4.1.2 Extent of UNSCR 1540 Implementation

Although Taiwan cannot submit a 1540 matrix to the 1540 Committee, Taiwan has created a 1540 matrix modeled on published 1540 matrices, and it is publicly available on the AEC's website. Treating Taiwan's matrix like other country matrices, the EIU has assigned credit based on the number of elements of UNSCR 1540 that have been implemented as reflected in the matrix.

4.2.1 CPPNM Implementation Authority

The EIU assigned credit to Taiwan on the basis of its having a national authority for the implementation of nuclear security regulations.

4.2.2 National Legal Framework for CPPNM

The EIU assigned credit to Taiwan on the basis of provisions in its domestic regulations.

SOURCES AND DEFINITIONS OF INDICATORS

Theft Ranking

Quantities and Sites

This category comprises three indicators: (a) Quantities of Nuclear Materials, (b) Sites and Transportation, and (c) Material Production and Elimination Trends. The category captures the quantity of nuclear materials, the number of sites, and the frequency of transport in a particular country—all related to the risk that materials could be stolen. In addition, it includes a leading indicator as to whether the country is increasing or decreasing its overall material quantities.

Indicator or Subindicator	Source	Indicator Definitions and Construction
1.1 Quantities of Nuclear Materials		**The larger the quantity of nuclear material held, the greater the materials management requirements and potential risk that materials could be stolen.**
1.1.1 Quantities of nuclear materials	Institute for Science and International Security; James Martin Center for Nonproliferation Studies; International Atomic Energy Agency INFCIRC 549 declarations; International Panel on Fissile Materials, *Global Fissile Material Report* 2013	What is the country's combined total quantity of highly enriched uranium (HEU), separated plutonium, and unirradiated mixed oxide (MOX) fuel? 0 = 500 tonnes or greater 1 = 100–499 tonnes 2 = 10–99.99 tonnes 3 = 2–9.99 tonnes 4 = 500 kg–1.99 tonnes 5 = 100–499 kg 6 = 21–99 kg 7 = 5–20 kg 8 = Less than 5 kg Totals are reported in kilograms (kg) and tonnes. 1 tonne = 1,000 kg. Total HEU quantities include spent fuel. Materials that are owned by one state but that are present in another state are accounted for under the latter's total. Plutonium content in MOX fuel is either reported as such by a state or is calculated as 5–8 percent of total MOX quantities. Analysis also includes materials in weapon components.

Indicator or Subindicator	Source	Indicator Definitions and Construction
1.2 Sites and Transportation		**The greater the number of sites with nuclear materials and the frequency of transport of those materials, the greater the potential risk of security breaches.**
1.2.1 Number of sites	EIU analyst qualitative assessment	The greater the number of sites with nuclear materials, the greater the potential risk of security breaches. How many sites (both military and civilian) with 1 kg or greater quantities of HEU (including spent fuel), separated plutonium, or unirradiated MOX fuel does the country maintain? 0 = 100 sites or greater 1 = 11–99 sites 2 = 2–10 sites 3 = One site A site is defined as a military or civilian location that maintains HEU (including spent fuel), separated plutonium, or unirradiated MOX material quantities that are equal to or greater than 1 kg. A military base with such nuclear materials (including quantities contained in nuclear weapons) is counted as a single site, even if materials within the site are contained in two or more buildings. Likewise, a civilian location that maintains materials, either in storage or in use, within multiple buildings is counted as a single site. Military ships that contain nuclear materials are counted as a single site. The following types of sites are considered, but are counted only if they contain 1 kg or greater quantities of HEU, separated plutonium, or unirradiated MOX fuel: • Dismantlement • Enrichment • Fuel fabrication • Medical isotope production • Plutonium production reactor • Power reactor • Reprocessing • Research and development • Research reactors • Storage • Testing • Waste management
1.2.2 Bulk processing facility	EIU analyst qualitative assessment	Production of nuclear materials in bulk increases the potential for undetected gradual theft of small quantities. Does the country have at least one bulk processing facility handling HEU, separated plutonium, or unirradiated MOX fuel? 0 = Yes 1 = No Bulk processing facilities include enrichment, reprocessing, and national fuel cycle facilities.

Indicator or Subindicator	Source	Indicator Definitions and Construction
1.2.3 Frequency of materials transport	EIU analyst qualitative assessment	Because nuclear material is particularly vulnerable during transport, the lower the frequency of transfer of material, the lower the potential risk of security breaches. Are nuclear materials (HEU, separated plutonium, or unirradiated MOX fuel) transported either domestically or internationally? 0 = Yes, transported domestically or internationally, and the country is one of nine nuclear-armed states 1 = Yes, domestically or internationally 2 = No *or* only for removal
1.3 Material Production and Elimination Trends		**Increasing or decreasing the quantities of nuclear material in a state changes the potential risk of materials being stolen.**
1.3.1 Material production and elimination trends	EIU analyst qualitative assessment	Countries receive the following scores based on trends in their total stock of nuclear materials: 0 = The total stock of nuclear materials is increasing 3 = The total stock of nuclear materials remains unchanged 4 = The total stock of nuclear materials is decreasing Scores are based on the actions of a state within the past four years. When considering whether a country's total stock of nuclear materials is decreasing, analysts evaluated the following: • Is the country reducing its stock of nuclear weapons? • Is reprocessing being discontinued? • Are HEU-fueled research reactors being converted to low-enriched uranium (LEU), and are unneeded research reactors being decommissioned? • Are military vessels that are fueled by HEU being converted to LEU? • Is the country returning or giving nuclear materials to another country? • Is a change the result of normal fluctuations due to the use of MOX fuel in power reactors?

Security and Control Measures

The Security and Control Measures category encompasses the core activities directly related to protection and accounting of nuclear materials. This category comprises six indicators: (a) On-Site Physical Protection, (b) Control and Accounting Procedures, (c) Insider Threat Prevention, (d) Physical Security during Transport, (e) Response Capabilities, and (f) Cybersecurity.

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.1 On-Site Physical Protection		**Essential measures for securing sites and facilities.**
2.1.1 Mandatory physical protection	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring licensees to provide physical protection increases the likelihood that nuclear materials facilities will meet strict standards. Is physical protection a condition for licensing? 0 = No *or* information not publicly available 1 = Yes
2.1.2 On-site reviews of security	EIU analyst qualitative assessment based on official national sources, which vary by country	On-site reviews of security increase the likelihood that physical protection measures meet prescribed standards and will be maintained. Are on-site reviews of security done in order to keep a license? 0 = No *or* information not publicly available 1 = Yes
2.1.3 Design Basis Threat (DBT)	EIU analyst qualitative assessment based on official national sources, which vary by country	A Design Basis Threat that is based on strong assumptions and that is regularly updated leads to a more rigorous security system. Do the country's regulations require the use of a Design Basis Threat that is required to be updated? 0 = No *or* information not publicly available 1 = Yes A Design Basis Threat means the attributes and characteristics of potential insider or external adversaries who might attempt unauthorized removal of nuclear material or sabotage against which a physical protection system is designed and evaluated.
2.1.4 Security responsibilities and accountabilities	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring licensees to hold particular individuals accountable for security increases the likelihood that physical protection measures will be implemented. Does the nuclear regulator define nuclear materials security responsibilities and accountabilities? 0 = No *or* information not publicly available 1 = Yes This subindicator seeks to answer whether the regulator requires licensees to define who is responsible and/or accountable for at least one aspect of nuclear materials security. It is not enough to note that the responsibility for materials security will fall to the licensee. The regulator should require that the licensee have individuals with security responsibilities or accountabilities in at least one area of security.

