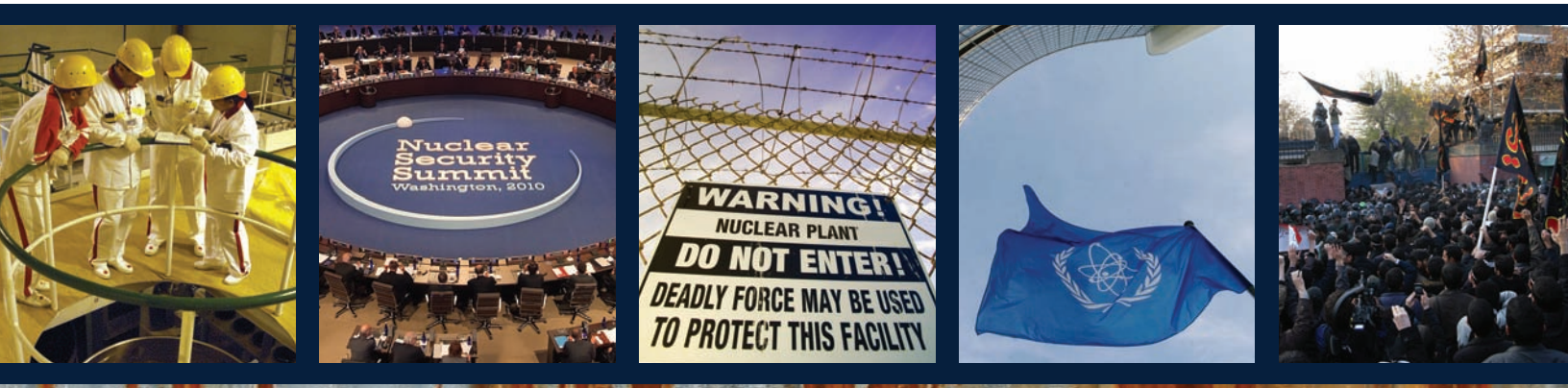
TEN YEARS OF NTI BUILDING A SAFER WORLD

January 2012

NTI Nuclear Materials SECURITY INDEX

Building a Framework for Assurance, Accountability, and Action



Index developed with
Economist Intelligence Unit
The Economist

THE NTI NUCLEAR MATERIALS SECURITY INDEX

The Nuclear Threat Initiative (NTI) Nuclear Materials Security Index is a first-of-its-kind public benchmarking project of nuclear materials security conditions on a country-by-country basis. The NTI Index, prepared with the Economist Intelligence Unit (EIU), was created to spark an international discussion about priorities required to strengthen security and, most important, to encourage governments to provide assurances and to take actions to reduce risks.

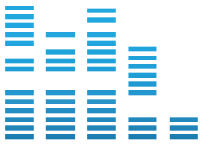
The project draws on NTI's nuclear expertise, the EIU's experience in constructing indices, and the reach of the EIU's global network of 900 analysts and contributors. NTI—working with an international panel of nuclear security experts and a number of technical advisors—focused on the framework and priorities that define effective nuclear materials security conditions. The EIU was responsible for developing the Excel-based model and gathering the data.

The NTI Index assesses the contribution of 32 states with one kilogram or more of weapons-usable nuclear materials toward improved global nuclear materials security conditions, using five categories: (a) Quantities and Sites, (b) Security and Control Measures, (c) Global Norms, (d) Domestic Commitments and Capacity, and (e) Societal Factors. An additional 144 states, with less than one kilogram of weapons-usable nuclear materials or none at all, are assessed on the last three of these categories. The Index includes three elements:

- The **print report**, with NTI findings and recommendations, a complete discussion of the EIU methodology, and selected data
- The website, **www.ntiindex.org**, with high-level results in an easily accessible format, including all country summaries and interactive tools that allow visitors to determine their own priorities and weighting of categories and indicators
- A **downloadable version of the NTI Index**, available through the website, with complete results and data and extended interactive features in an Excel format

This project is co-led by Page Stoutland, NTI Vice President, Nuclear Materials Security Program, and Deepti Choubey, NTI Senior Director for Nuclear and Bio-Security.

NTI Nuclear Materials SECURITY INDEX



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Correction

The original version of NTI's Nuclear Materials Security Index released on January 11, 2012 included an error in the scoring of Norway's quantities of weapons-usable nuclear materials. As a result, Norway's overall ranking was incorrect in the original version of this report, the website, and the EIU Excel model.

In overall scoring, Norway ties with Poland for 8th, with a score of 82 (rather than ranking 9th with a score of 81 reflected in the original Index release). Within the Quantities and Sites category, Norway has a score of 81, which moved its ranking in this particular category to 13th from 14th. As a result, Ukraine moves to 14th from 13th within this category.

This edition of the report includes these corrections.

NTI and the EIU apologize for the error.

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Print Report Design

HDN Studio, Alexandria, VA

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APPENDICES

ACKNOWLEDGMENTS

A project that breaks new ground and reshapes international norms on a grave global threat necessarily requires the best judgment available from as many experienced and knowledgeable people as possible. As co-leaders of this project, we are indebted to many such people. First and foremost, we are grateful to Nuclear Threat Initiative (NTI) Co-Chairman and Chief Executive Officer Sam Nunn for identifying the need for a public and common understanding of the global state of weapons-usable nuclear materials security and NTI President Joan Rohlfing for conceptualizing how best to meet that need. Their unerring leadership has been invaluable from project inception through conclusion.

NTI required a true partner to meet our project goals. We are grateful for the analytic support provided by the Economist Intelligence Unit (EIU). Leo Abruzzese, EIU's Director of Global Forecasting, and Hilary Ewing, EIU Senior Analyst, were indispensable as their team intrepidly researched this challenging topic.

Achieving one of the central aims of this project—namely, initiating an international dialogue on priorities—would not have been possible without our international panel, which consists of some of the world's most respected experts. These experts have been extremely generous with their time and insights, and we have done our best to ensure that this project reflects their collective wisdom.

We also appreciate the many officials and experts from around the world who participated in briefings and provided critical insights that further strengthened this final product. They included government officials who took the time to review and validate the data gathered by the EIU. Furthermore, the NTI Index would not have been possible without Matthew Bunn's groundbreaking *Securing the Bomb* series and the indispensable analytic work of the International Panel on Fissile Materials.

We would also like to thank the NTI Board of Directors for their support and especially convey our thanks to NTI's generous funders, including the John D. and Catherine T. MacArthur Foundation and the Carnegie Corporation of New York.

Finally, we are indebted to all of our colleagues at NTI, as everyone has made some contribution to this project in big ways and small. In particular, we thank Mimi Hall for her critical editing skills, as well as Deborah Rosenblum, Corey Hinderstein, and Carmen MacDougall for their wise counsel. We also thank Michelle Nalabandian, Catherine Crary, Samantha Pitts-Kiefer, and Philippe de Koning, our Herbert Scoville Jr. Peace Fellow, for their overall support of the project and our team.

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FOREWORD
by Sam Nunn, NTI Co-Chairman

BUILDING A FRAMEWORK FOR ASSURANCE, ACCOUNTABILITY, AND ACTION

The prospect is almost unthinkable: one of the world's great cities devastated at the hands of terrorists armed with a crude nuclear weapon built out of materials stolen or bought on the black market.

On that dreadful day, with the consequences of nuclear catastrophe reverberating around the globe, citizens and world leaders alike would ask, "What could we have done, and what should we have done, to prevent it?"

Amid the destruction, we could not plausibly argue that the threat was not clear. In fact, there is evidence today that the elements of a perfect storm are in place: an ample supply of weapons-usable nuclear materials, some of it poorly secured, spread across 32 countries; an expansion of the knowledge and technical know-how needed to build a crude nuclear bomb accessible by the Internet or through rogue scientists; and the determination of terrorist organizations that have publicly stated their desire to acquire and use nuclear weapons. Allowing these dark clouds to come together could result in the deaths of tens or hundreds of thousands of people, the wide-scale destruction of property and agriculture, the disruption of markets and global commerce, and the constriction of civil liberties worldwide.

The best defense against catastrophic nuclear terrorism begins with securing weapons and materials in every country and at every facility where they are stored.

We know that to get the materials needed to build a bomb, terrorists will not necessarily go where there is the most material; they will go where the material is most vulnerable. That makes global nuclear security only as strong as the weakest link in the chain.

We also know that the best defense against catastrophic nuclear terrorism begins with securing weapons and materials in every country and at every facility where they are stored. The work to secure the materials, however, does not end there. All states must accept responsibility, and all must participate in the global effort to combat this threat.

Thankfully, there is some good news to report. Over the past 25 years, Ukraine, Belarus, and Kazakhstan returned the nuclear weapons they inherited from the former Soviet Union and joined the Nuclear Non-Proliferation Treaty; South Africa dismantled its nuclear weapons program; and the United States and

Russia, through the Cooperative Threat Reduction program, turned their historic rivalry into a cooperative effort to reduce their nuclear arsenals and to secure, consolidate, and eliminate nuclear materials worldwide—all in an effort to reduce the vulnerability of nuclear materials. To date, 19 countries plus Taiwan have eliminated their weapons-usable materials. The past decade has also seen the creation of new and innovative approaches to combating the threat, such as the Proliferation Security Initiative in which more than 70 countries participate.

In 2010, new momentum was injected into nuclear security efforts when leaders from 47 countries committed to take steps toward better nuclear materials security at the first-ever Nuclear Security Summit held in Washington, D.C. This event helped build much-needed political awareness and increased capacity within many governments. Since then, a dozen additional countries have joined important international treaties on nuclear materials security, and the United States and Russia have destroyed enough highly enriched uranium to make thousands of nuclear weapons. In addition, more than a dozen nuclear security training and research centers have opened around the world.[1]

All countries can and must do more to strengthen security around the world's most dangerous materials.

A second Nuclear Security Summit will be held in Seoul, South Korea, in March 2012, bringing added attention to the threat—and providing an opportunity for important additional progress toward preventing catastrophe. World leaders must seize this opportunity.

Despite this welcome new attention to the threat, however, many governments face stark political and financial challenges and, as a result, still struggle to secure the dangerous materials that can be used to build nuclear weapons. We hope the NTI Nuclear Materials Security Index can serve as a solid foundation to help inform that urgent and ongoing work.

NTI and the Economist Intelligence Unit (EIU) created the NTI Index by developing five categories comprising 18 indicators to offer an initial objective assessment of the contribution of 176 countries toward global nuclear materials security. With this Index, NTI is proposing a framework that we hope will define the essential elements of a greatly strengthened global nuclear materials security program; spark an international discussion about priorities required to strengthen security; and, most important, encourage governments to provide assurances and to take actions to reduce risks.

[1] Laura Holgate, "Planning for the Second Nuclear Security Summit Underway," *The White House Blog*, November 18, 2011. See www.whitehouse.gov/blog/2011/11/18/planning-second-nuclear-security-summit-underway.

To be clear, the Index is not a facility-by-facility review of "guns, guards, and gates" or an on-the-ground review of materials control and accounting practices. These are all crucial measures, but their effectiveness must be evaluated by governments. The Index takes a necessarily broad view of security and assesses and scores each state across a range of publicly available indicators of a state's security practices and conditions.

At this time, governments and international institutions have not undertaken this kind of global assessment of nuclear materials security. Over time, this NTI Index can be improved, and we hope that, at some point, comprehensive updates will be performed on a regular basis by an independent international body. Until that occurs, NTI intends to update the Index periodically.

To develop a credible and useful Index, NTI and the EIU relied on a panel of international experts and advisors. Members included people who have been directly responsible for nuclear security at facilities and in governments as well as people who have worked on nuclear security issues in academia and at international organizations. NTI also conducted briefings with and sought feedback from governments and a host of other experts worldwide. This support strengthened the intellectual framework for the Index and enhanced its accuracy.

Although the Index ranks countries, it is not about congratulating some and chastising others. Instead, it highlights that all countries can and must do more to strengthen security around the world's most dangerous materials. To that end, the NTI Index offers priorities and actionable recommendations. It should be used as a tool and as a resource for improvement, not merely as a rating system. In the future, this Index can become more helpful and accurate, but only if governments participate in filling gaps and correcting errors that result from a lack of transparency.

In the meantime, this NTI Index challenges governments worldwide to respond to the threat by taking appropriate steps to strengthen security conditions. As citizens and as leaders, we need to ask ourselves this question: If we have a catastrophic nuclear terrorist attack on Moscow or New York, on Tokyo or Tel Aviv, on Jakarta or Brussels, or on any other city in the world, what steps would we wish we had taken to prevent it? Securing weapons-usable nuclear materials around the globe is the most critical step.

The international panel of experts discussed Index priorities at a July 2011 meeting.

EXECUTIVE SUMMARY

The NTI Nuclear Materials Security Index is a unique public baseline assessment of the status of nuclear materials security conditions around the world.[2] It is a first-of-its-kind analysis because of its approach and scope. The Index is not a facility-by-facility review of "guns, guards, and gates" or an on-the-ground review of materials control and accounting practices. Information about the security measures in place at specific facilities is understandably sensitive and should remain so. The NTI Index assesses and scores each state across a broad range of publicly available indicators of a state's nuclear materials security practices and conditions.

Without such an assessment, it is difficult to measure risk, to track progress, and to hold states accountable. It is also difficult to build international confidence in the security of the world's most dangerous materials. To that end, the Index should be considered more than simply a scorecard: it provides a foundation for the urgent and ongoing work of strengthening security. It also offers a path forward through recommendations for individual states and for the international community to keep the materials needed to build a nuclear bomb out of dangerous hands.

The Index should be considered more than simply a scorecard: it provides a foundation for the urgent and ongoing work of strengthening security. It also offers a path forward through recommendations for individual states and for the international community to keep the materials needed to build a nuclear bomb out of dangerous hands.

Those materials today are stored at hundreds of sites in 32 countries around the globe. Some of those sites are well secured. Many are not, leaving weapons-usable nuclear materials vulnerable to theft or sale on the black market to terrorist organizations that have publicly stated their desire to use nuclear weapons.

A nuclear blast at the hands of terrorists or a rogue state would be catastrophic, and the consequences would reverberate around the globe, with tens or hundreds of thousands of casualties, disruptions to markets and commerce, long-term implications for public health and the environment, and risks to civil liberties—not to mention the cost of any response.

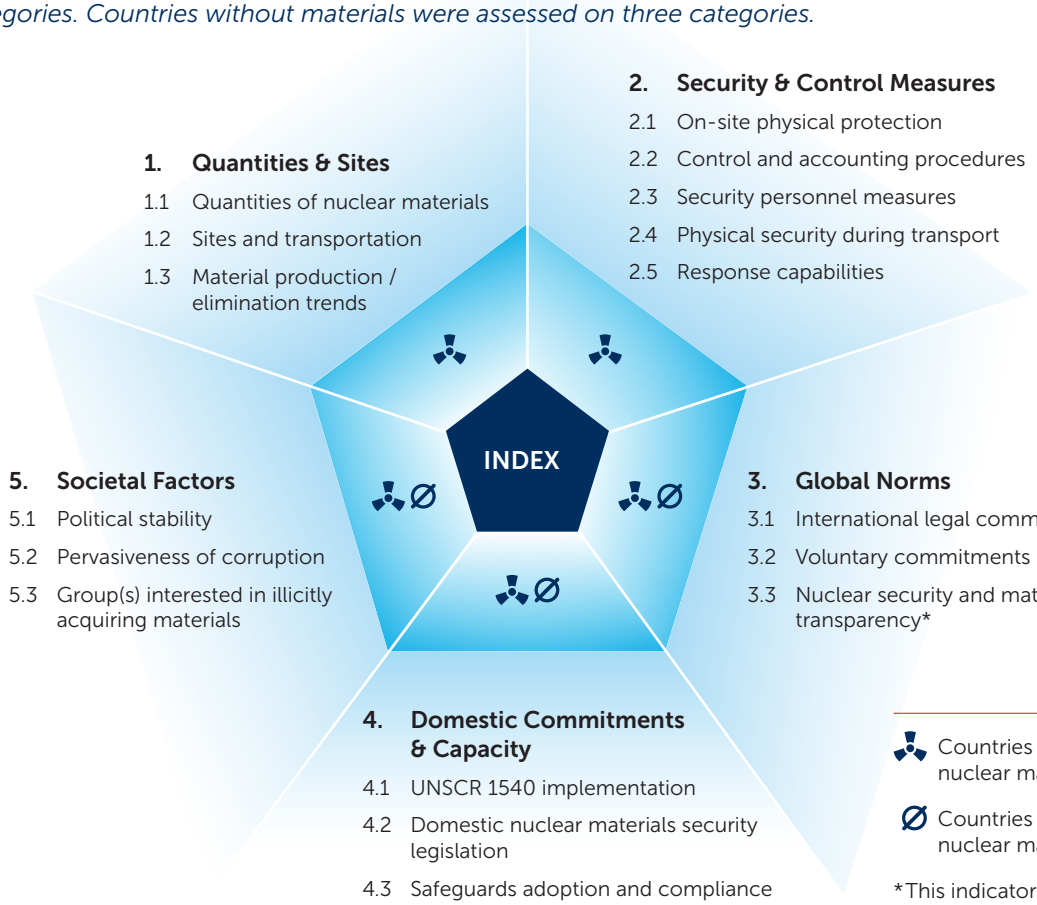
That is why all countries with weapons-usable nuclear materials have a responsibility to account for them, to take steps to secure them, and to provide continued assurances to the rest of the world that those materials are not at risk for theft or diversion. As long as weapons-usable nuclear materials exist on this planet, securing them will require constant vigilance.

There has been progress on mitigating the threat over the past two decades, including at the innovative and groundbreaking 2010 Nuclear Security Summit, at which leaders from 47 states gathered in Washington, D.C., and committed

[2] This inaugural NTI Index has greatly benefited from the rich analytic work provided by Matthew Bunn in his *Securing the Bomb* series, funded by NTI. The work of the International Panel on Fissile Materials has also been an indispensable resource.

HOW THE NTI INDEX MEASURES NUCLEAR SECURITY CONDITIONS

The NTI Index assessed countries with weapons-usable nuclear materials based on five categories. Countries without materials were assessed on three categories.



Note: For information about data sources used for scoring, see the EIU methodology, pp. 64–79.

to take new steps to strengthen nuclear materials security. Important political momentum was built at the summit, and a second summit is now planned for March 2012 in Seoul, South Korea.

Although a valuable foundation for international dialogue on nuclear materials security was laid at the 2010 Nuclear Security Summit, states have yet to reach a consensus on what steps matter most when it comes to securing vulnerable weapons-usable nuclear materials. Today, there is no common international system for regulating how weapons-usable nuclear materials are produced, tracked, protected, and controlled, and there is no way to measure the actions states are taking to build assurance and accountability around nuclear materials security. There is also no global institution or authority with the mandate to help create and monitor such a comprehensive security system.

Although the NTI Index scores and ranks countries, it is not meant to serve merely as a rating system. It highlights how all countries can do more to improve security, and it should be used as a resource and a tool that provides a foundation for setting priorities. It also offers actionable recommendations for all states and for individual states through 176 country summaries.

UNDERSTANDING TRANSPARENCY

The term transparency is an important concept in international security. It is widely used to describe various forms of openness that enhance public and international confidence and understanding and minimize misperceptions. States must strike a balance, however, between undermining security through too much transparency and undermining international understanding and confidence through excessive secrecy.

- The NTI Index examines transparency measures that would promote international confidence in a state's nuclear materials security conditions without undermining security.
- Specifically, the Index considers whether a state has publicly released the broad outlines of its security arrangements, has made any public declaration regarding its quantities of nuclear materials, and has requested an international review of its security arrangements.
- NTI believes these are important steps to promote greater international confidence in the nuclear materials security conditions of all states.
- The NTI Index does not consider transparency related to specific procedures for protecting nuclear materials (e.g., the physical security arrangements) as this information could compromise on-the-ground security.

To develop the Index, NTI and the Economist Intelligence Unit (EIU) worked with an international panel of experts and other technical advisors to develop a broad framework for nuclear materials security. The NTI Index includes five categories comprising 18 indicators to assess the nuclear materials security conditions in 176 countries (32 with one kilogram or more of weapons-usable nuclear materials and 144 with less than one kilogram or no weapons-usable nuclear materials). Countries without weapons-usable nuclear materials are included in the Index because they too have a responsibility not to become safe havens, staging grounds, or transit points for illicit nuclear activities. For the purposes of this Index, the term *weapons-usable nuclear materials* includes highly enriched uranium (HEU), separated plutonium, and the plutonium content in fresh mixed oxide fuel.[3] The Index does not assess security for low-enriched uranium or the radiological materials needed to build a "dirty bomb," although many of the improvements proposed in this report also could help prevent such an attack.

The five key factors the Index evaluated are the following:

1. **Quantities & Sites.** How much material does the state have and at how many locations?
2. **Security & Control Measures.** What kind of requirements for protection measures are in place?
3. **Global Norms.** What international commitments related to materials security has the state made?
4. **Domestic Commitments & Capacity.** What is the domestic capacity of the state to fulfill those international commitments?
5. **Societal Factors.** Could a given country's societal factors—such as corruption or government instability—undermine its security commitments and practices?

These categories are explained in more depth in the section of this report titled "Developing the Index," as well as in the EIU methodology appendix.

[3] These are the materials considered to be weapons-usable for International Atomic Energy Agency safeguards purposes.

Countries with weapons-usable nuclear materials were evaluated across all five categories. Countries without weapons-usable nuclear materials were evaluated across the last three. An international panel of experts convened by NTI and EIU assigned weights to the categories and indicators to reflect the relative importance of these measures.

NTI offered briefings to all 32 countries with weapons-usable nuclear materials (as well as South Korea, as host of the 2012 Nuclear Security Summit) and asked them to review and, if necessary, correct data drawn primarily from public and open-source information. More than half the countries engaged in the process by reviewing and validating the data in the Index as part of a process that resulted in important confirmations and corrections.

FINDINGS

Findings developed through the process of creating the NTI Index include the following:

- **Governments are becoming more aware of the threat** posed by vulnerable weapons-usable nuclear materials and the urgent need to strengthen security.
- **There is no global consensus about what steps matter most** to achieve security and no agreed international system or globally accepted practices for regulating the production of, use of, and security requirements for weapons-usable nuclear materials.
- **A deliberate lack of transparency makes it impossible to hold states accountable** for their security responsibilities. Many details around site security are—and should be—protected. But other information, such as general approaches to providing security and broad descriptions of security regulations for nuclear facilities and materials holdings, could be made public.
- **Australia ranks first among states with weapons-usable nuclear materials** because it has reduced holdings to a small amount of materials and does well across all other categories.
- **The United Kingdom is the leader among nuclear-armed states,** with high scores on Security and Control Measures as well as on its commitment to and follow-through on international obligations. Like most nuclear-armed states, its score is lowered because of its large inventory of weapons-usable materials held at numerous sites, both for military and civilian programs. All nuclear-armed states can and must do more.
- **Nearly a quarter of the states with weapons-usable nuclear materials scored poorly on Societal Factors** because of very high levels of corruption. Of those countries, several also scored poorly on the prospect of political instability over the next two years. The combination of those factors significantly increases the risk that nuclear materials might be stolen, with help from corrupt insiders or in the midst of government distraction or political chaos.
- **Stocks of weapons-usable materials continue to increase in a few countries,** making global security a difficult and moving target.
- **More states with weapons-usable materials could join the 19 countries plus Taiwan that already have completely eliminated their weapons-usable nuclear materials.** A number of countries have only small amounts of materials at one or two sites, which might be converted to non-weapons-usable fuels or shut down.
- **Many states lag on joining international agreements** aimed at tighter security; many that do join fail to implement their commitments.

TAKING ACTION

Ensuring the security of all weapons-usable nuclear materials is a huge challenge—but it is not impossible. Because no single state can address this threat alone, all states have a responsibility to work both individually and cooperatively to reduce the threat. The necessary tools, technology, and know-how exist. At the South Korean Nuclear Security Summit in March 2012, leaders should seize the opportunity to improve stewardship of the world's most dangerous materials.

Among NTI's recommendations for the global community are the following:

- **Establish an international dialogue on priorities for materials security** through the Nuclear Security Summit in South Korea or a subsequent process. This dialogue should also address how to build the capacity to help establish and monitor a nuclear materials security and management system and to strengthen the mandate and resources of the International Atomic Energy Agency (IAEA) to enable it to play a much stronger role in such a system.
- **Benchmark progress and hold states accountable for security** to build the assurance needed for international confidence in nuclear materials security.
- **Build appropriate transparency to increase international confidence.** To do so, governments should do the following:
  - → **Publish and provide access to nuclear materials security regulations.**
  - → **Declare nuclear materials inventories** as part of a system of inventory declarations, verification, and tracking that can serve as the basis for continued nuclear materials reductions.
  - → **Invite regular peer reviews.**
- **Stop increasing stocks of weapons-usable materials.**
- **Eliminate weapons-usable nuclear materials completely in as many states as possible.** Currently 14 of the 32 states with weapons-usable materials have less than 100 kilograms, and many may be good candidates to eliminate their stocks over the next few years.
- **Strengthen security and control measures,** including physical protection, control and accounting, and personnel measures at facilities and during transport of nuclear materials. Today there is no agreed global baseline defining what minimum security and control measures should be put in place at all sites with HEU and plutonium. All sites with these materials should be protected to a defined minimum level. States also should routinely test their security arrangements, particularly if there are challenging societal factors that could undermine security.
- **Bring all civil uranium enrichment and reprocessing facilities under IAEA safeguards.**
- **Target assistance** to states with urgent needs.
- **Ratify and implement negotiated treaties** (the International Convention on the Suppression of Acts of Nuclear Terrorism and the Convention on the Physical Protection of Nuclear Material, as well as its 2005 Amendment).

Progress has been made, but the threat is dynamic. The good news is that there are steps all states can take, including those that scored poorly in the Index, to improve security and provide greater assurances to their neighbors and to the international community that their materials are not at risk and that their territory cannot be used for illicit activities that endanger us all.

NTI urges countries to continue to engage in this Index project, which will be updated periodically, and invites feedback to ensure that future editions of the NTI Index provide the most public, useful, accurate, and up-to-date assessment of nuclear materials security conditions around the globe.

MAP AND RESULTS TABLES

The following pages contain a map showing the countries that were included in the NTI Nuclear Materials Security Index and two sets of results tables for countries with and without weapons-usable nuclear materials. The tables provide country rankings and scores, overall and by each category.

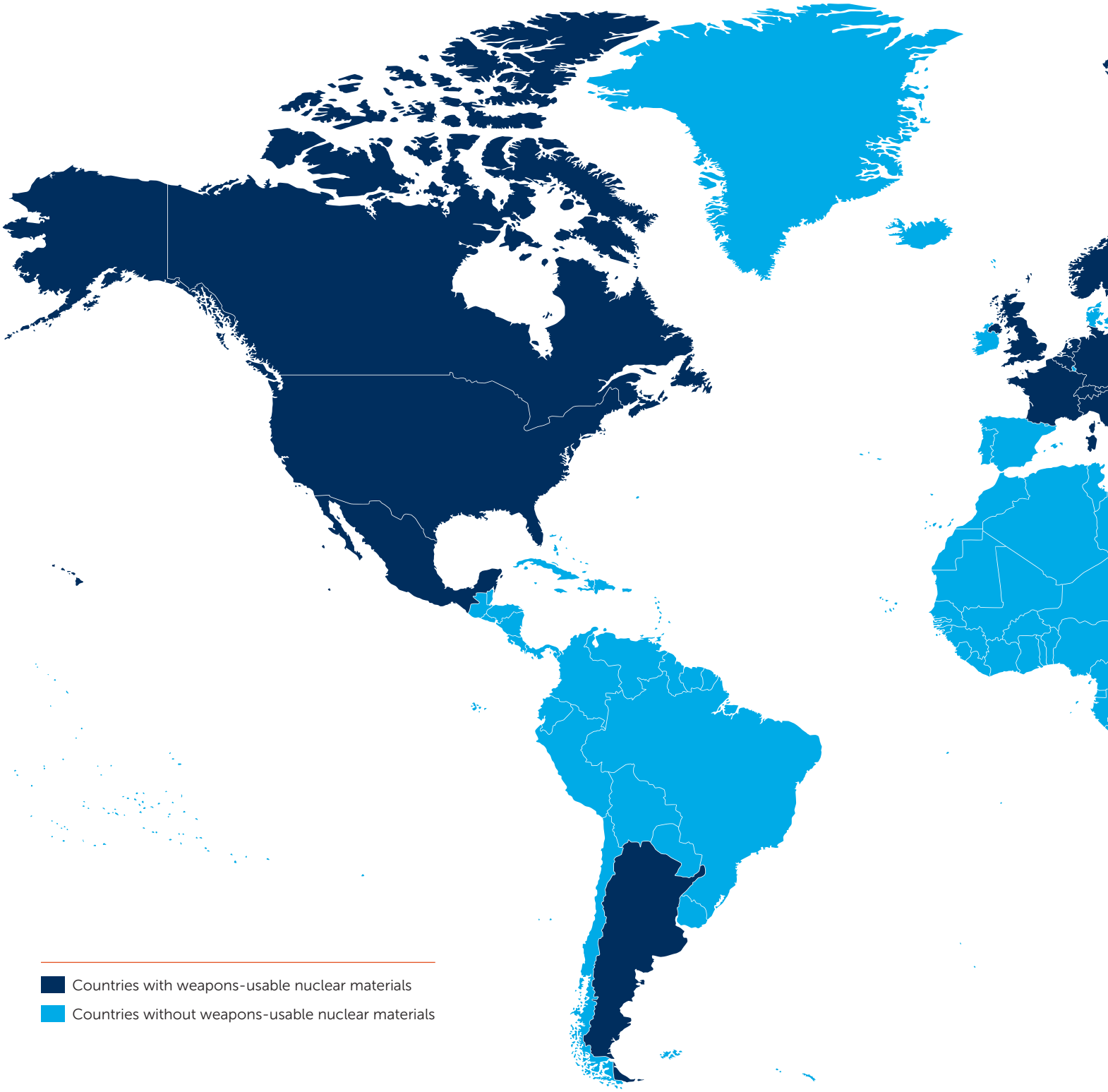
Overall scores are calculated using a weighted average of category and indicator scores. A full discussion of categories, indicators, and their weighting is included in the EIU methodology appendix.