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.1.5 Performance-based program	EIU analyst qualitative assessment based on official national sources, which vary by country	Required demonstration of performance, along with tests and assessments, improves effectiveness of and identifies weaknesses in physical protection measures. Does the regulator require a performance-based program, which includes tests and assessments of security systems and measures, and a demonstration of performance by security personnel at nuclear sites? 0 = No *or* information not publicly available 1 = Yes
2.2 Control and Accounting Procedures		**Materials control and accounting is a necessary element of a comprehensive security system.**
2.2.1 Legal and regulatory basis for material control and accounting (MC&A)	EIU analyst qualitative assessment based on official national sources, which vary by country	A legal and regulatory basis for materials control and accounting is part of the foundation of a strong system and culture of materials security. Is there a domestic legal and regulatory basis for nuclear material control and accounting (MC&A)? 0 = There is no domestic legal or regulatory basis for MC&A or information not publicly available 1 = There is a legal and regulatory basis for MC&A 2 = There is a legal and regulatory basis for MC&A and international guidelines are reflected in the legal and regulatory system
2.2.2 Measurement methods	EIU analyst qualitative assessment based on official national sources, which vary by country	The quality of measurement methods corresponds to the ability to detect the diversion or theft of nuclear materials. Do domestic regulations or license conditions require measurement methods that provide for accurate and precise quantification of nuclear materials? 0 = No *or* information not publicly available 1 = Yes
2.2.3 Inventory record	EIU analyst qualitative assessment based on official national sources, which vary by country	Maintaining complete, accurate, and timely records of the nuclear material inventory is necessary to detect the diversion or theft of nuclear materials. Do domestic regulations or license conditions require a complete, accurate, and timely record of the nuclear materials inventory that is reported at defined intervals? 0 = No *or* information not publicly available 1 = Yes

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.2.4 Material Balance Area(s)	EIU analyst qualitative assessment based on official national sources, which vary by country	Well-defined and well-controlled geographical locations for nuclear materials enable more accurate accounting and increase the likelihood of detection of diversion or theft of nuclear materials. Do domestic regulations or license conditions require that nuclear materials should be in well-defined and controlled geographical locations within the state? 0 = No *or* information not publicly available 1 = Yes The state body should establish the factors to be taken into account and the criteria to be met in determining material balance area(s) for each nuclear facility. Those areas are established for material accounting purposes, so that (1) the quantity of nuclear material in each transfer into or out of each material balance area can be determined, and (2) the physical inventory of nuclear material in each material balance area can be determined when necessary in accordance with specified procedures. The factors to be taken into account should include a. the existence and location of key measurement points and b. the use of containment and surveillance measures. The state body should also approve the facility material balance area(s).
2.2.5 Control measures	EIU analyst qualitative assessment based on official national sources, which vary by country	Nuclear materials control measures aid in the assurance that unauthorized access to restricted areas is detected in a timely manner. Do domestic regulations or licensing conditions require the following nuclear materials control measures? a. The identity of persons entering the protected area must be verified. b. Records must be kept of all persons who access inner areas and of all persons who have access to or possession of keys, keycards, and other systems—including computer systems—that control access to inner areas. 0 = Regulations do not require control measures, or information not publicly available 1 = Regulations require one of these control measures 2 = Regulations require two of these control measures

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.3 Insider Threat Prevention		**The qualifications of personnel, the strength of the security culture, and the use of certain surveillance measures are critical to how well security procedures are followed and decrease vulnerability to insider threats.**
2.3.1 Personnel vetting	EIU analyst qualitative assessment based on official national sources, which vary by country	Clear guidelines for the qualification and fitness of personnel increase the likelihood that security and other personnel with access to nuclear material areas will effectively discharge their responsibilities and decreases vulnerability to insider threats. Do domestic regulations or license conditions specify that security and other personnel with access to nuclear material areas are subject to the following checks: drug testing, background checks, and psychological or mental fitness checks? 0 = Personnel are not subject to any of these checks 1 = Personnel are subject to one of these checks 2 = Personnel are subject to two of these checks 3 = Personnel are subject to all three of these checks
2.3.2 Frequency of personnel vetting	EIU analyst qualitative assessment based on official national sources, which vary by country	Personnel vetting at frequent intervals is essential to identifying new and changing insider threats. Do domestic regulations or licensing conditions specify that security and other personnel with access to nuclear material areas are vetted at specified intervals? 0 = Frequency of vetting is not specified or information not publicly available 1 = Such personnel are subject to vetting at periods greater than five years 2 = Such personnel are subject to vetting at periods greater than two, but not more than five years 3 = Such personnel are subject to vetting at periods of two years or less
2.3.3 Reporting	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring personnel to report suspicious behavior increases the likelihood that insider threats will be detected early. Do domestic regulations or licensing conditions specify that personnel must report suspicious behavior to an official authority? 0 = No *or* information not publicly available 1 = Yes

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.3.4 Surveillance	EIU analyst qualitative assessment based on official national sources, which vary by country	To counter the insider threat, whenever an inner area is occupied, constant surveillance (e.g., a two-person surveillance system or technological surveillance system) should be used to detect unauthorized action. Do domestic regulations or license conditions require constant surveillance of inner areas when they are occupied, using either a two-person surveillance system or a technological surveillance system? 0 = No *or* information not publicly available 1 = Yes, a two-person surveillance system or a technological surveillance system is required 2 = Yes, both a two-person surveillance system and a technological surveillance system are required *Two-person surveillance system:* Requires at least two knowledgeable persons to be present to verify that activities involving nuclear material and nuclear facilities are authorized, allowing detection of access or actions that are unauthorized. *Technological surveillance:* Technological surveillance includes devices such as closed-circuit television (CCTV) and audio surveillance equipment.
2.4 **Physical Security during Transport**		**Materials in transit are particularly vulnerable to theft.**
2.4.1 Physical security during transport	EIU analyst qualitative assessment based on official national sources, which vary by country	Are the International Atomic Energy Agency (IAEA) guidelines regarding transport of nuclear materials encompassed in INFCIRC 225, Rev. 4 or Rev. 5, translated into the national regulatory regime? 0 = No *or* information not publicly available 1 = Appropriate guidelines encompassed in INFCIRC 225, Rev. 4 (based on quantities of materials in country), are met 2 = Appropriate guidelines encompassed in INFCIRC 225, Rev. 5 (based on quantities of materials in country), are met

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.5 Response Capabilities		**Response capabilities are part of a layered security system and may enable materials to be recovered should they be stolen from a site.**
2.5.1 Emergency response capabilities	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring on-site emergency response capabilities, including trained response teams and required incident reports (i.e., notification), increases the level of preparedness for potential nuclear theft incidents. Do the state's licensing requirements for civilian nuclear facilities require that each facility have on-site nuclear security emergency response capabilities? 0 = Licensing does not require an on-site trained response team or incident reports to appropriate law enforcement authority 1 = Licensing requires incident reports to appropriate law enforcement authority 2 = Licensing requires an on-site trained response team 3 = Licensing requires *both* an on-site trained response team and incident reports to appropriate law enforcement authority Capabilities should include a trained response team and a requirement to report an incident to appropriate law enforcement authorities.
2.5.2 Armed response capabilities	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring on-site armed response capabilities increases the chance of success in responding to armed attacks. Do the state's licensing requirements for civilian nuclear facilities require that each facility with Category I quantities of nuclear material have an on-site armed response team? 0 = No *or* information not publicly available 1 = Yes, an on-site armed response team is required or state does not have Category I quantities of nuclear material The IAEA classifies 2 kg or more of plutonium and 5 kg or more of highly enriched uranium (HEU) as Category I materials, and less than 2 kg but more than 500 grams of plutonium and less than 5 kg but more than 1 kg of HEU as Category II materials. This categorization enables the IAEA to use a graded approach in recommending physical protection measures.
2.5.3 Law enforcement response training	EIU analyst qualitative assessment based on official national sources, which vary by country	Law enforcement officers who are trained to respond to security incidents at nuclear facilities have a greater chance of success responding to those incidents than those who are untrained. Are law enforcement trained to respond in the event of a security incident at a nuclear facility? 0 = No 1 = Yes