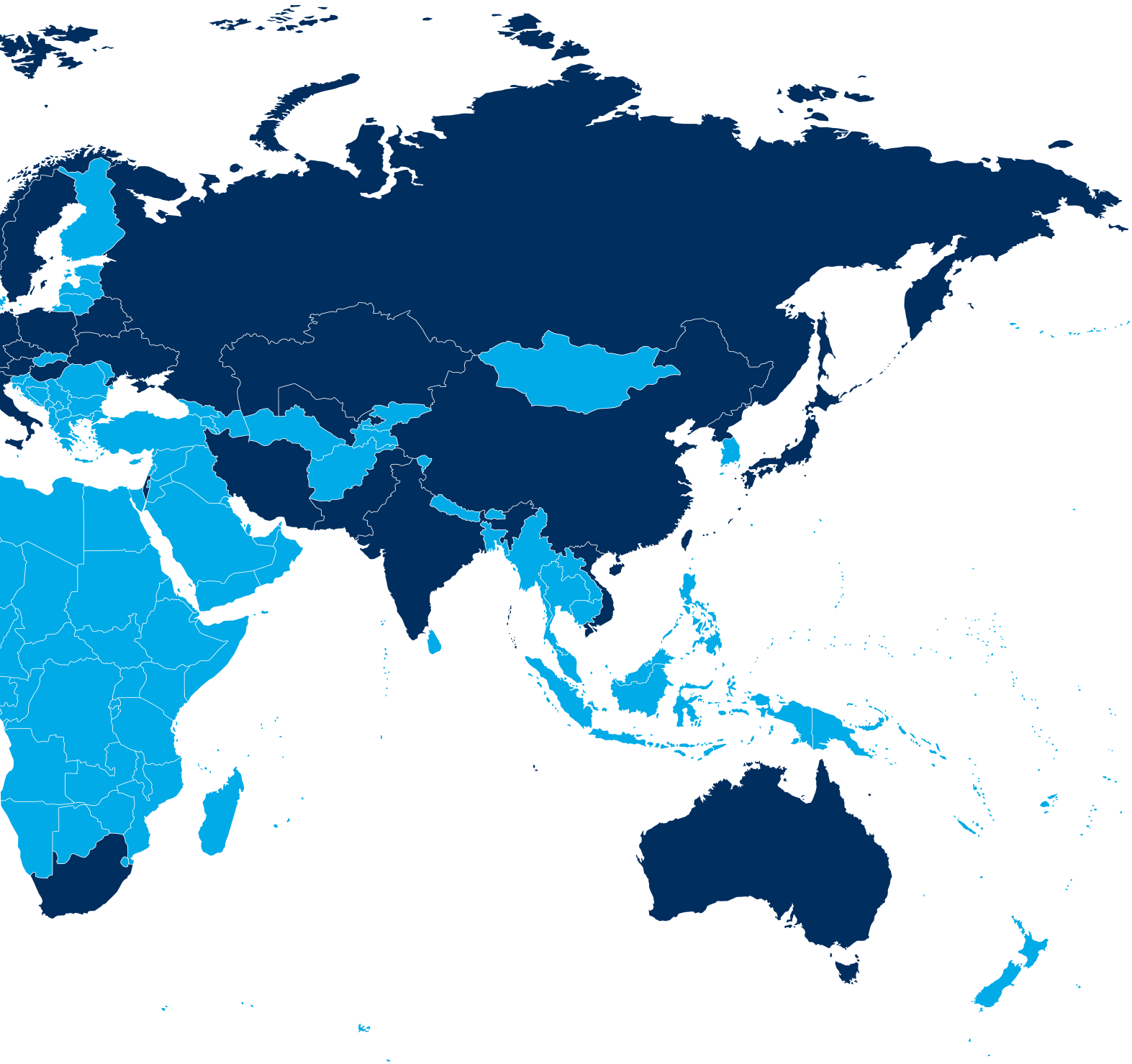
Country rankings preceded by an "=" sign indicate a tie with other countries.

Overall and category scores are scored 0–100 where 100 equals the most favorable nuclear materials security conditions.

The number of countries without weapons-usable nuclear materials included in the NTI Index was determined by the scope of EIU's Risk Briefing service.

COUNTRIES INCLUDED IN THE NTI INDEX





SUMMARY RESULTS: COUNTRIES WITH WEAPONS-USABLE NUCLEAR MATERIALS

OVERALL SCORE		
1	Australia	94
2	Hungary	89
3	Czech Republic	87
4	Switzerland	86
5	Austria	85
6	Netherlands	84
7	Sweden	83
=8	Norway	82
=8	Poland	82
=10	Canada	79
=10	Germany	79
=10	United Kingdom	79
=13	Belgium	78
=13	United States	78
15	Ukraine	76
=16	Argentina	74
=16	Belarus	74
=16	Italy	74
=19	France	73
=19	Mexico	73
=19	South Africa	73
22	Kazakhstan	71
23	Japan	68
24	Russia	65
25	Israel	56
26	Uzbekistan	55
27	China	52
28	India	49
29	Vietnam	48
30	Iran	46
31	Pakistan	41
32	North Korea	37

1) QUANTITIES & SITES		
=1	Argentina	96
=1	Australia	96
=1	Vietnam	96
=4	Hungary	93
=4	Poland	93
6	Uzbekistan	92
7	Sweden	89
=8	Belarus	88
=8	Czech Republic	88
=10	Austria	85
=10	Iran	85
=10	Mexico	85
13	Norway	81
14	Ukraine	80
15	Italy	73
16	South Africa	72
17	Netherlands	69
=18	Germany	68
=18	Kazakhstan	68
20	Switzerland	66
21	Canada	65
22	North Korea	51
23	Belgium	50
24	Israel	35
25	France	34
26	China	27
27	Japan	23
=28	Russia	22
=28	United States	22
=30	India	20
=30	Pakistan	20
32	United Kingdom	12

2) SECURITY & CONTROL MEASURES		
=1	Australia	100
=1	Hungary	100
=1	United Kingdom	100
=1	United States	100
5	Austria	91
=6	Czech Republic	88
=6	Switzerland	88
=8	Belgium	85
=8	Russia	85
10	Italy	83
=11	Canada	81
=11	Netherlands	81
=13	France	79
=13	Kazakhstan	79
=15	Belarus	78
=15	Israel	78
=17	Poland	76
=17	Ukraine	76
19	Germany	75
20	Norway	71
21	South Africa	70
22	Argentina	69
23	Mexico	68
24	Sweden	65
=25	India	60
=25	Japan	60
27	China	58
28	North Korea	55
29	Iran	54
30	Pakistan	50
31	Vietnam	36
32	Uzbekistan	34

COUNTRIES WITH WEAPONS-USABLE NUCLEAR MATERIALS *(continued)*

3) GLOBAL NORMS

1	United Kingdom	100
2	Switzerland	96
=3	Germany	93
=3	Netherlands	93
=3	Russia	93
6	Australia	92
7	Ukraine	89
=8	Czech Republic	87
=8	Kazakhstan	87
=10	Belgium	85
=10	Japan	85
12	United States	84
=13	Austria	79
=13	Hungary	79
=13	Norway	79
=16	France	77
=16	Sweden	77
18	Poland	76
19	Uzbekistan	75
=20	Argentina	71
=20	Belarus	71
=20	Canada	71
=20	Mexico	71
=20	South Africa	71
25	China	69
26	India	65
27	Italy	64
28	Pakistan	52
29	Israel	40
30	Vietnam	39
31	Iran	31
32	North Korea	7

4) DOMESTIC COMMITMENTS & CAPACITY

=1	Australia	100
=1	Austria	100
=1	Belgium	100
=1	Czech Republic	100
=1	Germany	100
=1	Italy	100
=1	Netherlands	100
=1	Norway	100
=1	Poland	100
=1	South Africa	100
=1	Switzerland	100
=1	Ukraine	100
=13	France	97
=13	United Kingdom	97
=15	Canada	96
=15	Hungary	96
=15	Kazakhstan	96
=15	Mexico	96
=15	Sweden	96
=20	Argentina	93
=20	Belarus	93
=20	United States	93
23	Russia	91
24	Pakistan	88
25	Uzbekistan	87
26	China	82
27	Japan	79
28	Israel	63
29	India	50
30	Iran	37
31	Vietnam	22
32	North Korea	3

5) SOCIETAL FACTORS

1	Sweden	98
2	Japan	89
3	Norway	86
4	Switzerland	83
=5	Australia	81
=5	Canada	81
7	Netherlands	79
8	Czech Republic	76
9	Poland	75
10	Hungary	73
=11	Austria	72
=11	United States	72
=13	France	70
=13	Germany	70
=15	Belgium	68
=15	United Kingdom	68
17	South Africa	59
18	Vietnam	58
19	Mexico	56
20	Argentina	55
21	Italy	52
22	Belarus	51
23	Ukraine	47
=24	Israel	45
=24	North Korea	45
26	India	43
27	Kazakhstan	34
28	Russia	30
29	China	28
=30	Iran	25
=30	Uzbekistan	25
32	Pakistan	5

SUMMARY RESULTS: COUNTRIES WITHOUT WEAPONS-USABLE NUCLEAR MATERIALS

Ø OVERALL SCORE			3) GLOBAL NORMS			4) DOMESTIC COMMITMENTS & CAPACITY			5) SOCIETAL FACTORS		
1	Denmark	100	=1	Denmark	100	=1	Albania	100	=1	Denmark	98
2	Finland	97	=1	Finland	100	=1	Bulgaria	100	=1	Luxembourg	98
3	Spain	96	=1	Romania	100	=1	Denmark	100	3	Barbados	96
4	Slovenia	94	=1	Spain	100	=1	Estonia	100	=4	Iceland	95
=5	Latvia	92	=1	United Arab Emirates	100	=1	Finland	100	=4	New Zealand	95
=5	Lithuania	92	=6	Latvia	93	=1	Latvia	100	6	Finland	87
=5	Romania	92	=6	Lithuania	93	=1	Lithuania	100	=7	Bahamas	85
8	Estonia	88	=6	Slovenia	93	=1	Romania	100	=7	Botswana	85
=9	Slovakia	87	=9	Bahrain	87	=1	Slovakia	100	=7	Costa Rica	85
=9	United Arab Emirates	87	=9	Chile	87	=1	Slovenia	100	10	Singapore	83
11	Bulgaria	85	=9	Croatia	87	=1	South Korea	100	=11	Brunei	82
12	New Zealand	83	=9	Estonia	87	=1	Spain	100	=11	Cape Verde	82
=13	Iceland	82	=9	Jordan	87	=13	Iceland	97	=11	Chile	82
=13	South Korea	82	=9	Libya	87	=13	Serbia	97	=11	Cyprus	82
15	Croatia	81	=9	Saudi Arabia	87	=15	Armenia	95	=11	Slovenia	82
16	Armenia	80	=9	Turkmenistan	87	=15	Peru	95	=11	Uruguay	82
=17	Luxembourg	78	=17	Armenia	80	=15	Turkey	95	17	Qatar	81
=17	Serbia	78	=17	Bulgaria	80	=18	Bosnia and Herzegovina	91	18	Malta	80
19	Portugal	77	=17	Georgia	80	=18	Guatemala	91	=19	Ireland	78
20	Malta	76	=17	Kenya	80	=18	Nicaragua	91	=19	Spain	78
=21	Bosnia and Herzegovina	75	=17	Moldova	80	=21	Algeria	89	=21	Bhutan	76
=21	Cyprus	75	=17	Panama	80	=21	Uruguay	89	=21	Portugal	76
=21	Jordan	75	=17	Portugal	80	=23	New Zealand	88	=21	Seychelles	76
=21	Macedonia	75	=17	Slovakia	80	=23	United Arab Emirates	88	=21	Slovakia	76
=25	Chile	74	=17	Tunisia	80	=25	Macedonia	86	=25	Cuba	75
=25	Ireland	74	=26	Algeria	73	=25	Tajikistan	86	=25	Mauritius	75
=25	Mongolia	74	=26	Azerbaijan	73	=27	Ghana	84	=25	Samoa	75
=28	Algeria	73	=26	Bosnia and Herzegovina	73	=27	Indonesia	84	=25	Taiwan	75
=28	Peru	73	=26	Cyprus	73	=27	Malta	84	=29	Latvia	71
30	Albania	72	=26	Fiji	73	=27	Morocco	84	=29	Lithuania	71
=31	Morocco	71	=26	Gabon	73	=31	Jordan	83	=29	Namibia	71
=31	Uruguay	71	=26	Greece	73	=31	Mongolia	83	=32	Croatia	69
=33	Greece	70	=26	Ireland	73	=33	Croatia	81	=32	Estonia	69
=33	Turkey	70	=26	Luxembourg	73	=33	Tanzania	81	=32	Ghana	69
35	Nicaragua	69	=26	Macedonia	73	=33	Uganda	81	35	Belize	67
=36	Cuba	68	=26	Mali	73	=36	Botswana	79	=36	Lesotho	65
=36	Georgia	68	=26	Mauritania	73	=36	Nigeria	79	=36	Rwanda	65
38	Qatar	67	=26	Mongolia	73	38	Rwanda	77	=38	Brazil	64
=39	Ghana	66	=26	Morocco	73	=39	Qatar	74	=38	Bulgaria	64
=39	Guatemala	66	=26	New Zealand	73	=39	Suriname	74	=38	El Salvador	64
41	Brazil	65	=26	Niger	73	=41	Cuba	73	=38	Tonga	64
42	Seychelles	64	=26	Serbia	73	=41	Cyprus	73	=42	South Korea	62
43	Tajikistan	63	=26	South Korea	73	=41	Greece	73	=42	Trinidad and Tobago	62
=44	Botswana	62	=44	Bangladesh	67	=41	Ireland	73	=44	Mongolia	60
=44	Mali	62	=44	Cambodia	67	=41	Luxembourg	73	=44	Romania	60
=46	Kenya	61	=44	Dominican Republic	67	=41	Portugal	73	=44	Suriname	60
=46	Moldova	61	=44	El Salvador	67	=41	Taiwan	73	=44	Vanuatu	60
=46	Niger	61	=44	Lebanon	67	48	Brazil	70	=44	Zambia	60