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.5.4 Nuclear infrastructure protection plan	EIU analyst qualitative assessment based on official national sources, which vary by country	Natural disasters may increase vulnerability of nuclear materials as a result of physical damage to facilities and additional pressures placed upon government and personnel. Does the country's regulatory framework state that, in the event of a natural disaster, plans are in place to physically protect the nuclear infrastructure? 0 = No mention 1 = Partially mentioned 2 = Fully described Emergency preparedness regulations must mention nuclear facilities specifically.
2.6 Cybersecurity		**Nuclear materials and facilities are vulnerable to cyber attacks as well as physical attacks. Therefore, cybersecurity is a critical component of protecting against theft.**
2.6.1 Mandatory cybersecurity	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring nuclear facilities to have protection from a cyber attack increases the likelihood that nuclear facilities will take measures to protect against cyber attacks. Do domestic laws, regulations, or licensing requirements require nuclear facilities to have protection from a cyber attack? 0 = No *or* information not publicly available 1 = Yes
2.6.2 Critical digital asset protection	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring protection of critical digital assets against cyber attacks decreases the chance that an attacker can circumvent physical protection, control and accounting, and safety systems. Do domestic laws, regulations, or licensing requirements require nuclear facilities to protect critical digital assets from a cyber attack? 0 = No *or* information not publicly available 1 = Yes Critical digital assets include the following systems and networks: • Safety-related functions • Security functions • Emergency preparedness functions • Support systems and equipment related to the above functions
2.6.3 Cybersecurity Design Basis Threat (DBT)	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring that the Design Basis Threat take into account the potential for cyber attacks increases the likelihood that nuclear facilities will consider cyber attacks when designing their security plans. Does the state consider cyber threats in its threat assessment or Design Basis Threat for nuclear facilities? 0 = No *or* information not publicly available 1 = Yes

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.6.4 Cybersecurity assessments	EIU analyst qualitative assessment based on official national sources, which vary by country	Required demonstration of performance, along with tests and assessments, improves effectiveness of and identifies weaknesses in cybersecurity measures. Does the regulator require a performance-based program, which includes tests and assessments of cybersecurity at nuclear facilities? 0 = No *or* information not publicly available 1 = Yes

Global Norms

The Global Norms category includes actions that contribute to the establishment of global norms for nuclear materials security. This category comprises three indicators: (a) International Legal Commitments, (b) Voluntary Commitments, and (c) International Assurances.

Indicator or Subindicator	Source	Indicator Definitions and Construction
3.1 International Legal Commitments*		**International legal commitments are the basis for domestic legislation, regulations, and security capacity.**
3.1.1 Convention on the Physical Protection of Nuclear Material (CPPNM)*	International Atomic Energy Agency (IAEA)	Parties to the CPPNM commit to provide certain levels of physical protection during international transport of nuclear materials; cooperate in the protection, recovery, and return of stolen nuclear material; and criminalize offenses involving nuclear material. Is the state a party to the CPPNM? 0 = Non-compliant *or* not a member 1 = Signed 2 = Signed and ratified (or action having the same legal effect)
3.1.2 2005 Amendment to the CPPNM*	IAEA	Parties to the 2005 Amendment to the CPPNM commit to expand the scope of their responsibilities under the CPPNM to include protection of nuclear material in domestic use, in storage, and during transport, as well as protection of nuclear facilities. Is the state a party to the 2005 Amendment to the CPPNM? 0 = Not ratified, accepted, or approved 1 = Ratified, accepted, or approved (or action having the same legal effect)
3.1.3 International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT)*	United Nations	Parties to the ICSANT commit to criminalize acts of nuclear terrorism and promote cooperation with other states to prevent, investigate, and punish those acts. Is the state a party to ICSANT? 0 = Non-compliant or not a member 1 = Signed 2 = Signed and ratified (or action having the same legal effect)

* Denotes that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without.

Indicator or Subindicator	Source	Indicator Definitions and Construction
3.2 Voluntary Commitments*		**Voluntary commitments demonstrate a state's support for nuclear materials security as a global agenda.**
3.2.1 International Atomic Energy Agency (IAEA) membership*	IAEA	Is the country a member of the IAEA? 0 = No 1 = Yes
3.2.2 Proliferation Security Initiative (PSI) membership*	U.S. Department of State	Is the country a member of the PSI? 0 = No 1 = Yes
3.2.3 Global Initiative to Combat Nuclear Terrorism (GICNT) membership*	U.S. Department of State	Is the country a member of GICNT? 0 = No 1 = Yes
3.2.4 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction membership*	U.S. Department of State	Is the country a member of the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction? 0 = No 1 = Yes
3.2.5 World Institute for Nuclear Security (WINS) contributions*	WINS 2013 and 2014 annual reports	Has the country provided financial or in-kind contributions to WINS within the previous two years? 0 = No 1 = Yes
3.2.6 IAEA Nuclear Security Fund contributions*	IAEA	Has the country provided financial or in-kind contributions to the IAEA Nuclear Security Fund within the previous two years? 0 = No 1 = Yes
3.2.7 Bilateral or multilateral assistance*	EIU analyst qualitative assessment	Has the country provided financial and/or practical bilateral or multilateral assistance for other states or received such assistance in the field of nuclear security (exclusive of contributions captured elsewhere in this indicator) within the previous two years? 0 = No 1 = Yes

* Denotes that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without.

Indicator or Subindicator	Source	Indicator Definitions and Construction
3.2.8 Centers of Excellence*	EIU analyst qualitative assessment	Does the country have a Center of Excellence or Nuclear Security Training and Support Center that offers training in nuclear security? 0 = No 1 = Yes To receive credit, a Center of Excellence or Nuclear Security Training and Support Center should have the following characteristics: (a) serve as a centralized organization to facilitate broad cross-industry engagement in education and training; (b) focus on nuclear security, even if safeguards, safety, or nuclear energy are also addressed; (c) provide practical training courses; (d) provide education in the form of lectures or seminars; and (e) have government support. Centers that are not yet operational are excluded.
3.3 International Assurances		**International assurances enhance international confidence in the effectiveness of a country's nuclear security conditions.**
3.3.1 Published regulations and reports	EIU analyst qualitative assessment based on official national sources, which vary by country	Public release of broad outlines of nuclear security regulations and nuclear security issues increases confidence in a country's commitment to nuclear material security. Does the state publicly release broad outlines of its nuclear security regulations and/or annual reports on nuclear security issues? 0 = The state does not publish regulations or annual reports 1 = The state publishes regulations or an annual report 2 = The state publishes regulations and an annual report
3.3.2 Public declarations and reports about nuclear materials	EIU analyst qualitative assessment	Public declarations or reports about nuclear material help build international confidence. Does the state make any public declarations or reports about nuclear materials (civilian or military)? 0 = No 1 = Yes A state receives a "yes" if it has made civilian plutonium declarations, if it has made any quantitative declarations about inventories of fissile materials or nuclear weapons, or if it publishes the IAEA's safeguards conclusions for the state.

* Denotes that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without.

Indicator or Subindicator	Source	Indicator Definitions and Construction
3.3.3 Review of security arrangements	EIU analyst qualitative assessment	Hosting security reviews demonstrates the importance a country places on its security obligations and creates international confidence in levels of security. Has the state hosted a review of its security arrangements? 0 = No 1 = Yes 2 = Yes, within the past five years A state receives credit if it has hosted any of the following IAEA missions, including follow-up missions: International Physical Protection Advisory Service (IPPAS) mission, International Nuclear Security Advisory Service (INSServ) mission, State System for Accountancy and Control (SSAC) Advisory Service, or Integrated Regulatory Review Service (IRRS) missions that have a security component. A state receives a "yes" if it has received bilateral or multilateral assistance (outside an international organization) to review security arrangements.

* Denotes that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without.

Domestic Commitments and Capacity

This category comprises four indicators: (a) UN Security Council Resolution (UNSCR) 1540 Implementation, (b) Domestic Nuclear Materials Security Legislation, (c) Safeguards Adherence and Compliance, and (d) Independent Regulatory Agency. The category includes actions that indicate how well a country has implemented its international commitments and a country's capacity to do so.