COUNTRIES WITHOUT WEAPONS-USABLE NUCLEAR MATERIALS *(continued)*

Ø OVERALL SCORE			3) GLOBAL NORMS			4) DOMESTIC COMMITMENTS & CAPACITY			5) SOCIETAL FACTORS		
=49	Azerbaijan	60	=44	Malta	67	=49	Congo (DRC)	68	=49	Gabon	58
=49	Bahrain	60	=44	Paraguay	67	=49	Georgia	68	=49	Greece	58
=49	Montenegro	60	=44	Philippines	67	51	Azerbaijan	65	=49	Malawi	58
=49	Rwanda	60	=44	Seychelles	67	52	Bangladesh	63	=49	Mozambique	58
=49	Tunisia	60	=53	Afghanistan	60	53	Montenegro	61	=49	Sri Lanka	58
=54	Gabon	59	=53	Albania	60	=54	Chile	57	54	United Arab Emirates	57
=54	Indonesia	59	=53	Brazil	60	=54	Jamaica	57	=55	Gambia	56
=56	Congo (DRC)	58	=53	Central African Republic	60	=54	Niger	57	=55	Kuwait	56
=56	Costa Rica	58	=53	Colombia	60	=54	Philippines	57	=55	Mali	56
=56	Paraguay	58	=53	Congo (DRC)	60	58	Costa Rica	56	=55	Montenegro	56
=59	Bangladesh	57	=53	Cuba	60	=59	Burkina Faso	54	=55	Panama	56
=59	Nigeria	57	=53	Iceland	60	=59	Ecuador	54	=55	Swaziland	56
=59	Turkmenistan	57	=53	Lesotho	60	=59	Mali	54	=61	Guatemala	55
62	Panama	56	=53	Montenegro	60	=59	Seychelles	54	=61	Guyana	55
=63	Jamaica	55	=53	Nicaragua	60	=59	Tunisia	54	=61	Jamaica	55
=63	Philippines	55	=53	Peru	60	64	Namibia	53	=61	Liberia	55
=63	Taiwan	55	=53	Tajikistan	60	=65	Afghanistan	51	=61	Macedonia	55
66	Tanzania	54	=53	Turkey	60	=65	Kenya	51	=61	Oman	55
=67	Lebanon	53	=67	Comoros	53	=65	Lebanon	51	=61	Paraguay	55
=67	Uganda	53	=67	Djibouti	53	=65	Moldova	51	=61	Peru	55
=69	El Salvador	51	=67	Guinea-Bissau	53	=65	Paraguay	51	69	Djibouti	53
=69	Fiji	51	=67	Jamaica	53	=65	Senegal	51	=70	Benin	51
=71	Burkina Faso	50	=67	Kuwait	53	71	Cameroon	47	=70	Bolivia	51
=71	Dominican Republic	50	=67	Kyrgyz Republic	53	72	Gabon	45	=70	Burkina Faso	51
=71	Libya	50	=67	Madagascar	53	73	Singapore	43	=70	Burundi	51
=71	Singapore	50	=67	Qatar	53	74	Bahrain	42	=70	Madagascar	51
=75	Colombia	49	=67	Sri Lanka	53	75	Colombia	41	=70	São Tomé and Príncipe	51
=75	Ecuador	49	=76	Burkina Faso	47	76	Mozambique	40	=70	Senegal	51
=75	Namibia	49	=76	Costa Rica	47	77	Cape Verde	39	=70	Serbia	51
=75	Senegal	49	=76	Ecuador	47	78	Venezuela	38	=78	Armenia	49
79	Saudi Arabia	48	=76	Ghana	47	79	Turkmenistan	36	=78	Dominican Republic	49
=80	Mozambique	46	=76	Guatemala	47	=80	Dominican Republic	33	=78	Laos	49
=80	Sri Lanka	46	=76	Honduras	47	=80	Panama	33	=78	Zimbabwe	49
=82	Afghanistan	45	=76	Indonesia	47	=80	Sri Lanka	33	82	Malaysia	48
=82	Cape Verde	45	=76	Mozambique	47	83	Libya	31	=83	Angola	47
84	Lesotho	44	=76	Nigeria	47	=84	El Salvador	29	=83	Bosnia and Herzegovina	47
85	Cambodia	43	=76	Oman	47	=84	Fiji	29	=83	Cameroon	47
=86	Cameroon	42	=76	Senegal	47	=86	Egypt	27	=83	Fiji	47
=86	Madagascar	42	=76	Uruguay	47	=86	Iraq	27	=83	Thailand	47
=86	Mauritania	42	=88	Bahamas	40	=86	Madagascar	27	=88	Bahrain	45
=86	Suriname	42	=88	Guinea	40	=86	Malaysia	27	=88	Eritrea	45
90	Bahamas	41	=88	Guyana	40	=86	Mauritius	27	=88	Ethiopia	45
=91	Central African Republic	40	=88	Rwanda	40	=86	Thailand	27	=88	Georgia	45
=91	Kuwait	40	=88	Singapore	40	=92	Bolivia	26	=88	Honduras	45
=91	Kyrgyz Republic	40	=88	Swaziland	40	=92	Kyrgyz Republic	26	=88	Nepal	45
94	Oman	38	=88	Togo	40	=92	Tonga	26	=88	Togo	45
=95	Comoros	37	=88	Yemen	40	=92	Trinidad and Tobago	26	=95	Central African Republic	44
=95	Djibouti	37	=96	Bolivia	33	96	Honduras	24	=95	Côte d'Ivoire	44

COUNTRIES WITHOUT WEAPONS-USABLE NUCLEAR MATERIALS *(continued)*

Ø OVERALL SCORE			3) GLOBAL NORMS			4) DOMESTIC COMMITMENTS & CAPACITY			5) SOCIETAL FACTORS		
=95	Honduras	37	=96	Botswana	33	97	Vanuatu	23	=95	Ecuador	44
=95	Mauritius	37	=96	Burundi	33	98	Côte d'Ivoire	22	=95	Equatorial Guinea	44
=99	Bolivia	34	=96	Cameroon	33	=99	Barbados	21	=95	Kenya	44
=99	Swaziland	34	=96	Cape Verde	33	=99	Belize	21	=95	Moldova	44
=99	Thailand	34	=96	Malawi	33	=99	Bhutan	21	=95	Nicaragua	44
=99	Tonga	34	=96	Namibia	33	=99	Brunei	21	=95	Sierra Leone	44
=103	Guyana	33	=96	Sudan	33	=99	Cambodia	21	=95	Solomon Islands	44
=103	Trinidad and Tobago	33	=96	Tanzania	33	=99	Ethiopia	21	=95	Timor-Leste	44
=105	Malawi	32	=96	Thailand	33	=99	Laos	21	=105	Colombia	43
=105	Togo	32	=96	Uganda	33	=99	Myanmar	21	=105	Niger	43
=107	Guinea-Bissau	31	=107	Equatorial Guinea	27	=99	Nepal	21	=105	Tanzania	43
=107	Malaysia	31	=107	Laos	27	=99	Oman	21	=108	Chad	42
=109	Burundi	29	=107	Liberia	27	=99	Papua New Guinea	21	=108	Comoros	42
=109	Laos	29	=107	Malaysia	27	=99	Samoa	21	=108	Congo (Brazzaville)	42
=111	Barbados	28	=107	Mauritius	27	=99	Sierra Leone	21	=108	Kyrgyz Republic	42
=111	Solomon Islands	28	=107	Solomon Islands	27	=99	Solomon Islands	21	=108	Turkmenistan	42
=113	Belize	27	=107	Taiwan	27	=99	Syria	21	=108	Venezuela	42
=113	Brunei	27	=107	Tonga	27	=114	Angola	19	114	Turkey	41
=115	Egypt	26	=107	Trinidad and Tobago	27	=114	Bahamas	19	=115	Albania	40
=115	Guinea	26	=116	Benin	20	=114	Central African Republic	19	=115	Papua New Guinea	40
=115	Samoa	26	=116	Egypt	20	=114	Comoros	19	=117	Mauritania	39
=115	Venezuela	26	=116	Haiti	20	=114	Gambia	19	=117	Morocco	39
=119	Sierra Leone	25	=116	Sierra Leone	20	=114	Haiti	19	119	Cambodia	38
=119	Yemen	25	=116	Syria	20	=114	Kuwait	19	=120	Algeria	37
=121	Bhutan	24	=121	Angola	13	=121	Lesotho	17	=120	Jordan	37
=121	Liberia	24	=121	Belize	13	=121	Malawi	17	=120	Saudi Arabia	37
=121	Vanuatu	24	=121	Côte d'Ivoire	13	=121	Swaziland	17	=120	Uganda	37
=124	Benin	23	=121	Iraq	13	=121	Togo	17	=124	Guinea-Bissau	36
=124	Côte d'Ivoire	23	=121	Nepal	13	=125	Guyana	15	=124	Haiti	36
=124	Haiti	23	=121	São Tomé and Príncipe	13	=125	Saudi Arabia	15	=126	Guinea	35
=124	Nepal	23	=121	Timor-Leste	13	=125	Sudan	15	=126	Indonesia	35
=124	Sudan	23	=121	Zambia	13	=125	Yemen	15	=126	Myanmar	35
=124	Zambia	23	=129	Brunei	7	=125	Zambia	15	129	Egypt	34
=130	Angola	22	=129	Chad	7	=130	Burundi	13	=130	Congo (DRC)	33
=130	Equatorial Guinea	22	=129	Congo (Brazzaville)	7	=130	Chad	13	=130	Nigeria	33
132	Syria	21	=129	Eritrea	7	=130	Mauritania	13	132	Tunisia	32
133	Ethiopia	20	=129	Ethiopia	7	=133	Benin	12	133	Lebanon	30
=134	Gambia	19	=129	Myanmar	7	=133	Djibouti	12	134	Bangladesh	28
=134	Iraq	19	=129	Papua New Guinea	7	=133	Eritrea	12	=135	Azerbaijan	25
=134	Papua New Guinea	19	=129	Samoa	7	=133	Timor-Leste	12	=135	Philippines	25
=134	Timor-Leste	19	=129	Vanuatu	7	137	Zimbabwe	10	=135	Tajikistan	25
=138	Myanmar	18	=129	Venezuela	7	=138	Congo (Brazzaville)	7	138	Syria	23
=138	São Tomé and Príncipe	18	=129	Zimbabwe	7	=138	Equatorial Guinea	7	139	Sudan	17
=140	Chad	16	=140	Barbados	0	=138	Guinea	7	140	Iraq	15
=140	Eritrea	16	=140	Bhutan	0	=138	Guinea-Bissau	7	=141	Libya	14
=140	Zimbabwe	16	=140	Gambia	0	=138	Liberia	7	=141	Somalia	14
143	Congo (Brazzaville)	14	=140	Somalia	0	=138	São Tomé and Príncipe	7	=141	Yemen	14
144	Somalia	5	=140	Suriname	0	=138	Somalia	7	144	Afghanistan	4

DEVELOPING THE INDEX

THE THREAT

The key ingredients needed to make a nuclear weapon—highly enriched uranium (HEU) or separated plutonium—are stored today in "hundreds of buildings and bunkers in dozens of countries" around the globe.[4] Given the availability of the materials and terrorist organizations' publicly stated desire to acquire and use nuclear weapons, the path to a terrorist bomb is not hard to imagine.[5] A team of terrorists could overwhelm the guards at an understaffed nuclear materials facility or attack a convoy moving materials from one place to another. A terrorist or criminal network also could take a more subtle approach, radicalizing or corrupting insiders who have access to and could secretly provide the materials needed to build an improvised weapon that could destroy the heart of a city.[6]

The consequences of such a catastrophe would reverberate around the globe, with tens or hundreds of thousands of casualties, disruptions to markets and commerce, long-term implications for public health and the environment, and risks to civil liberties—not to mention the staggering cost of any response.

Heightening the prospect for this dire scenario, "a large percentage of the materials reported as lost or stolen are never recovered," and, perhaps worse, "a large percentage of materials which are recovered have not been previously reported as missing."[7] That is why all countries with weapons-usable nuclear materials have a responsibility to account for them, to take steps to secure them, and to provide continued assurances to the rest of the world that such materials are not at risk for theft or diversion. As long as weapons-usable nuclear materials exist on this planet, securing them will require constant vigilance.

Countries without weapons-usable nuclear materials also have a responsibility: they must ensure that their territory does not become a safe haven, staging ground, or transit point for illicit nuclear activities. All citizens and all countries should demand greater clarity about how governments are fulfilling their responsibility to the rest of the world.

> "A large percentage of the materials reported as lost or stolen are never recovered.... A large percentage of materials which are recovered have not been previously reported as missing."
>
> *Mohamed ElBaradei*

[4] Matthew Bunn, *Securing the Bomb 2010* (Cambridge, MA, and Washington, DC: Project on Managing the Atom, Harvard University, and Nuclear Threat Initiative, April 2010).

[5] Rolf Mowatt-Larssen, "Al Qaeda's Religious Justification of Nuclear Terrorism" (working paper, Belfer Center for Science and International Affairs, Harvard Kennedy School, Cambridge, MA, November 12, 2010).

[6] David Albright, Kathryn Buehler, and Holly Higgins, "Bin Laden and the Bomb," *Bulletin of Atomic Scientists* 58, no. 1 (2002): 23–24.

[7] Mohamed ElBaradei, "Reviving Nuclear Disarmament" (statement at the Conference on Achieving the Vision of a World Free of Nuclear Weapons, Oslo, Norway, February 26, 2008).

On all of these fronts, much more needs to be done—and countries must act with a sense of urgency. Despite post–Cold War progress dismantling and securing the weaponry built up over decades; despite political momentum from the 2010 Nuclear Security Summit in Washington, D.C.; and despite recent gains against al Qaeda, the threat posed by terrorist networks and their allies remains very much alive[8] and will continue as long as weapons-usable nuclear materials and terrorists bent on mass destruction exist. Whether these materials are being used in military weapons programs or in civilian programs, they must not be left vulnerable to theft or sale on the black market.

WHY AN INDEX?

As governments look to build on recent progress and to improve global nuclear weapons and materials security, fundamental gaps still remain in their ability to set priorities and to provide for a global system of assurance, accountability, and action.

To begin with, there is no international consensus or common set of practices for how materials should be tracked, controlled, and protected. Also, no official, public, and transparent database of how much material states hold exists. Without these elements in place, it is extremely difficult to track progress, assess risk, and hold states accountable for how well they are securing their materials.

To help states close these fundamental gaps, NTI has undertaken the construction of this Index to provide an initial framework for discussion and decisions about what actions matter most for nuclear materials security and to contribute to international confidence and guidance for policymakers. In cooperation with the Economist Intelligence Unit (EIU) and an independent panel of international experts, NTI identified five key factors that contribute to a state's nuclear materials security conditions:

- How much material does the state have and at how many locations?
- What kind of requirements for protection measures are in place?

DOESN'T THE IAEA OVERSEE ALL NUCLEAR MATERIALS GLOBALLY?

Many people assume there is a comprehensive global system for managing nuclear materials from cradle to grave and that the International Atomic Energy Agency (IAEA) is responsible for administering the system. Although the IAEA, through its safeguards system, has a crucial role in verifying that nuclear materials are not diverted from peaceful use to nuclear weapons, its role in ensuring the security of nuclear materials is limited, by both its mandate and its budget.

The IAEA's principal objective, as established in its founding statute of 1956, is to "accelerate and enlarge the contribution of atomic energy to peace, health, and prosperity throughout the world." The IAEA was also charged with responsibility, among other things, for administering a safeguards system for civilian facilities to detect whether civilian nuclear materials have been diverted for military purposes.

Safeguards, however, are not—nor have they ever been—designed to provide physical security measures for the "safeguarded" facilities. IAEA safeguards inspections are designed for the specific purpose of detecting—after the fact—whether material is missing from a facility or whether nuclear material has not been declared. They also help determine whether the inspected state may have diverted the material to a weapons program. Such inspections do not prevent material from being stolen. In the 2008 "Report of the Commission of Eminent Persons on the Future of the Agency," the commission states, "No program exists in which safeguards inspectors systematically report any security weaknesses they may observe."[1]

In addition, safeguards are not applied at all civilian sites that have weapons-usable nuclear materials, because nuclear-weapon states—where the

[8] Fissile Materials Working Group, "After bin Laden: Nuclear Terrorism Still a Top Threat," *Bulletin of the Atomic Scientists*, May 13, 2011. See www.thebulletin.org/web-edition/columnists/fissile-materials-working-group/after-bin-laden-nuclear-terrorism-still-top-t.

majority of the world's highly enriched uranium and separated plutonium are located—are not subject to IAEA "comprehensive" safeguards (i.e., safeguards applied at all facilities in a state). Nuclear-weapon states have "voluntary offer" safeguards agreements, under which they may designate facilities as being eligible for IAEA safeguards. Although the United States and United Kingdom have designated all civilian facilities, the other nuclear-weapon states have designated only some facilities. Because of resource constraints, however, the IAEA chooses to inspect only a small proportion of the facilities that are eligible for inspection in the nuclear-weapon states. In addition, all UK and French facilities, including plutonium-reprocessing plants, are inspected by the European safeguards authority, Euratom.

Beyond safeguards inspections, the IAEA provides a number of important services to help states strengthen their nuclear security to combat the risk of nuclear terrorism; however, use of these services is strictly voluntary and is not binding, and both states and the IAEA still see nuclear security as primarily a matter of state responsibility. The IAEA develops and disseminates guidelines and procedures for securing nuclear and radiological materials through various publications, advisory services, training courses, seminars, workshops, and conferences.[2] However, these services are primarily funded through extra-budgetary funding (i.e., donations) and are not yet part of the IAEA's regular budget. The overall nuclear security budget of the agency is insufficient to meet the challenge of the global task of materials security.

In sum, although it is the closest thing the world has to a global nuclear watchdog, the IAEA does not have the authority or resources to develop a comprehensive picture of the status of weapons-usable nuclear materials around the world. Given the significant foundation of expertise and experience of the IAEA and consistent with the "Report of the Commission of Eminent Persons on the Future of the Agency," the authority and resources of the agency should be significantly strengthened so that it can play a much more robust role in a future global nuclear materials security system.

All nuclear-armed states must achieve significant additional progress on nuclear disarmament before they will be prepared to subject all weapons-usable materials (including those in nuclear-weapons components and at military sites) to some form of oversight. In the interim, however, these states have much work to do to individually and collectively ensure that every nuclear weapon and every cache of highly enriched uranium or separated plutonium is protected by security measures that can reliably defeat the threat that terrorists and criminals can pose.

As discussed in the recommendations section of this report, several practical steps could be taken in the near term to significantly strengthen the IAEA's role in building global confidence in materials security. Such steps could include bringing all civil uranium enrichment and plutonium-reprocessing facilities under IAEA safeguards (including those in nuclear-armed states) and initiating a regular IAEA peer review system. Collaboration between the IAEA and the recently established World Institute for Nuclear Security on the global security mission, including on how peer reviews are conducted, could also help extend the IAEA's capacity in this important area.

[1] IAEA, "Report of the Commission of Eminent Persons on the Future of the Agency" (report, IAEA, Vienna, Austria, 2008).

[2] For more about these IAEA services, see the appendix to this report titled "Resources for Countries."

- What international commitments related to materials security has the state made?
- What is the domestic capacity of the state to fulfill those international commitments?
- Could a given country's societal factors—such as corruption or government instability—undermine its security commitments and practices?

SCOPE OF THE INDEX

The Index evaluated these five factors in each of 32 states with at least one kilogram of weapons-usable nuclear materials. An additional 144 states with less than one kilogram of or no weapons-usable nuclear materials were evaluated across three of the categories. For the purposes of this project, weapons-usable nuclear materials include HEU, which is uranium enriched to 20 percent or more in the isotope U-235; separated plutonium, which is plutonium separated from irradiated nuclear fuel by reprocessing; and the plutonium content in fresh mixed oxide fuel, which consists of blended uranium and plutonium used to fuel nuclear power plants.[9] The NTI Index does not assess security for low-enriched uranium or the radiological materials needed for a "dirty bomb."

ASSESSING NUCLEAR MATERIALS SECURITY: WHAT MATTERS

A more detailed description of each of the five categories developed to assess nuclear materials security conditions follows:

1. **Quantities & Sites.** This category examines the total amount of weapons-usable nuclear materials and the number of facilities within a state on the premise that the vulnerability and threat increase with higher quantities of materials, more sites where materials are located, and more frequent transport of materials.[10] Over time, actions that decrease quantities of materials and numbers of sites will reduce risks.

2. **Security & Control Measures.** This category assesses five specific measures: physical protection, control and accounting procedures, personnel and security infrastructure, security related to materials in transport, and emergency response. Because detailed information about site security and other physical protection measures are not—and should not be—publicly available, the EIU reviewed a state's legal and regulatory system as an alternative way to assess the state's commitment to these measures. This approach is based on the assumption that if states have stringent legal mechanisms in place, they are more likely to have robust physical security, accounting systems, and personnel reliability measures as well. For some states (Israel, Iran, Pakistan, and North Korea), even this proxy data was not available. In those cases, because the military has a major role in securing such states' weapons-usable nuclear materials stocks,[11] a separate proxy based on estimates of the military's capabilities was used.

3. **Global Norms.** This category examines the extent to which states participate in international legal agreements, take on voluntary commitments to materials security, and provide transparency about inventories and security measures. Two international legal agreements were deemed especially important for assessing a state's commitment to nuclear materials security: (a) the Convention on the Physical Protection of Nuclear Material (CPPNM), along with a 2005 amendment to that convention, and (b) the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT). Participation in voluntary initiatives or financial or other security-related assistance to other countries or international organizations was also assessed. Because appropriate transparency can contribute to international confidence

[9] The materials listed constitute the vast majority of weapons-usable material. The NTI Index does not consider other weapons-usable nuclear materials such as U-233. These other materials are typically present in small quantities in nuclear-armed states with significantly larger quantities of HEU and plutonium and would not affect the index scores.

[10] By grouping countries, the Index accommodates the large variation among states in the quantities of materials (from 1 kilogram to 1,000 tons or more), in the number of sites (from 1 to 100 or more), and in the range of uncertainties in public estimates of states' holdings.

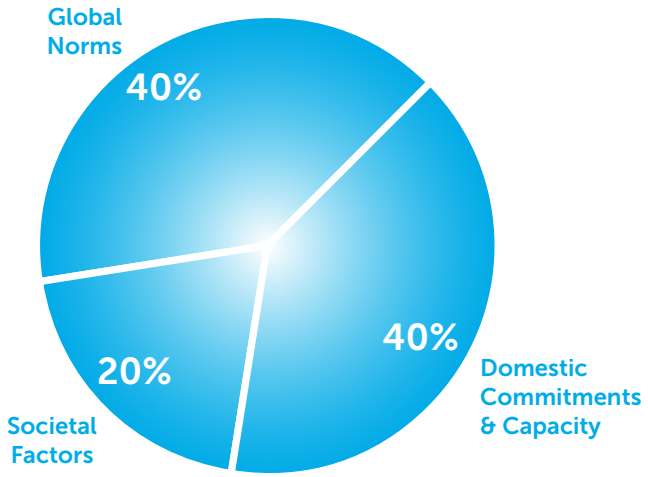
[11] In the case of Israel, the nuclear program is thought to be under the control of the civil defense force.

NTI-EIU PRIORITIES

The charts show the relative weights assigned to categories when assessing countries with weapons-usable nuclear materials and those without. Rounded numbers may not add up to 100.

COUNTRIES WITH WEAPONS-USABLE NUCLEAR MATERIALS

COUNTRIES WITHOUT WEAPONS-USABLE NUCLEAR MATERIALS



in a state's materials security practices, countries with weapons-usable nuclear materials were evaluated for whether they report their quantities of materials, publish broad outlines of materials security arrangements, and invite security reviews.

4. **Domestic Commitments & Capacity.** This category evaluates how well a state discharges international obligations to which it has committed. In particular, it assesses the domestic implementation of United Nations Security Council Resolution 1540 and the CPPNM. It also examines the presence of and adherence to International Atomic Energy Agency (IAEA) safeguards agreements and looks at whether a state has an independent regulatory agency responsible for nuclear security.

5. **Societal Factors.** This category examines underlying conditions that contribute to or detract from the confidence of the international community concerning the risk of nuclear theft within a state. Indicators include levels of corruption, prospects for political instability over the next two years, and the presence of groups interested in and capable of illicitly acquiring nuclear materials.[12] The indicators addressing corruption and political stability are based on the EIU's existing data.

Within the five broad categories, 18 indicators and 51 subindicators were evaluated, some of which were weighted more heavily than others. Countries without

[12] The EIU also worked with terrorism experts to determine the presence and capabilities of groups interested in illicitly acquiring nuclear materials. Although U.S. institutions have developed some very good databases, efforts to collect and report data on these issues should be internationalized. For further details about the sources used by the EIU to research each indicator, see the EIU methodology appendix.

weapons-usable nuclear materials were evaluated across three of the five categories (i.e., Global Norms, Domestic Commitments and Capacity, and Societal Factors). The weights assigned to the categories and indicators for each index are a proxy for the relative importance of each measure as determined with input from the international panel of experts. The weights in the Index are offered as an initial proposal to spark an international dialogue about priorities. Once there is a common agreement among governments on what actions matter most, governments with limited political flexibility and resources can establish priorities. For more about the weighting process and the weights assigned to each category and indicator, see the methodology appendix authored by the EIU.

CREATING THE INDEX

The NTI Nuclear Materials Security Index is the result of a collaboration between NTI and the EIU. The project draws on the nuclear expertise at NTI as well as the EIU's expertise in constructing indices and on the EIU's global network of 900 analysts and contributors in more than 200 countries. The EIU was responsible for developing the Excel model and gathering the data; NTI, working with an international panel of nuclear security experts and a number of technical advisors, focused on the framework and priorities that define effective nuclear materials security conditions. NTI and the EIU coordinated on efforts to validate and confirm government data. Additional information on the creation of the NTI Index and the review process is provided in the EIU methodology appendix.

Four key principles guided the development of the Index. NTI and the EIU determined that the Index must have the following:

1. **A robust analytical framework.** NTI's framework is composed of indicators that measure policies, actions, and other conditions that shape a country's overall nuclear materials security. More details, including the approach for scoring indicators, addressing numerical issues, and weighting, are discussed in EIU's methodology appendix.

2. **An open and inclusive process.** To encourage and engage the participation of the countries covered in the Index, NTI offered briefings to all 32 countries with weapons-usable nuclear materials and to South Korea as the host of the 2012 Nuclear Security Summit. NTI conducted 29 in-person meetings and asked all 32 countries to review and, if necessary, correct the data collected by the EIU. More than half of the countries reviewed and validated data, resulting in important data confirmations and corrections.[13]

3. **An international perspective.** Considering the need for a global dialogue and consensus on priorities for combating the threat posed by vulnerable weapons-usable nuclear materials, NTI and the EIU developed the Index with guidance from technical and policy advisors, as well as an independent international panel of experts. The panel included experts from Australia, Brazil, China, India, Indonesia, Kazakhstan, Russia, Sweden, South Africa, the United Kingdom, and the United States. A representative from the World Institute for Nuclear Security and a former IAEA official also participated in the panel. The experts' role was not to represent their country's interests or to score individual countries, but rather to assist with the selection of indicators and weights given to prioritize each category and its indicators.

4. **Actionable policy prescriptions.** Through the country summaries, the NTI Index identifies areas for improving a country's nuclear materials security. The Index also can be used as a baseline to ensure that commitments made at the next Nuclear Security Summit have as much impact as possible.

[13] For a list of the countries that participated in the data validation process, see the EIU methodology appendix.

THE INTERNATIONAL PANEL OF EXPERTS

In developing the NTI Index, both the EIU and NTI recognized the need for a global dialogue and consensus on priorities for combating the threat posed by vulnerable weapons-usable nuclear materials. The EIU and NTI convened highly respected nuclear materials security experts from nuclear- and non-nuclear-weapon states, from countries with and without materials, and from developed and developing nations. Throughout the process, this expert panel has ensured that the NTI Index has an international point of view.