Indicator or Subindicator	Source	Indicator Definitions and Construction
4.1 UN Security Council Resolution (UNSCR) 1540 Implementation*		**UNSCR 1540 obliges action on nuclear materials security and its implementation demonstrates a state's commitment level.**
4.1.1 UNSCR 1540 reporting*	Security Council Committee established pursuant to resolution 1540 (1540 Committee)	Compliance with UNSCR 1540 reporting requirements demonstrates commitment to UNSCR 1540's security objectives. Has the state provided the required UNSCR 1540 report to the Security Council Committee established pursuant to resolution 1540 (1540 Committee)? 0 = The state has not provided a UNSCR 1540 report 1 = The state has provided a UNSCR 1540 report

* Denotes that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without.

Indicator or Subindicator	Source	Indicator Definitions and Construction
4.1.2 Extent of UNSCR 1540 implementation°	Creation of a coding and scoring scheme by the Economist Intelligence Unit (EIU), based on documents from the 1540 Committee	Implementation of UNSCR 1540 demonstrates commitment to UNSCR 1540's security objectives and improves security procedures and culture. Extent of implementation is identified through the measures taken by a state and reflected in its UNSCR 1540 matrix. Scoring is based on an evaluation of the total number of elements of UNSCR 1540 that have been implemented, as reflected in the individual country matrices. Elements related to nuclear security in the matrix that have been implemented are indicated by an "X." The EIU summed the number of elements related to nuclear security (out of a maximum of 117) with an "X" designation, providing a numerical score for implementation. The resulting numerical score is banded into five categories scored from 0 to 4 points: 0 = Very weak (0–24 points) 1 = Weak (25–49 points) or matrix exists but is not publicly available 2 = Moderate (50–74 points) 3 = Good (75–99 points) 4 = Very good (100+ points) For countries without weapons-usable nuclear materials, 87 elements in the matrix were evaluated, and the following scoring scheme was used: 0 = Very weak (0–14 points) 1 = Weak (15–29 points) or matrix exists but is not publicly available 2 = Moderate (30–44 points) 3 = Good (45–59 points) 4 = Very good (60+ points) Those states that do not have a matrix have been given the lowest possible score. Countries that have a matrix but have not made it public were assigned the second-lowest score to give credit for estimated levels of implementation.

° Denotes that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without, but that the scoring scheme for the latter differed.

Indicator or Subindicator	Source	Indicator Definitions and Construction
4.2 Domestic Nuclear Materials Security Legislation*		**The implementation of security measures is rooted in domestic nuclear materials security legislation.**
4.2.1 Convention on the Physical Protection of Nuclear Material (CPPNM) implementation authority*	EIU analyst qualitative assessment based on official national sources, which vary by country	Existence of a national authority (state body) to implement the CPPNM increases the likelihood of implementation and demonstrates commitment to the CPPNM's objectives. Is there a national authority for implementation of the CPPNM? 0 = No 1 = Yes This indicator considers whether there is a national authority (state body) that is responsible for implementing the CPPNM. The convention requires states to establish or designate a competent authority responsible for the implementation of the legislative and regulatory framework.
4.2.2 National legal framework for CPPNM*	EIU analyst qualitative assessment based on official national sources, which vary by country	A national legal framework is part of the foundation of a strong system and culture of nuclear materials security. Has the state fulfilled all obligations for a national legal framework for the CPPNM? 0 = No 1 = Yes This indicator assesses whether the legal elements specified by the CPPNM are enshrined in domestic legislation.
4.3 Safeguards Adherence and Compliance*		**States compliant with safeguards measures take seriously responsibilities related to their stewardship of nuclear materials.**
4.3.1 International Atomic Energy Agency (IAEA) safeguards agreement (excluding Additional Protocol)°	IAEA	Conclusion of a safeguards agreement demonstrates a state's commitment to its stewardship of nuclear materials. Has the state concluded an IAEA safeguards agreement (excluding the Additional Protocol)? 0 = No 1 = Yes, INFCIRC 66 or voluntary offer agreement (VOA) 2 = Yes, comprehensive safeguards agreement (CSA) The following is the scoring scheme for countries without materials: 0 = No 1 = Yes, small quantities protocol (SQP) 2 = Yes, modified small quantities protocol 3 = Yes, comprehensive safeguards agreement (CSA)

* Denotes that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without.

° Denotes that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without, but that the scoring scheme for the latter differed.

Indicator or Subindicator	Source	Indicator Definitions and Construction
4.3.2 IAEA additional protocol*	IAEA	Ratification of the additional protocol demonstrates a high level of commitment to a state's stewardship of nuclear materials. Has the state ratified the additional protocol? 0 = No 1 = Yes
4.3.3 Facility exclusion from safeguards	EIU analyst qualitative assessment	Exclusion of facilities from safeguards shows a weakening of a state's commitment to its stewardship of nuclear materials. Does the state exclude any enrichment or reprocessing facilities from international and/or European Atomic Energy Community (Euratom) safeguards? 0 = Yes, the state excludes some or all of its enrichment or reprocessing facilities 1 = No, the state does not exclude any of its enrichment or reprocessing facilities or the state does not have an enrichment or reprocessing facility
4.3.4 Safeguards violations*	IAEA	Safeguards violations undermine a state's commitment to its stewardship of nuclear materials. Has the state been reported to the IAEA Board of Governors or the UN Security Council for a violation of its safeguards agreement, and do the issues reported therein remain outstanding? 0 = The state has been reported to both the IAEA Board of Governors and the UN Security Council, and issues reported therein remain outstanding 1 = The state has been reported to the IAEA Board of Governors and issues reported therein remain outstanding 2 = The state has never been reported to either the IAEA Board of Governors or the UN Security Council or has been previously reported, but no issues remain outstanding
4.4 Independent Regulatory Agency		**A robust and independent regulatory structure helps ensure compliance with nuclear materials–related regulations.**
4.4.1 Independent regulatory agency	EIU analyst qualitative assessment based on official national sources, which vary by country	Does the state have an independent regulatory agency responsible for regulating security? 0 = No 1 = Yes According to the IAEA, independence requires "an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy."

* Denotes that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without.

° Denotes that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without, but that the scoring scheme for the latter differed.

Risk Environment

The risk environment can affect the nuclear materials security conditions in a country. The Risk Environment category comprises four indicators: (a) Political Stability, (b) Effective Governance, (c) Pervasiveness of Corruption, and (d) Group(s) Interested in Illicitly Acquiring Materials.

Indicator or Subindicator	Source	Indicator Definitions and Construction
5.1 Political Stability*		**A lack of political stability may enable lapses in nuclear materials security.**
5.1.1 Social unrest*	EIU Risk Briefing	Significant social unrest can affect the government's ability to secure nuclear materials, or the upheaval created by the unrest may provide opportunities for groups that are seeking to acquire nuclear materials to operate. What is the risk of significant social unrest during the next two years? 0 = Very high 1 = High 2 = Moderate 3 = Low 4 = Very low Social unrest can include large-scale demonstrations, political strikes, and interethnic, racial, or religious clashes.
5.1.2 Orderly transfers of power*	EIU Risk Briefing	Instability and conflict surrounding changes of power may provide opportunities for groups seeking to acquire nuclear materials. How clear, established, and accepted are constitutional mechanisms for the orderly transfer of power from one government to another? 0 = Not clear, established, or accepted 1 = Two of the three criteria are absent 2 = One of the three criteria is absent 3 = Clear, established, and accepted 4 = Very clear, established, and accepted Unclear, poorly established, or weakly accepted constitutional mechanisms for the transfer of power are a particular concern for succession in autocracies, but they can also prove an issue in more democratic systems, for example, if election results are not accepted by all sides.

* Denotes that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without.

Indicator or Subindicator	Source	Indicator Definitions and Construction
5.1.3 International disputes or tensions*	EIU Risk Briefing	Tensions with important trade or strategic partners and armed regional conflicts could have destabilizing implications for a country and, hence, for nuclear materials security. Is there a risk that international disputes or tensions will negatively affect the country during the next two years? 0 = Very high 1 = High 2 = Moderate 3 = Low 4 = No threat In addition to armed regional conflict, tensions with important trade or strategic partners, resulting in economic sanctions or other barriers to trade, could have destabilizing implications for the country and, hence, for nuclear materials security.
5.1.4 Armed conflict*	EIU Risk Briefing	Armed conflict in areas where nuclear materials are stored could seriously compromise site security. Is this country presently subject to armed conflict, or is there at least a moderate risk of such conflict during the next two years? 0 = Territorial conflict; opposition has effective control over a region or regions 1 = Sporadic and incursive conflict 2 = Incursive conflict; government remains in control, but opposition engages in frequent armed incursions 3 = Sporadic conflict; government control is firm, but opposition engages in isolated incidents of violence 4 = No armed conflict exists This indicator covers armed conflict either within the territory of the state or directly threatening it. Forms of conflict may range from sporadic or incursive conflict with non-state actors to conventional conflict with secessionist entities or other states.
5.1.5 Violent demonstrations or violent civil or labor unrest*	EIU Risk Briefing	Violent demonstrations or civil or labor unrest may compromise government control, providing opportunities for groups seeking to acquire nuclear materials. Are violent demonstrations or violent civil or labor unrest likely to occur during the next two years? 0 = Very high 1 = High 2 = Moderate 3 = Low 4 = Very low Violent demonstrations or civil or labor unrest may arise from socioeconomic factors, such as unemployment or fiscal austerity; ethnic, religious, or political divisions; labor disputes; and refugee or migrant flows.

* Denotes that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without.

Indicator or Subindicator	Source	Indicator Definitions and Construction
5.2 Effective Governance*		**A lack of effective governance can compromise a country's ability to establish and sustain policies to secure nuclear materials.**
5.2.1 Effectiveness of the political system*	EIU Business Environment Ranking	An ineffective political system can compromise a country's ability to establish and sustain policies to secure nuclear materials. How effective is the country's political system in formulating and executing policy? 0 = Very low 1 = Low 2 = Moderate 3 = High 4 = Very high This indicator assesses tensions between the legislative and executive branches of government, instability in government formation, and cohesion of the legislature.
5.2.2 Quality of the bureaucracy*	EIU Risk Briefing	An ineffective bureaucracy can negatively impact a country's ability to put into place and sustain policies to secure nuclear materials. What is the quality of the country's bureaucracy and its ability to carry out government policy? 0 = Very low 1 = Low 2 = Moderate 3 = High 4 = Very high This indicator assesses the quality of the bureaucracy across the following criteria: overall competency and training, morale and dedication, and compensation and status.
5.3 Pervasiveness of Corruption*		**Corruption affects the potential for theft of nuclear materials and the rigor with which nuclear material security measures are implemented.**
5.3.1 Pervasiveness of corruption*	EIU Risk Briefing	How pervasive is corruption among public officials? 0 = Very high 1 = High 2 = Moderate 3 = Low 4 = Very low The following factors are considered in this assessment: length of time that the regime or government has been in power, number of officials appointed rather than elected, frequency of reports or rumors of bribery, and perception of the degree to which public officials are involved in corrupt practices (e.g., misuse of public office for private benefit, accepting bribes, dispensing favors, and patronage for private gain).

* Denotes that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without.

Indicator or Subindicator	Source	Indicator Definitions and Construction
5.4 Group(s) Interested in Illicitly Acquiring Materials*		**The presence and capabilities of terrorist or criminal group(s), particularly those with the goal of illicitly acquiring nuclear materials, raise the risk of theft of nuclear materials.**
5.4.1 Group(s) interested in illicitly acquiring materials*	EIU and expert assessment based on various sources	Are there terrorist or criminal group(s) interested in illicitly acquiring nuclear materials? 0 = Such group(s) are present and are thought to have the capabilities to carry out their goals acting alone or with the assistance of a capable third party 1 = Such group(s) are present, but are likely incapable of carrying out their aims 2 = No such group(s) are known to be present

* Denotes that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without.

Sabotage Ranking

Number of Sites

This category comprises one indicator: Number of Sites. The Number of Sites category captures the number of sites in a country that, if subject to an act of sabotage, could pose the risk of a radiological release with significant off-site health consequences.

Indicator or Subindicator	Source	Indicator Definitions and Construction
1.1 Number of Sites		**The greater the number of nuclear facilities, the greater the potential risk of acts of sabotage.**
1.1.1 Number of sites	EIU analyst qualitative assessment	How many sites with nuclear facilities does the country maintain that, if subject to an act of sabotage, could pose the risk of a radiological release with significant off-site health consequences? The following types of nuclear facilities are considered: • Operating nuclear power reactors or nuclear power reactors that have been shut down within the last five years • Research reactors with a capacity of 2 MW (megawatts) or greater • Reprocessing facilities • Spent fuel pools, only if the fuel has been discharged in the last five years and if not associated with an operating reactor. 0 = 30 sites or greater 1 = 20–29 sites 2 = 10–19 sites 3 = 4–9 sites 4 = 2–3 sites 5 = One site A location with multiple facilities on site is counted as a single site.

Security and Control Measures

The Security and Control Measures category encompasses the core activities directly related to protection of nuclear facilities. This category comprises five indicators: (a) On-Site Physical Protection, (b) Control and Accounting Procedures, (c) Insider Threat Prevention, (d) Response Capabilities, and (e) Cybersecurity.

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.1 On-Site Physical Protection		**Essential measures for securing sites and facilities.**
2.1.1 Mandatory physical protection	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring licensees to provide physical protection increases the likelihood that nuclear facilities will meet strict standards. Is physical protection a condition for licensing? 0 = No *or* information not publicly available 1 = Yes

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.1.2 On-site reviews of security	EIU analyst qualitative assessment based on official national sources, which vary by country	On-site reviews of security increase the likelihood that physical protection measures meet prescribed standards and will be maintained. Are on-site reviews of security done in order to keep a license? 0 = No *or* information not publicly available 1 = Yes
2.1.3 Design Basis Threat (DBT)	EIU analyst qualitative assessment based on official national sources, which vary by country	A Design Basis Threat that is based on strong assumptions and that is regularly updated leads to a more rigorous security system. Do the country's regulations require the use of a Design Basis Threat that is required to be updated? 0 = No *or* information not publicly available 1 = Yes A Design Basis Threat means the attributes and characteristics of potential insider or external adversaries, who might attempt unauthorized removal of nuclear material or sabotage, against which a physical protection system is designed and evaluated.
2.1.4 Security responsibilities and accountabilities	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring licensees to hold particular individuals accountable for security increases the likelihood that physical protection measures will be implemented. Does the nuclear regulator define nuclear security responsibilities and accountabilities? 0 = No *or* information not publicly available 1 = Yes This subindicator seeks to answer whether the regulator requires licensees to define who is responsible and/or accountable for at least one aspect of nuclear security. It is not enough to note that the responsibility for security will fall to the licensee. The regulator should require that the licensee have individuals with security responsibilities or accountabilities in at least one area of security.
2.1.5 Performance-based program	EIU analyst qualitative assessment based on official national sources, which vary by country	Required demonstration of performance, along with tests and assessments, improves effectiveness of and identifies weaknesses in physical protection measures. Does the regulator require a performance-based program, which includes tests and assessments of security systems and measures, and a demonstration of performance by security personnel at nuclear sites? 0 = No *or* information not publicly available 1 = Yes