The panel included people from Australia, Brazil, China, India, Indonesia, Kazakhstan, Russia, Sweden, South Africa, the United Kingdom, and the United States. A representative from the World Institute for Nuclear Security and a former IAEA official also participated. They assisted with the selection of indicators and weights given to prioritize each category and its indicators. The role of the experts was not to represent their country's interests or score individual countries, nor was it to contribute information to help evaluate individual countries.

The list of panel members is included in the appendix.

Participation on the panel does not imply endorsement of every aspect of the NTI Index or its findings and recommendations.

EVOLVING THE INDEX

NTI recognizes that there are certain constraints imposed on an index that draws primarily from public and open-source information. Governments can build greater international confidence in the security conditions of their nuclear materials by being more transparent about their practices. As governments take important steps to strengthen security and to provide more clarity in coming years, the NTI Index will adapt and evolve.

NTI also urges countries to continue to engage in this assessment and invites feedback to ensure that future editions of the Index provide the most useful, accurate, and up-to-date assessment of nuclear materials security around the globe. A public, transparent accounting of the global inventory of weapons-usable nuclear materials and the broad security environment around these materials is the best way to foster public confidence that the urgent steps are being taken in the race to prevent catastrophe.

Finally, NTI hopes that governments will use the results of this assessment to inform themselves about steps they can take to strengthen the security of their weapons-usable nuclear materials and to reduce or eliminate these materials. NTI also hopes the Index will inform the dialogue and the action agenda at the upcoming 2012 Nuclear Security Summit in Seoul, South Korea, and at future international gatherings.

FINDINGS
The Status of Nuclear Materials Security

The Nuclear Threat Initiative (NTI) Nuclear Materials Security Index includes findings for each of 176 countries, including 32 with at least one kilogram of weapons-usable nuclear materials and 144 with less than one kilogram of or no weapons-usable nuclear materials. Selected country summaries are included in the appendix of this report. All summaries are included on the website, www.ntiindex.org.

Presented next are several key observations from the process of creating the Index, followed by more specific findings based on the data gathered and analyzed by NTI and the Economist Intelligence Unit (EIU).

Despite broad agreement on the need for nuclear materials security, there is no consensus about what measures matter most to achieving security and no agreed international system or institution for regulating the production, use, and security of weapons-usable nuclear materials.

KEY OBSERVATIONS

The process of creating the NTI Nuclear Materials Security Index revealed some positive developments related to nuclear materials security conditions around the globe as well as areas for urgent improvement. The process also highlighted substantial gaps in how states approach nuclear materials security.

Governments Are Becoming More Engaged

The past two decades have seen tremendous progress in reducing the threat posed by nuclear materials. Nineteen nations plus Taiwan have eliminated their stocks of weapons-usable materials entirely. This progress was facilitated by a range of important international initiatives aimed at combating the threat, such as the Group of Eight (G-8) Global Partnership against the Spread of Weapons and Materials of Mass Destruction; the Global Initiative to Combat Nuclear Terrorism; the Proliferation Security Initiative; and the U.S. Department of Energy's Global Threat Reduction Initiative and Materials, Protection, Control

and Accounting Program.[14] The genesis for many such programs was the groundbreaking Cooperative Threat Reduction program, also known as the Nunn–Lugar program, in which the United States, Russia, and other countries worked together following the dissolution of the Soviet Union.

Today, more governments—particularly those that still hold weapons-usable nuclear materials—recognize that the nature of the threat has changed dramatically since the end of the Cold War. Preparations for the 2010 Nuclear Security Summit, which was led by President Barack Obama and held in Washington, D.C., and for the 2012 Nuclear Security Summit, which will be held in Seoul, South Korea, have greatly facilitated a growing awareness and understanding of the urgent need to minimize the threat posed by vulnerable materials. This heightened awareness was evident in discussions NTI and the EIU held with representatives from the countries scored in the Index. NTI also was encouraged that more than half the countries with weapons-usable nuclear materials included in the Index engaged the EIU in reviewing and validating the data.

Consensus on Priorities Is Missing

Despite broad agreement on the need for nuclear materials security, there is no consensus about what measures matter most to achieving security and no agreed international system or institution for regulating the production, use, and security of weapons-usable nuclear materials. Although the International Atomic Energy Agency (IAEA) is charged with safeguarding[15] nuclear materials used in civilian activities, it has not been given the mandate or the financial resources by its 152 member states to oversee a comprehensive system covering all weapons-usable nuclear materials. The lack of consensus among countries and experts in the field undercuts urgent and effective action by governments.

An Unnecessary and Deliberate Lack of Transparency Impedes Confidence and Accountability

Many details surrounding the site security of some of the world's most dangerous materials are—and should remain—protected as sensitive information, and the information made public by governments must not serve as a roadmap for terrorists. Although information about specific practices at a particular site must be kept secret, other important security-related information could and should be shared with the public and other governments to build international assurance in nuclear materials security conditions around the world without undermining security.

For example, states today have no obligation to publicly disclose or publish their aggregate weapons-usable nuclear materials holdings (although a few states do), which stymies efforts to create an official public baseline inventory of global materials holdings. States also do not regularly invite peer reviews of their security practices, which is another missed opportunity to build international confidence through greater clarity. This lack of transparency makes it very difficult, if not impossible, for the global community to hold states accountable for their security responsibilities.

[14] In addition to these initiatives, the International Atomic Energy Agency also provides nuclear advisory services through which it works with countries to assess their capabilities in the area of nuclear materials security and provides recommendations and assistance in formulating plans for improvement. For more information, see "Nuclear Security Advisory Services" at www-ns.iaea.org/security/advisory.asp?s=7&l=48.

Through the Global Threat Reduction Initiative, the U.S. National Nuclear Security Administration works with countries to return U.S.- and Russian-origin highly enriched uranium to the United States and Russia for blend down and to convert reactors running on highly enriched uranium to low-enriched uranium. See the fact sheet, "GTRI: Reducing Nuclear Threats," dated February 1, 2011, at nnsa.energy.gov/mediaroom/factsheets/reducingthreats. In addition, see the National Nuclear Security Administration's description of its Material Control and Accounting Program at nnsa.energy.gov/aboutus/ourprograms/nonproliferation/programoffices/internationalmaterialprotectionandcooperation/ma.

[15] *Safeguarding* is a term that refers to inspections carried out by the IAEA under agreements entered into between the agency and the inspected state. Despite the name, however, safeguards "have little to do with safety or guarding." (Matthew Bunn, *Securing the Bomb 2010*, 11). The inspections are not designed to prevent the theft of material, but to detect, after the fact, whether material has been diverted to a weapons program within the inspected state.

DATA FINDINGS

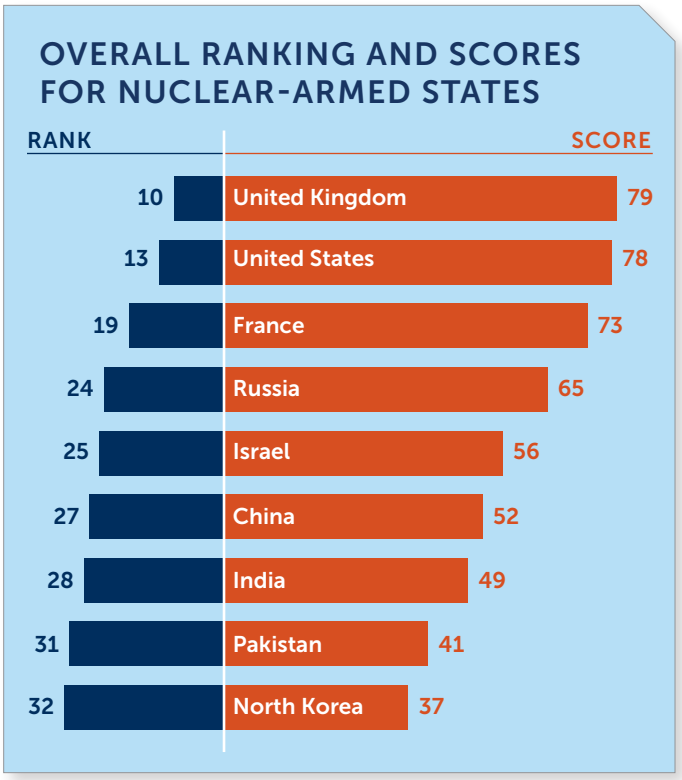
Australia Ranks First among the 32 States with Weapons-Usable Nuclear Materials

Australia, which has reduced its materials holdings, ranks first for two key reasons: (a) it maintains only a small amount of weapons-usable nuclear materials, and (b) it scores well across all other categories, from political stability and requirements for protection of materials to participation in and commitment to international security regimes.

The United Kingdom Is a Leader among Nuclear-Armed States[16]

The **United Kingdom** ranks 10th overall among the 32 states with weapons-usable nuclear materials because of high scores on Security and Control Measures for its materials as well as its commitment and follow-through on international obligations. Because the United Kingdom separates plutonium for civilian purposes, its total stocks of weapons-usable nuclear materials are believed to be increasing, and this factor significantly lowered the United Kingdom's overall score. As in the case of most nuclear-armed states, the overall score of the United Kingdom is lowered because of its large inventory of weapons-usable materials held at numerous sites, both for military and for civilian programs. If quantities of materials and number of sites had not been counted in the Index, the United Kingdom would have ranked fourth overall.

The **United States** ranks 13th overall. Although the United States scores well across most of the indicators in the Index, it could improve by ratifying relevant international agreements. If quantities of materials and number of sites were not counted in the Index, the United States would move up to second overall.



Similarly, **France** would have also improved from a ranking of 19th overall to 15th overall.[17] Although France scores well across a range of indicators (and above the Index average across all categories except for Quantities and Sites), improvements in regulations regarding the physical security of materials while in transit, ratification of international agreements, and potential consolidation of sites with weapons-usable nuclear materials are needed.

Russia has made tremendous progress in securing its weapons-usable nuclear materials. As a result, Russia ranks far above the Index average in its efforts to secure its materials and in its support of global norms. It ranks 24th overall because of its quantities of nuclear materials, large number of sites (which could be further consolidated), and the need for stronger regulations regarding the physical security of materials while in transit.

[16] *Nuclear-armed states* include the five acknowledged states with nuclear weapons (China, France, Russia, the United Kingdom, and the United States) as well as the four other states capable of making nuclear weapons (India, Israel, Pakistan, and North Korea). Although Israel has neither confirmed nor denied its nuclear-weapons capabilities, it is widely believed to have a nuclear-weapons program.

[17] Quantities of materials and numbers of sites affected the score of several other countries discussed here. If quantities of materials and numbers of sites were not counted for Russia, Israel, China, India, Pakistan, and North Korea, their ranks would be as follows: Russia would improve from 24th to 18th overall, Israel would remain at 25th overall, China would improve from 27th to 26th overall, India would improve from 28th to 27th overall, Pakistan would improve from 31st to 29th overall, and North Korea would have no change in its ranking.

Israel, which has neither confirmed nor denied the existence of its nuclear-weapons program but is widely believed to have one, ranks 25th overall. Because of the state's policy of opacity regarding its nuclear-weapons program and the sheer dearth of public information about regulations and security practices, evaluating Israel was a challenge. Although Israel might be thought to strongly protect its materials because it scores above the Index average on Security and Control Measures, the lack of clarity regarding regulations and security practices erodes international confidence. Beyond taking even basic actions that would require greater openness (such as publishing regulations), Israel could do more to build confidence in its stewardship of weapons-usable nuclear materials by ratifying relevant international legal agreements.

China is another country where a lack of transparency proved challenging when evaluating the nuclear materials security condition. Although scoring highly in some areas, such as having an effective national legal and regulatory framework, China scores 27th overall. It has an almost even distribution of areas where it is above average, average, or below average. By providing the international community appropriate information about what security measures are in place, China could vastly improve confidence in its nuclear materials security conditions.

India, which ranks 28th overall, generally performs below the Index average across all categories. The fact that it is one of two states known to be still producing materials for nuclear-weapons purposes has an additional negative impact on India's score. Providing greater transparency into nuclear materials security measures, establishing true independence for its nuclear regulator, and improving regulations about the physical security of materials in transit are all areas for urgent action.

Although **Pakistan**, ranking 31st overall, has repeatedly stated that its nuclear arsenal[18] is secure, independently verifying that claim was difficult. Despite its low overall ranking, Pakistan scores above the Index average in how well it implements its international legal obligations, particularly as measured by the national legal and regulatory framework in place. Pakistan does not score as well as it could have because of a lack of publicly available information regarding Security and Control Measures. Making appropriate details about relevant security measures more public could be a feasible way to instill greater international confidence. Pakistan is one of two states known to be continuing to produce materials for nuclear-weapons purposes, and it is also the only state out of those with weapons-usable nuclear materials that was scored as having the presence of capable groups interested in illicitly acquiring weapons-usable nuclear materials.[19]

No matter how these nuclear-armed states ranked overall, all of them have areas where they can improve and take urgent action.

North Korea ranks last at 32nd overall, with scores that fall at or near the bottom of each category. North Korea is unique because of its international isolation. It is impossible to know whether the state follows any domestic laws and regulations, and the government does not participate in international agreements and conventions. Because of the high value the regime places on its nuclear program, physical security may be strong—but that security could be undermined by political instability and insider threats. The uncertainties surrounding the political transition after the death of Kim Jong-il underscore these concerns.

Finally, as a general observation, many of the low-scoring nuclear-armed states are also beset by societal factors that undermine international confidence in the application and enforcement of their nuclear materials security measures. Some of these states face pervasive corruption and high

[18] The Index assesses weapons-usable nuclear materials beyond those used in weapons or as counted as part of an arsenal. Pakistani government statements about the security of the arsenal do not necessarily address the nuclear materials security conditions for materials that may be in bulk-processing facilities, in transit, or in storage.

[19] This indicator is hard to evaluate because of the challenges in collecting good data about the intentions and capabilities of terrorist groups. Further research into this area, particularly by international experts, is needed.

prospects of political instability in the next two years through conflict within the state, political and labor unrest, or armed conflict with other states.

No matter how these nuclear-armed states ranked overall, all of them have areas where they can improve and take urgent action.

Several States Are Particularly Vulnerable to Insider Threats

Overall nuclear materials security is fundamentally compromised by political instability and corruption within governments. Political instability can lead to chaos that may provide an opening for nuclear theft. Even strong physical security systems can be undermined by corrupt or radicalized insiders with access to materials. Indeed, experts say that corruption has played a key role in past attempts by groups to illicitly acquire bomb-making materials.[20]

Nearly a quarter of the countries with weapons-usable nuclear materials scored poorly on the Societal Factors category because of very high levels of corruption. Of those countries, several also scored poorly on political stability. The combination of these two factors significantly raises the risk of nuclear theft.