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.2 Control and Accounting Procedures		**Control and accounting is a necessary element of a comprehensive security system.**
2.2.1 Legal and regulatory basis for material control and accounting (MC&A)	EIU analyst qualitative assessment based on official national sources, which vary by country	A legal and regulatory basis for control and accounting is part of the foundation of a strong system and culture of nuclear security. Is there a domestic legal and regulatory basis for nuclear material control and accounting (MC&A)? 0 = There is no domestic legal *or* regulatory basis for MC&A *or* information not publicly available 1 = There is a legal and regulatory basis for MC&A 2 = There is a legal and regulatory basis for MC&A and international guidelines are reflected in the legal and regulatory system
2.2.2 Radiological consequences (materials)	EIU analyst qualitative assessment based on official national sources, which vary by country	A graded approach that identifies different levels of security ensures that security measures are commensurate with the potential consequences of an act of sabotage. Do domestic laws, regulations, or licensing requirements require that the potential levels of radiological consequences of sabotage be used to determine physical protection of nuclear materials? 0 = No *or* information not publicly available 1 = Yes
2.2.3 Radiological consequences (equipment, systems, and devices)	EIU analyst qualitative assessment based on official national sources, which vary by country	A graded approach that identifies different levels of security ensures that security measures for equipment, systems, and devices are commensurate with the potential consequences of an act of sabotage. Do domestic laws, regulations, or licensing requirements require that potential levels of radiological consequences of sabotage be used to determine physical protection of equipment, systems, and devices? 0 = No *or* information not publicly available 1 = Yes

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.2.4 Control measures	EIU analyst qualitative assessment based on official national sources, which vary by country	Control measures aid in the assurance that unauthorized access to restricted areas of nuclear facilities is detected in a timely manner. Do domestic regulations or licensing conditions require the following control measures? a. The identity of persons entering areas with nuclear material and/or areas with equipment, systems, and devices, the sabotage of which could lead to high radiological consequences (the equivalent of a "vital area" as defined by the IAEA), must be verified. b. Records must be kept of all persons who access areas with nuclear material and/or areas with equipment, systems, and devices, the sabotage of which could lead to high radiological consequences (the equivalent of a "vital area" as defined by the IAEA), and of all persons who have access to or possession of keys, keycards, and other systems—including computer systems—that control access to such areas. 0 = Regulations do not require control measures *or* information not publicly available 1 = Regulations require one of these control measures 2 = Regulations require two of these control measures
2.2.5 Access control	EIU analyst qualitative assessment based on official national sources, which vary by country	Effective access control measures increase the likelihood of the detection and prevention of unauthorized access to restricted areas of nuclear facilities. Is access to areas with nuclear material and/or areas with equipment, systems, and devices, the sabotage of which could lead to high radiological consequences (the equivalent of a "vital area" as defined by the IAEA), limited to persons with authorized access? 0 = No *or* information not publicly available 1 = Yes
2.3 Insider Threat Prevention		**The qualifications of personnel, the strength of the security culture, and the use of certain surveillance measures are critical to how well security procedures are followed and decrease vulnerability to insider threats.**
2.3.1 Personnel vetting	EIU analyst qualitative assessment based on official national sources, which vary by country	Clear guidelines for the qualification and fitness of personnel increase the likelihood that security and other personnel with access to protected areas will effectively discharge their responsibilities and decrease vulnerability to insider threats. Do domestic regulations or license conditions specify that security and other personnel with access to protected areas are subject to the following checks: drug testing, background checks, and psychological or mental fitness checks? 0 = Personnel are not subject to any of these checks 1 = Personnel are subject to one of these checks 2 = Personnel are subject to two of these checks 3 = Personnel are subject to all three of these checks

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.3.2 Frequency of personnel vetting	EIU analyst qualitative assessment based on official national sources, which vary by country	Personnel vetting at frequent intervals is essential to identifying new and changing insider threats. Do domestic regulations or licensing conditions specify that security and other personnel with access to protected areas are vetted at specified intervals? 0 = Frequency of vetting is not specified *or* information not publicly available 1 = Such personnel are subject to vetting at periods greater than five years 2 = Such personnel are subject to vetting at periods greater than two but not more than five years 3 = Such personnel are subject to vetting at periods of two years or less
2.3.3 Reporting	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring personnel to report suspicious behavior increases the likelihood that insider threats will be detected early. Do domestic regulations or licensing conditions specify that personnel must report suspicious behavior to an official authority? 0 = No *or* information not publicly available 1 = Yes
2.3.4 Surveillance	EIU analyst qualitative assessment based on official national sources, which vary by country	To counter the insider threat, whenever a protected area is occupied, constant surveillance (e.g., a two-person surveillance system or technological surveillance system) should be used to detect unauthorized action. Do domestic regulations or license conditions require constant surveillance of areas with nuclear material and/or areas with equipment, systems, and devices, the sabotage of which could lead to high radiological consequences (the equivalent of a "vital area" as defined by the IAEA), when they are occupied using either a two-person surveillance system or a technological surveillance system? 0 = No *or* information not publicly available 1 = Yes, a two-person surveillance system or a technological surveillance system is required 2 = Yes, both a two-person surveillance system and a technological surveillance system are required *Two-person surveillance system:* Requires at least two knowledgeable persons to be present to verify that activities involving nuclear material and nuclear facilities are authorized, allowing detection of access or actions that are unauthorized. *Technological surveillance:* Technological surveillance includes devices such as closed-circuit television (CCTV) and audio surveillance equipment.

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.4 Response Capabilities		**Response capabilities are part of a layered security system to prevent and mitigate acts of sabotage.**
2.4.1 Emergency response capabilities	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring on-site emergency response capabilities, including trained response teams and required incident reports (i.e., notification), increases the level of preparedness for potential acts of sabotage. Do the state's licensing requirements for civilian nuclear facilities require that each facility have on-site nuclear security emergency response capabilities? 0 = Licensing does not require an on-site trained response team or incident reports to appropriate law enforcement authority 1 = Licensing requires incident reports to appropriate law enforcement authority 2 = Licensing requires an on-site trained response team 3 = Licensing requires *both* an on-site trained response team and incident reports to appropriate law enforcement authority Capabilities should include a trained response team and a requirement to report an incident to appropriate law enforcement authorities.
2.4.2 Armed response capabilities	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring on-site armed response capabilities increases the chance of success in responding to armed attacks. Do the state's licensing requirements for civilian nuclear facilities require that each nuclear power reactor and reprocessing facility have an on-site armed response team? 0 = No *or* information not publicly available 1 = Yes, an on-site armed response team is required *or* the state does not have a nuclear power reactor or reprocessing facility
2.4.3 Law enforcement response training	EIU analyst qualitative assessment based on official national sources, which vary by country	Law enforcement officers who are trained to respond to security incidents at nuclear facilities have a greater chance of success responding to those incidents than those who are untrained. Are law enforcement trained to respond in the event of a security incident at a nuclear facility? 0 = No 1 = Yes
2.4.4 Nuclear infrastructure protection plan	EIU analyst qualitative assessment based on official national sources, which vary by country	Natural disasters may increase vulnerability of nuclear facilities as a result of physical damage to facilities and additional pressures placed upon government and personnel. Does the country's regulatory framework state that, in the event of a natural disaster, plans are in place to physically protect the nuclear infrastructure? 0 = No mention 1 = Partially mentioned 2 = Fully described Emergency preparedness regulations must mention nuclear facilities specifically.

Indicator or Subindicator	Source	Indicator Definitions and Construction
2.5 Cybersecurity		**Nuclear facilities are vulnerable to cyber attacks as well as physical attacks. Therefore, cybersecurity is a critical component of protecting against acts of sabotage.**
2.5.1 Mandatory cybersecurity	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring nuclear facilities to have protection from a cyber attack increases the likelihood that nuclear facilities will take measures to protect against cyber attacks. Do domestic laws, regulations, or licensing requirements require nuclear facilities to have protection from a cyber attack? 0 = No *or* information not publicly available 1 = Yes
2.5.2 Critical digital asset protection	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring protection of critical digital assets against cyber attacks decreases the chance that an attacker can circumvent physical protection, control and accounting, and safety systems. Do domestic laws, regulations, or licensing requirements require nuclear facilities to protect critical digital assets from a cyber attack? 0 = No *or* information not publicly available 1 = Yes Critical digital assets include the following systems and networks: • Safety-related functions • Security functions • Emergency preparedness functions • Support systems and equipment related to the above functions.
2.5.3 Cybersecurity Design Basis Threat	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring the Design Basis Threat to take into account the potential for cyber attacks increases the likelihood that nuclear facilities will consider cyber attacks when designing their security plans. Does the state consider cyber threats in its threat assessment or Design Basis Threat for nuclear facilities? 0 = No *or* information not publicly available 1 = Yes
2.5.4 Cybersecurity assessments	EIU analyst qualitative assessment based on official national sources, which vary by country	Required demonstration of performance, along with tests and assessments, improves effectiveness of and identifies weaknesses in cybersecurity measures. Does the regulator require a performance-based program, which includes tests and assessments of cybersecurity at nuclear facilities? 0 = No *or* information not publicly available 1 = Yes

Global Norms

The Global Norms category includes actions that contribute to the establishment of global norms for nuclear security. This category comprises three indicators: (a) International Legal Commitments, (b) Voluntary Commitments, and (c) International Assurances.

Indicator or Subindicator	Source	Indicator Definitions and Construction
3.1 International Legal Commitments		**International legal commitments are the basis for domestic legislation, regulations, and security capacity.**
3.1.1 Convention on the Physical Protection of Nuclear Material (CPPNM)	International Atomic Energy Agency (IAEA)	Parties to the CPPNM commit to provide certain levels of physical protection during international transport of nuclear materials; cooperate in the protection, recovery, and return of stolen nuclear material; and criminalize offenses involving nuclear material. The CPPNM is the basis for the 2005 Amendment, which requires protection of nuclear facilities against sabotage. Is the state a party to the CPPNM? 0 = Non-compliant *or* not a member 1 = Signed 2 = Signed and ratified (or action having the same legal effect)
3.1.2 2005 Amendment to the CPPNM	IAEA	Parties to the 2005 Amendment to the CPPNM commit to expand the scope of their responsibilities under the CPPNM to include protection of nuclear material in domestic use, in storage, and during transport, as well as protection of nuclear facilities against acts of sabotage. Is the state a party to the 2005 Amendment to the CPPNM? 0 = Not ratified, accepted, or approved 1 = Ratified, accepted, or approved (or action having the same legal effect)
3.1.3 International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT)	United Nations	Parties to the ICSANT commit to criminalize acts of nuclear terrorism and promote cooperation with other states to prevent, investigate, and punish those acts. Is the state a party to ICSANT? 0 = Non-compliant *or* not a member 1 = Signed 2 = Signed and ratified (or action having the same legal effect)
3.1.4 Convention on Nuclear Safety	IAEA	Parties to the Convention on Nuclear Safety commit to provide high levels of nuclear safety and defend nuclear installations against potential radiological hazards, and prevent and mitigate radiological accidents. Those steps also minimize the risks associated with acts of sabotage against nuclear facilities. Is the state a party to the Convention on Nuclear Safety? 0 = Non-compliant *or* not a member 1 = Signed 2 = Signed and ratified (or action having the same legal effect)

Indicator or Subindicator	Source	Indicator Definitions and Construction
3.2 Voluntary Commitments		**Voluntary commitments demonstrate a state's support for nuclear security as a global agenda.**
3.2.1 International Atomic Energy Agency (IAEA) membership	IAEA	Is the country a member of IAEA? 0 = No 1 = Yes
3.2.2 Global Initiative to Combat Nuclear Terrorism (GICNT) membership	U.S. Department of State	Is the country a member of the GICNT? 0 = No 1 = Yes
3.2.3 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction membership	U.S. Department of State	Is the country a member of the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction? 0 = No 1 = Yes
3.2.4 World Institute for Nuclear Security (WINS) contributions	WINS 2013 and 2014 annual reports	Has the country provided financial or in-kind contributions to the WINS within the previous two years? 0 = No 1 = Yes
3.2.5 IAEA Nuclear Security Fund contributions	IAEA	Has the country provided financial or in-kind contributions to the IAEA Nuclear Security Fund within the previous two years? 0 = No 1 = Yes
3.2.6 Bilateral or multilateral assistance	EIU analyst qualitative assessment	Has the country provided financial and/or practical bilateral or multilateral assistance for other states or received such assistance in the field of nuclear security (exclusive of contributions captured elsewhere in this indicator) within the previous two years? 0 = No 1 = Yes
3.2.7 Centers of Excellence	EIU analyst qualitative assessment	Does the country have a Center of Excellence or Nuclear Security Training and Support Center that offers training in nuclear security? 0 = No 1 = Yes To receive credit, a Center of Excellence or Nuclear Security Training and Support Center should have the following characteristics: (a) serve as a centralized organization to facilitate broad cross-industry engagement in education and training; (b) focus on nuclear security, even if safeguards, safety, or nuclear energy is also addressed; (c) provide practical training courses; (d) provide education in the form of lectures or seminars; and (e) have government support. Centers that are not yet operational are excluded.

Indicator or Subindicator	Source	Indicator Definitions and Construction
3.3 International Assurances		**International assurances enhance international confidence in the effectiveness of a country's nuclear security conditions.**
3.3.1 Published regulations and reports	EIU analyst qualitative assessment based on official national sources, which vary by country	Public release of broad outlines of nuclear security regulations and nuclear security issues increases confidence in a country's commitment to nuclear security. Does the state publicly release broad outlines of its nuclear security regulations and/or annual reports on nuclear security issues? 0 = The state does not publish regulations or annual reports 1 = The state publishes regulations *or* an annual report 2 = The state publishes regulations *and* an annual report
3.3.2 Review of security arrangements	EIU analyst qualitative assessment	Hosting security reviews demonstrates the importance a country places on its security obligations and creates international confidence in levels of security. Has the state hosted a review of its security arrangements? 0 = No 1 = Yes 2 = Yes, within the past five years A state receives credit if it has hosted any of the following IAEA missions, including follow-up missions: International Physical Protection Advisory Service (IPPAS) mission, International Nuclear Security Advisory Service (INSServ) mission, State System for Accountancy and Control (SSAC) Advisory Service, or Integrated Regulatory Review Service (IRRS) missions that have a security component. A state receives a "yes" if it has received bilateral or multilateral assistance (outside an international organization) to review security arrangements.

Domestic Commitments and Capacity

The Domestic Commitments and Capacity category includes actions that indicate how well a country has implemented its international commitments and a country's capacity to do so. This category comprises three indicators: (a) UN Security Council Resolution (UNSCR) 1540 Implementation, (b) Domestic Nuclear Security Legislation, and (c) Independent Regulatory Agency.

Indicator or Subindicator	Source	Indicator Definitions and Construction
4.1 UN Security Council Resolution (UNSCR) 1540 Implementation		**UNSCR 1540 obliges action on nuclear security and its implementation demonstrates a state's commitment level.**
4.1.1 UNSCR 1540 reporting	Security Council Committee established pursuant to resolution 1540 (1540 Committee)	Compliance with UNSCR 1540 reporting requirements demonstrates commitment to UNSCR 1540's security objectives. Has the state provided the required UNSCR 1540 report to the Security Council Committee established pursuant to resolution 1540 (1540 Committee)? 0 = The state has not provided a UNSCR 1540 report 1 = The state has provided a UNSCR 1540 report
4.1.2 Extent of UNSCR 1540 implementation	Creation of a coding and scoring scheme by the Economist Intelligence Unit (EIU), based on documents from the 1540 Committee	Implementation of UNSCR 1540 demonstrates commitment to UNSCR 1540's security objectives and improves security procedures and culture. Extent of implementation is identified through the measures taken by a state and reflected in its UNSCR 1540 matrix. Scoring is based on an evaluation of the total number of elements of UNSCR 1540 that have been implemented, as reflected in the individual country matrices. Elements related to nuclear security in the matrix that have been implemented are indicated by an "X." The EIU summed the number of elements related to the security of nuclear facilities against sabotage (out of a maximum of 25) with an "X" designation, providing a numerical score for implementation. The resulting numerical score is banded into five categories scored from 0 points to 4 points: 0 = Very weak (0–5 points) 1 = Weak (6–10 points) or matrix exists but is not publicly available 2 = Moderate (11–15 points) 3 = Good (16–20 points) 4 = Very good (21+ points) Those states that do not have a matrix have been given the lowest possible score. Countries that have a matrix, but have not made it public, were assigned the second-lowest score to give credit for estimated levels of implementation.