These findings raise questions about whether there are measures that more vulnerable states can take—and other states can support—to mitigate the risk of an insider threat. Such measures could include imposing stringent access controls, conducting in-depth background checks, implementing two-person or three-person rules, having radiation portal monitors on all exits and ensuring that all other means of removing materials are blocked, using effective tamper-indicating seals, and ensuring that accounting systems are accurate enough to tell when and where a discrepancy occurred and who had access at the time. New efforts on that front from governments and civil society would increase the confidence of the broader international community in those states' overall nuclear security.

According to the EIU, 70 percent of countries without weapons-usable materials suffer from high or very high levels of corruption among public officials.[21] These conditions could make these countries more susceptible to the use of their territory as a safe haven, staging ground, or transit point. Specific steps to combat corruption are beyond the scope of the Index, although a significant body of work addresses this issue.

Materials Stocks Continue to Increase

The challenge of securing nuclear materials is a moving target because global stocks of nuclear materials continue to increase and there are no legal barriers to new production of highly enriched uranium (HEU) or plutonium. Weapons-usable materials stocks are still increasing in four states in particular: in India and Pakistan, which use those stocks for weapons, and in the United Kingdom and Japan, which reprocess plutonium for use in civilian power reactors. In addition to those four countries, some other states, such as France, continue to produce weapons-usable nuclear materials, but because of the use of plutonium as fuel in civil power reactors, their overall materials inventories are currently static.

Increasing quantities of weapons-usable nuclear materials adds to the risk that material could be stolen or diverted for illicit purposes. Although negotiation of a Fissile Material Cutoff Treaty to prohibit the production of plutonium and HEU for weapons use is widely supported, there is not yet an international consensus on the need to regulate and control the production of these same materials in the civil sector. Some progress has been made in moving toward an international consensus on minimizing and eventually even eliminating the use of HEU in civilian applications. For instance, Kazakhstan recently took another step to eliminate 33 kilograms of HEU at the Institute of Nuclear Physics in Almaty by downblending the material into low-enriched uranium at the Ulba Metallurgical Plant in Ust-Kamenogorsk, Kazakhstan.[22] However, there has been no analogous trend with respect to separated plutonium, as

[20] Matthew Bunn, "Corruption and Nuclear Proliferation," in *Corruption, Global Security, and World Order*, ed. Robert I. Rotberg (Washington, DC: Brookings Institution Press, 2009), 156.

[21] For more information about how the EIU measures levels of corruption, see page 79 of the EIU methodology appendix.

[22] U.S. National Nuclear Security Administration, "NNSA and Kazakhstan Complete Operation to Eliminate Highly Enriched Uranium" (press release, October 12, 2011), www.nnsa.energy.gov/mediaroom/pressreleases/uskazakhcoop.

some states view plutonium as an important fuel for power generation. This uneven treatment of plutonium and HEU increases the importance of developing an international consensus around transparent production control and protection regimes for both materials.

More States with Weapons-Usable Materials Could Eliminate Stocks

In the past two decades, 19 countries plus Taiwan have eliminated or removed their weapons-usable nuclear materials. Most have done so through the U.S. Department of Energy's Global Threat Reduction Initiative (GTRI) or its predecessors. GTRI is a program that works with countries to return U.S.- and Russian-origin HEU to the United States and Russia for blend down. The cooperation between the United States and Russia—and among the states returning the materials—has produced significant results in risk reduction.

Today, 14 of the 32 states with weapons-usable nuclear materials in the NTI Index have limited quantities of those materials (less than 100 kilograms), and many may be good candidates to eliminate their stocks over the next few years. Many of these countries have only small amounts of materials (which might be converted to non-weapons-usable fuels) at one or two sites (which might be shut down).

Many States Lag on Joining International Agreements, and Many That Do Join Fail to Implement Their Commitments

Countries can build broader international confidence in nuclear materials security by adopting international legal obligations, and most have done so. They have a mixed record, however, on implementation—a problem that undermines confidence in security and in the agreements themselves.

PROGRESS IN ELIMINATING WEAPONS-USABLE NUCLEAR MATERIALS

Between 1992 and 2010, the following 19 countries plus Taiwan have entirely eliminated their stocks of weapons-usable nuclear materials, specifically highly enriched uranium: Brazil, Bulgaria, Chile, Colombia, Denmark, Georgia, Greece, Iraq, Latvia, Libya, the Philippines, Portugal, Romania, Serbia, Slovenia, Spain, South Korea, Thailand, and Turkey.

Thirty-two countries now have more than one kilogram of weapons-usable nuclear materials.

Sources: International Panel on Fissile Materials, Global Fissile Material Report 2010: Balancing the Books—Production and Stocks (Princeton, NJ: International Panel on Fissile Materials, 2010) and Robert Golan-Viella, Michelle Marchesano, and Sarah Williams, "The 2010 Nuclear Security Summit: A Status Update" (report, Arms Control Association, Washington, DC, April 2011).

Two international agreements are deemed to be of particular importance in a state's approach to nuclear security:

- **The Convention on the Physical Protection of Nuclear Material (CPPNM) and its 2005 amendment.** With the 2005 amendment to the CPPNM in force, states would be obligated to enact standards for protecting nuclear facilities and materials in domestic use, both while in storage and during transport, and to take criminal action against nuclear thieves, smugglers, and saboteurs. Although 29 of 32 countries with weapons-usable materials have signed and ratified the CPPNM, only 17 have ratified, accepted, or approved its 2005 amendment. Additionally, nearly 80 percent of the 144 countries without materials have not approved or ratified the amendment.
- **The International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT).** This convention commits states to criminalize acts of nuclear terrorism (including possession of unlawful materials and damage to nuclear facilities) and promotes information sharing and cooperation among countries

on investigations and extraditions.[23] More than 70 percent of countries without materials have ratified or signed ICSANT, suggesting that there is broad-based agreement about the threat of nuclear terrorism. However, nine key states with weapons-usable nuclear materials—Argentina, Australia, Canada, France, Israel, Italy, Norway, Sweden, and the United States—have not ratified ICSANT. Four more of the 32 states with weapons-usable materials—Iran, North Korea, Pakistan, and Vietnam—have yet to even sign the convention, much less ratify it.

States with little or no weapons-usable nuclear materials are less likely to follow through on implementation of their international commitments, suggesting a lack of capacity or will to put new security measures in place. Voluntary actions and political commitments, meanwhile, have become more widespread over the past decade, particularly among developed countries. In addition, more than half of the countries without weapons-usable materials participated in some voluntary security initiative.

Countries can build broader international confidence in nuclear materials security by adopting international legal obligations, and most have done so. They have a mixed record, however, on implementation.

Wealthy and Democratic States Score Higher

Higher scores for wealthier and more democratic states with weapons-usable nuclear materials[24] may stem from the states' greater access to human and financial resources to undertake the complex task of securing materials as well as from public pressure, more often found in democracies, to act responsibly. Conversely, some of the least developed and least democratic countries in the world score poorly. Despite this observation, many elements of nuclear materials security can be undertaken by governments at all financial resource levels.

[23] The text of ICSANT can be found at www-ns.iaea.org/security/nuclear_terrorism_convention.asp?s-4&l=28.

[24] The EIU correlated the NTI Index with other indices. The EIU observed a positive correlation between the NTI Index and the EIU's Index of Democracy as well as with gross domestic product per head. See the EIU methodology appendix for more detail.

KEY INTERNATIONAL AGREEMENTS FOR BUILDING INTERNATIONAL CONFIDENCE

	Physical Protection Convention (CPPNM)		2005 CPPNM Amendment		Nuclear Terrorism Convention (ICSANT)		
	Signed & ratified	Not a member	Ratified/ accepted/ approved	Not ratified/ accepted/ approved	Ratified	Signed	Not a member
Argentina	✔			✖		✔	
Australia	✔		✔			✔	
Austria	✔		✔		✔		
Belarus	✔			✖	✔		
Belgium	✔			✖	✔		
Canada	✔			✖		✔	
China	✔		✔		✔		
Czech Republic	✔		✔		✔		
France	✔			✖		✔	
Germany	✔		✔		✔		
Hungary	✔		✔		✔		
India	✔		✔		✔		
Iran		✖		✖			✖
Israel	✔			✖		✔	
Italy	✔			✖		✔	
Japan	✔			✖	✔		
Kazakhstan	✔		✔		✔		
Mexico	✔			✖	✔		
Netherlands	✔		✔		✔		
North Korea		✖		✖			✖
Norway	✔		✔			✔	
Pakistan	✔			✖			✖
Poland	✔		✔		✔		
Russia	✔		✔		✔		
South Africa	✔			✖	✔		
Sweden	✔			✖		✔	
Switzerland	✔		✔		✔		
Ukraine	✔		✔		✔		
United Kingdom	✔		✔		✔		
United States	✔			✖		✔	
Uzbekistan	✔			✖	✔		
Vietnam		✖		✖			✖

Chart includes countries with weapons-usable nuclear materials.

RECOMMENDATIONS
An Agenda for Assurance, Accountability, and Action

Poorly secured weapons-usable nuclear materials pose a risk to everyone, everywhere, with potential consequences that can best be described as catastrophic: a crude nuclear bomb, assembled by terrorists, could destroy the heart of a city and significantly undermine markets and commerce, public health and the environment, and civil liberties around the globe.

No single state can address this threat alone. All states have a responsibility to work both individually and cooperatively to help reduce this threat. Global security is only as strong as the weakest link in the chain.

Although the challenge of ensuring the security of all weapons-usable nuclear materials is great, it is not impossible. The tools, technology, and know-how needed to address these dangers exist. As with most truly global challenges, building the political will for action is paramount. The 2012 Nuclear Materials Security Summit in Seoul represents an important near-term opportunity for moving this agenda forward. Described here are some initial recommendations for advancing the process in Seoul and beyond.

No single state can address this threat alone. All states have a responsibility to work both individually and cooperatively to help reduce this threat. Global security is only as strong as the weakest link in the chain.

BUILD THE FOUNDATION FOR A GLOBAL NUCLEAR MATERIALS SECURITY SYSTEM

All states must work together to build a system for tracking, protecting, and managing these deadly materials in a way that builds confidence that each state is fulfilling its obligations in a responsible manner. A necessary part of developing such a system will be establishing an international entity or significantly strengthening an existing entity, such as the International Atomic Energy Agency (IAEA), to play a stronger role in developing standards, promoting best practices, and conducting peer reviews.[25]

Today, we are a long way from such a system, and the Seoul summit would be a good place to begin building one. States should not let the opportunity slip by. Although a number of important legal and voluntary arrangements exist to provide guidelines for securing nuclear materials, they are insufficient. Not all states adhere to these arrangements, nor are they specific enough to cover all

[25] Strengthening the authority and capacity of the IAEA to play a greater role in global nuclear materials security is addressed in detail in IAEA, "Report of the Commission of Eminent Persons on the Future of the Agency" (report, IAEA, Vienna, Austria, 2008). See especially pages 21–23 for recommendation on the IAEA's role in preventing nuclear terrorism.

of the actions needed to give us high confidence in the security of the materials governed by the agreements.

It is beyond the scope of this project to determine the full range of security governance measures that are needed, but the governance challenge can be advanced immediately through three important near-term steps. Government leaders should determine robust new ways to do the following:

- Create a global dialogue and build consensus on a new security framework.
- Hold states accountable for their progress.
- Build a practice of transparency that includes declarations and peer reviews.

Each of these elements is discussed briefly in the following subsections.

Establish a Dialogue on Priorities

A global consensus on the highest-priority actions for robust nuclear materials security does not yet exist. States should begin at the Nuclear Security Summit process, or some other high-level intergovernmental meeting process, to create a forum for establishing a common framework for action for securing nuclear materials globally. Establishing and prioritizing the actions needed to strengthen nuclear materials security are essential, particularly for states with limited capacity and resources.

The security indicators used in this study were selected by experts from around the world (see the appendix titled "About the International Panel of Experts" for a list of members). The indicators offer a start, and the Index can serve as an initial framework for debate and provide a starting point for discussion on which actions are most critical. States should use the Index as the basis for a dialogue on priorities and as a resource as they consider commitments to strengthen their security conditions. For more details about the priority and relative weights accorded to each category and specific indicator, see the EIU methodology appendix.

Benchmark Progress and Hold States Accountable

Over the past 20 years, significant progress has been made in securing and eliminating weapons-usable nuclear materials. In terms of how much exists and where, the best unclassified estimates currently come from the International Panel on Fissile Materials. To track progress over time and for future accountability, however, it is critical that governments provide official and accurate inventory declarations of weapons-usable nuclear materials as well as the current status, or baseline, of their nuclear materials security conditions. The NTI Index offers an initial baseline assessment of confidence in the security conditions in countries both with and without weapons-usable nuclear materials and provides steps for improvement. Importantly, it also can be used as the starting point for discussion and for tracking of the global progress on reducing risks from poorly secured weapons-usable nuclear materials.

Build Appropriate Transparency Practices to Increase International Confidence

This is not a call for states to reveal so much information that they compromise national and global security interests; rather, it is a call for states to build essential international confidence in their materials security practices by providing greater access to relevant security practices. States could provide information to the IAEA or even other states that they are not willing to make public. Without sufficient openness, it is impossible to gain confidence in how weapons-usable nuclear materials are secured globally or to track progress.

Specifically, all states should do the following:

- **Publish nuclear security regulations and other "framework" information that provide general descriptions of security arrangements.** Currently 13 of 32 countries with weapons-usable nuclear materials publish both their regulations and an annual report.[26] Countries can do much better, however, and should

[26] The following states publish both regulations and an annual report: Australia, Belgium, the Czech Republic, France, India, the Netherlands, Pakistan, Russia, Sweden, Switzerland, Ukraine, the United Kingdom, and the United States.

regularly publish their security framework and provide access to relevant regulations.

- **Declare inventory quantities for both highly enriched uranium (HEU) and plutonium.** Today, there is no requirement for a state to publicly declare its weapons-usable nuclear materials holdings for either military or civilian applications, and for those states that have done so, there is no mechanism for verifying those declarations. Nine states, however, voluntarily declare their civilian plutonium holdings to the IAEA.[27] In addition, the United States and the United Kingdom have declared their nuclear-weapon holdings; both also have released the production history for the HEU and plutonium in their military programs. These examples show that governments can do more to report their inventories without compromising their national security interests. Such declarations are needed to confidently assess and track inventory trends and to monitor whether inventories are growing or declining.