Indicator or Subindicator	Source	Indicator Definitions and Construction
4.2 Domestic Nuclear Security Legislation		**The implementation of security measures is rooted in domestic nuclear security legislation.**
4.2.1 Convention on the Physical Protection of Nuclear Material (CPPNM) implementation authority	EIU analyst qualitative assessment based on official national sources, which vary by country	Existence of a national authority (state body) to implement the CPPNM increases the likelihood of implementation and demonstrates commitment to the CPPNM's objectives. Is there a national authority for implementation of CPPNM? 0 = No 1 = Yes This indicator considers whether there is a national authority (state body) that is responsible for implementing the CPPNM. The convention requires states to establish or designate a competent authority responsible for the implementation of the legislative and regulatory framework.
4.2.2 National legal framework for CPPNM	EIU analyst qualitative assessment based on official national sources, which vary by country	A national legal framework is part of the foundation of a strong system and culture of nuclear security. Has the state fulfilled all obligations for a national legal framework for CPPNM? 0 = No 1 = Yes This indicator determines whether the legal elements specified by the CPPNM are enshrined in domestic legislation.
4.2.3 Convention on Nuclear Safety report	International Atomic Energy Agency (IAEA)	Compliance with Convention on Nuclear Safety reporting requirements demonstrates commitment to the Convention on Nuclear Safety's security objectives. Has the state provided the required report to the IAEA in conjunction with the most recent review meeting on measures taken to implement the Convention on Nuclear Safety? 0 = No 1 = Yes, *or* the state does not have a nuclear power reactor
4.3 Independent Regulatory Agency		**A robust and independent regulatory structure helps to ensure compliance with nuclear security–related regulations.**
4.3.1 Independent regulatory agency	EIU analyst qualitative assessment based on official national sources, which vary by country	Does the state have an independent regulatory agency responsible for regulating security? 0 = No 1 = Yes According to the IAEA, independence requires "an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy."

Risk Environment

The risk environment can affect the nuclear security conditions in a country. The Risk Environment category comprises four indicators: (a) Political Stability, (b) Effective Governance, (c) Pervasiveness of Corruption, and (d) Group(s) Interested in Committing Acts of Nuclear Terrorism.

Indicator or Subindicator	Source	Indicator Definitions and Construction
5.1 Political Stability		**A lack of political stability may enable lapses in nuclear security.**
5.1.1 Social unrest	EIU Risk Briefing	Significant social unrest can affect the government's ability to secure nuclear facilities, or the upheaval created by the unrest may provide opportunities for groups seeking to commit acts of sabotage against nuclear facilities. What is the risk of significant social unrest during the next two years? 0 = Very high 1 = High 2 = Moderate 3 = Low 4 = Very low Social unrest can include large-scale demonstrations, political strikes, and interethnic, racial, or religious clashes.
5.1.2 Orderly transfers of power	EIU Risk Briefing	Instability and conflict surrounding changes of power may provide opportunities for groups seeking to commit acts of sabotage against nuclear facilities. How clear, established, and accepted are constitutional mechanisms for the orderly transfer of power from one government to another? 0 = Not clear, established, or accepted 1 = Two of the three criteria are absent 2 = One of the three criteria is absent 3 = Clear, established, and accepted 4 = Very clear, established, and accepted Unclear, poorly established, or weakly accepted constitutional mechanisms for the transfer of power are a particular concern for succession in autocracies, but they can also prove an issue in more democratic systems, for example, if election results are not accepted by all sides.

Indicator or Subindicator	Source	Indicator Definitions and Construction
5.1.3 International disputes or tensions	EIU Risk Briefing	Tensions with important trade or strategic partners and armed regional conflicts could have destabilizing implications for a country and, hence, for nuclear security. Is there a risk that international disputes or tensions will negatively affect the country during the next two years? 0 = Very high 1 = High 2 = Moderate 3 = Low 4 = No threat In addition to armed regional conflict, tensions with important trade or strategic partners, resulting in economic sanctions or other barriers to trade, could have destabilizing implications for the country and, hence, for nuclear security.
5.1.4 Armed conflict	EIU Risk Briefing	Armed conflict in areas where nuclear facilities are located could seriously compromise site security. Is this country presently subject to armed conflict, or is there at least a moderate risk of such conflict during the next two years? 0 = Territorial conflict; opposition has effective control over a region or regions 1 = Sporadic and incursive conflict 2 = Incursive conflict; government remains in control, but opposition engages in frequent armed incursions 3 = Sporadic conflict; government control is firm, but opposition engages in isolated incidents of violence 4 = No armed conflict exists This indicator covers armed conflict either within the territory of the state or directly threatening it. Forms of conflict may range from sporadic or incursive conflict with non-state actors to conventional conflict with secessionist entities or other states.
5.1.5 Violent demonstrations or violent civil or labor unrest	EIU Risk Briefing	Violent demonstrations or civil or labor unrest may compromise government control and provide opportunities for groups seeking to commit acts of sabotage against nuclear facilities. Are violent demonstrations or violent civil or labor unrest likely to occur during the next two years? 0 = Very high 1 = High 2 = Moderate 3 = Low 4 = Very low Violent demonstrations or civil or labor unrest may arise from socioeconomic factors, such as unemployment or fiscal austerity; ethnic, religious, or political divisions; labor disputes; and refugee or migrant flows.

Indicator or Subindicator	Source	Indicator Definitions and Construction
5.2 Effective Governance		**A lack of effective governance can compromise a country's ability to establish and sustain policies to secure nuclear facilities.**
5.2.1 Effectiveness of the political system	EIU Business Environment Ranking	An ineffective political system can compromise a country's ability to establish and sustain policies to secure nuclear facilities. How effective is the country's political system in formulating and executing policy? 0 = Very low 1 = Low 2 = Moderate 3 = High 4 = Very high This indicator assesses tensions between the legislative and executive branches of government, instability in government formation, and cohesion of the legislature.
5.2.2 Quality of the bureaucracy	EIU Risk Briefing	An ineffective bureaucracy can compromise a country's ability to establish and sustain policies to secure nuclear facilities. What is the quality of the country's bureaucracy and its ability to carry out government policy? 0 = Very low 1 = Low 2 = Moderate 3 = High 4 = Very high This indicator assesses the quality of the bureaucracy across the following criteria: overall competency and training, morale and dedication, and compensation and status.
5.3 Pervasiveness of Corruption		**Corruption affects the potential for acts of sabotage and the rigor with which nuclear security measures are implemented.**
5.3.1 Pervasiveness of corruption	EIU Risk Briefing	How pervasive is corruption among public officials? 0 = Very high 1 = High 2 = Moderate 3 = Low 4 = Very low The following factors are considered in this assessment: length of time that the regime or government has been in power, number of officials appointed rather than elected, frequency of reports or rumors of bribery, and perception of the degree to which public officials are involved in corrupt practices (e.g., misuse of public office for private benefit, accepting bribes, dispensing favors, and patronage for private gain).

Indicator or Subindicator	Source	Indicator Definitions and Construction
5.4 Group(s) Interested in Committing Acts of Nuclear Terrorism		**The presence and capabilities of terrorist or criminal groups, particularly those with the goal of committing acts of nuclear terrorism, raise the risk of sabotage.**
5.4.1 Group(s) interested in committing acts of nuclear terrorism	EIU and expert assessment based on various sources	Are there terrorist or criminal group(s) interested in committing acts of nuclear terrorism? 0 = Such group(s) are present and are thought to have the capabilities to carry out their goals acting alone or with the assistance of a capable third party 1 = Such group(s) are present, but are likely incapable of carrying out their aims 2 = No such group(s) are known to be present

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