- **Make regular "peer reviews" the norm for sites holding HEU and plutonium.** International peer review is a powerful mechanism for ensuring good security performance. When the World Association for Nuclear Operators (WANO) was established following the Chernobyl accident, peer review was seen as too intrusive. At the time, nuclear safety was perceived to be too sensitive to discuss—the responsibility of national authorities to define—and important only for domestic concerns. Over time, however, WANO has established mandatory, regular peer review of the safety arrangements for all member facilities, and the previous concerns are no longer such an obstacle. Similarly, peer reviews for security should be established as a regular process, with each state committed to inviting peer reviews commensurate with the nature and scale of its nuclear activities. To the extent compatible with protecting sensitive information, the peer review process should be transparent, with states reporting on what reviews were undertaken and whether recommendations were followed. Although many countries with weapons-usable nuclear materials have invited some form of IAEA review within the past five years, the overwhelming majority of those reviews have evaluated the security and regulatory frameworks in place in those states. Very few have requested reviews of security implementation at sites holding HEU or plutonium.

IMPROVE INDIVIDUAL STATE STEWARDSHIP OF NUCLEAR MATERIALS

Although all states should cooperate in the types of activities just proposed, a number of key measures can and should be taken on an urgent basis by individual states as applicable. Listed next are those additional measures.

Accelerate the Clean-out of Weapons-Usable Nuclear Materials

Eliminating weapons-usable nuclear materials altogether is the best step a country can take to combat the threat of unsecured nuclear materials. During the past two decades, 19 countries plus Taiwan have set an important example by eliminating their stocks of weapons-usable nuclear materials. Currently, 14 of the 32 states with weapons-usable nuclear materials in the NTI Index have less than 100 kilograms, and many of these states may be good candidates to eliminate them over the next few years. Through this action, these states would no longer need to be concerned about the potential loss or theft of these materials. Countries in a position to support these efforts should provide assistance to help these states to act as quickly as possible.

Strengthen Security and Control Measures, Especially to Mitigate "Insider Threats"

Security and control measures, including physical protection, control and accounting, and personnel measures, are the foundation of robust nuclear materials security conditions. At a minimum, all states should ensure that basic requirements are in place. All states should also work to strengthen and routinely test the performance of their security arrangements. Such

[27] In keeping with the IAEA's guidelines for the management of plutonium (Information Circular 549), the following states voluntarily declare their civilian plutonium holdings to the IAEA: Belgium, China, France, Germany, Japan, Russia, Switzerland, the United Kingdom, and the United States.

measures are particularly important for states with political instability and high levels of corruption and states with large quantities and numerous nuclear materials sites that present a greater potential for loss or theft. States should pay particular attention to their personnel screening and other previously listed security measures,[28] which are critical to addressing the potential of an insider threat, and to security during transport, when materials are most vulnerable to overt, forcible theft. The Index identifies areas in which states may not yet have adequate measures in place. It should be used to focus the attention of each state in conducting more detailed assessments and performance tests and putting stronger security measures into place.

In addition to state-level actions, states should act to promote the exchange of best security practices at the operator level. They can do so by participation in the World Institute of Nuclear Security or through regional Centers of Excellence in developing and implementing active materials security training programs.

Stop Increasing Stocks of Weapons-Usable Materials

Four countries (India, Japan, Pakistan, and the United Kingdom) continue to increase their holdings of HEU, plutonium, or both. Several other states continue to produce these same materials, but their aggregate quantities have remained relatively constant because of consumption of equivalent quantities of the materials (either because they use plutonium in a power reactor or because they convert HEU to a non-weapons-usable form through downblending). All states that produce these materials should stop increasing their overall stocks, and over time, all states that hold weapons-usable nuclear materials should reduce their stocks to the lowest possible levels commensurate with civilian energy or scientific needs.

As mentioned in the "Findings" section of this report, there is wide support for the negotiation of a Fissile Material Cutoff Treaty to prohibit the further production of plutonium and HEU for military purposes, although the negotiation of this treaty is currently stalled within the Conference on Disarmament in Geneva. The two states known to be currently producing materials for weapons (India and Pakistan)[29] should join with the other nuclear-armed states (China, France, Russia, the United Kingdom, and the United States) in observing a moratorium on the further production of these materials for weapons while working to negotiate the Fissile Material Cutoff Treaty.

In contrast to materials produced for weapons, there is not yet any international consensus on the need to track, regulate, and control the production of weapons-usable materials in the civil sector. States should begin a dialogue about how to better and more transparently manage weapons-usable nuclear materials being produced for the civilian sector, including the development of multilateral approaches to enrichment and reprocessing.[30] In the meantime, states producing nuclear materials for the civil sector should observe a policy of no net increases in their overall holdings of weapons-usable materials.

[28] Such measures could include imposing stringent access controls, conducting in-depth background checks, implementing two-person or three-person rules, having radiation portal monitors on all exits and ensuring that all other means of removing materials are blocked, using effective tamper-indicating seals, and ensuring that accounting systems are accurate enough to tell when and where a discrepancy occurred and who had access at the time.

[29] Because of dismantlement activities over the past few years, North Korea is not believed to be producing additional separated plutonium. Plutonium was used as the basis for the devices North Korea has tested in the past. Despite recent revelations about a uranium enrichment program, there is no publicly available evidence that North Korea is producing HEU.

[30] Proposed multilateral approaches to the fuel cycle include diverse arrangements that involve participation by different types of entities (commercial, governmental, or other) from several countries. The goal of such arrangements would be to use investment, management, regulatory control, and other meaningful participation of entities from several states to increase barriers to diversion of material, technology, or facilities from peaceful uses. Although such arrangements would not necessarily increase security, they would, if widely adopted, increase oversight and potentially reduce the number of future sites capable of enriching uranium or separating plutonium.

IRAN'S NUCLEAR PROGRAM

Iran's program to enrich uranium, which is being developed in violation of IAEA and UN Security Council resolutions, has created grave international concern that Iran is enriching uranium for weapons.

Iran is not yet believed, on the basis of publicly available information, to be enriching uranium to the point at which it becomes HEU (greater than 20 percent enriched in U-235). For that reason, it is not counted in this Index as one of the states that is increasing its quantities of weapons-usable nuclear materials. Iran is, however, increasing its stocks of low-enriched uranium, including stocks at 19.75 percent U-235, just below the HEU threshold. Its recent declarations that it will continue enriching at 19.75 percent to create the fuel for the Tehran Research Reactor will further decrease the time needed for Iran to produce weapons-usable nuclear materials, if they choose to do so. The concern of the international community stems from the fact that Iran, or any other state with uranium enrichment facilities, could technically enrich uranium to weapons-usable levels by running the uranium through centrifuges for additional cycles or by reconfiguring machines. For uranium already enriched at 19.75 percent, relatively little additional enrichment effort is required to produce weapons-grade HEU.

The fact that all states with uranium enrichment technology can do this, means that all such states have a latent capacity to produce bomb-making materials. This challenge underscores the urgency of creating and implementing a transparent system of management, tracking, and control for all uranium involved in uranium enrichment.

Until such a system can be created, international confidence could be strengthened by bringing all civil enrichment facilities and reprocessing plants under international safeguards.

Bring All Civil Production Facilities under International Safeguards

Facilities that handle and process weapons-usable nuclear materials in bulk represent one of the greatest vulnerabilities to loss or theft of weapons-usable nuclear materials.[31] Non-nuclear-weapon states that are party to the Nuclear Non-Proliferation Treaty (NPT) have concluded comprehensive safeguards agreements with the IAEA, placing such facilities under safeguards. Although the nuclear-weapon states have signed agreements that voluntarily offer to make some facilities available for international safeguards, a number of civilian enrichment and reprocessing facilities and facilities that handle weapons-usable nuclear materials for civil applications (such as fuel fabrication) have not been included. This is also the situation with non-NPT parties. All such facilities in France and the United Kingdom are covered by Euratom.

The international community should work to establish that the system of safeguards for enrichment and reprocess facilities and weapons-usable nuclear materials also applies to such facilities and materials in civilian use in all nuclear-armed states. Such an effort would be an important first step in building the foundation for verification of a treaty banning the production of materials for weapons (such as the Fissile Material Cutoff Treaty). In the meantime, it would also help to ensure that nuclear materials produced for civilian purposes are not diverted for weapons purposes. It would also build international confidence in the security conditions of those facilities and establish the principle that civilian facilities, whether in nuclear-weapon states or non-nuclear-weapon states, need to play by the same rules.

Target Assistance to States with Urgent Needs

Matching countries with urgent needs with those countries able to provide assistance is critical to strengthening nuclear materials security worldwide. Although many countries are better informed on materials security, significant uncertainty remains regarding which actions have higher priority. The NTI Index can be used as a

[31] See Matthew Bunn, *Securing the Bomb 2010* (Cambridge, MA, and Washington, DC: Project on Managing the Atom, Harvard University, and Nuclear Threat Initiative, April 2010), 34.

resource in that regard. For each country, it identifies areas needing improvement that may benefit from various forms of international assistance as well as other countries that may have the capacity to provide assistance. For instance, the United States and Russia, along with other states that have engaged in cooperative threat reduction measures, are particularly well suited to provide assistance to those in need. States can also request assistance from the IAEA through the International Nuclear Security Advisory Service.[32] Over the past two years, 18 countries have provided financial or other bilateral or multilateral assistance in the area of nuclear materials security.[33] For those and other countries wishing to provide assistance, the NTI Index should be used to more effectively target financial and other forms of assistance.

Sign and Ratify Relevant Treaties and Fulfill Existing Treaty Obligations

Countries can build broader international confidence in nuclear materials security by supporting international legal obligations, and most have done so. There remain, however, important gaps. Despite broad support, the 2005 amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM) has not yet been ratified by a sufficient number of countries for entry into force. The amended convention broadens responsibilities beyond when materials are in transit. States should urgently complete the procedures necessary for acceptance, approval, and ratification of the CPPNM amendment. In the meantime, pending entry into force, states should commit to implement the provisions of the amendment.

There also is a mixed record on treaty implementation, undermining confidence in the agreements and in security more generally. In particular, states with little or no weapons-usable nuclear materials often do not implement their international commitments, suggesting that they lack the capacity or will to implement security measures. For instance, countries that have ratified the CPPNM may still not have in place the national authority charged with implementing the provision of the CPPNM. All countries should redouble their efforts not only to join international agreements, but also to realize full implementation.

LOOKING AHEAD

A public baseline assessment of nuclear materials security conditions can help countries do the following:

- Assure others that weapons-usable nuclear materials are not at risk from theft or diversion.
- Develop more accountability to implement existing commitments.
- Identify actions they can take alone or with others to urgently confront the threat.

The 2012 Nuclear Security Summit in South Korea and other prospective summits provide opportunities for countries to demonstrate individual progress and to take concerted action. Because the Index identifies areas for improvement, through its 176 country summaries, governments participating in the Nuclear Security Summit should align their 2012 commitments to areas requiring urgent attention. Experts, the media, and other observers can also use the NTI Index as a reliable barometer by which to evaluate and, more important, encourage further action.

Until an international organization, or other appropriate authority, is empowered and funded to conduct an improved global assessment, governments are urged to continue to participate in NTI's benchmarking project. NTI intends to track progress periodically. As part of that process, governments will continue to be able to review, confirm, and correct data collected. NTI also requests input from governments, experts, and other stakeholders that will help to improve future editions of the NTI Index. E-mail comments and suggestions to ntiindex@nti.org.

[32] See the "Resources for Countries" appendix for additional information.

[33] These countries are Argentina, Australia, Canada, China, France, Germany, India, Ireland, Italy, Japan, Kazakhstan, the Netherlands, New Zealand, Norway, South Africa, Sweden, the United Kingdom, and the United States.

APPENDICES

ECONOMIST INTELLIGENCE UNIT METHODOLOGY

1. SUMMARY

To gain a better understanding of the state of nuclear materials security globally, the Nuclear Threat Initiative (NTI) commissioned the Economist Intelligence Unit (EIU) to construct an index of country-level nuclear materials security conditions. NTI proposed that the index comprise a broad set of factors, including nuclear materials, security and control measures, global norms and their implementation, and societal factors. The result is the first Nuclear Materials Security Index, a rating and ranking of the security framework in 32 nations that possess one kilogram or more of weapons-usable nuclear materials. A second index measures nuclear materials security in 144 countries that have less than one kilogram or no weapons-usable nuclear materials but could serve as safe havens, staging grounds, or transit points for illicit nuclear activities.

To address the need for an objective, country-level standard for nuclear materials security, the EIU developed a multidimensional analytical framework, sometimes 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 materials security conditions. Nuclear materials security is particularly difficult to observe, both because of the 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 others in the index. In this way, indices can be a useful tool for public policy reforms. The goal of this index, then, is not only to prompt improvements in national nuclear materials security policies and programs, but also to spur debate and research on the factors that affect the likelihood of a country losing control of its weapons-usable nuclear materials.

The Nuclear Materials Security Index is the result of a collaboration between NTI and the EIU. In addition, NTI and the EIU have drawn on the expertise of an international panel of nuclear materials security experts from a number of countries, both developed and developing. Working together, the groups identified the likely determinants of nuclear materials security, from the quantities of weapons-usable materials in a country (higher quantities increase both materials management requirements and the potential risk of theft) to societal factors (which can undermine nuclear materials security conditions). Information was gathered from a wide range of trusted international sources, including the United Nations (UN), the International Atomic Energy Agency (IAEA), the World Institute for Nuclear Security (WINS), academic and technical studies, and EIU resources and databases. Many national sources were also reviewed to determine, for example, the scope of domestic regulations regarding nuclear materials security. Most of the research was conducted between March and September 2011.

NTI, in consultation with nuclear materials security experts, developed the initial intellectual framework for the index, which included proposed categories and indicators. An international panel of experts reviewed and further refined the framework. The EIU and its technical advisors were then responsible for further vetting categories and indicators to ensure that they could be appropriately included in an index.

The categories are (a) *Quantities and Sites*, which captures the amount of weapons-usable nuclear materials and the number of sites, both related to the potential and opportunity for theft; (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 security personnel; (c) *Global Norms*, which includes actions that contribute to an international consensus on improved security; (d) *Domestic Commitments and Capacity*, which evaluates implementation and compliance with global norms; and (e) *Societal Factors*, which examines issues that can undermine nuclear materials security at the national level, such as corruption, political instability, or the presence of groups interested in illicitly acquiring materials.

Within each of these categories a set of quantitative or qualitative indicators (or both) were chosen. Several principles guided the selection of these indicators and, indeed, the broader research and scoring process.

First, the team excluded output indicators—for example, the number of security breaches in a country (e.g., nuclear smuggling incidents). Benchmarking indices are most useful when they judge the enabling environment for a particular goal. The number of actual security incidents, by comparison, is the result of a poor enabling environment and does not explain the lapses in the national framework that led to the breach. Input indicators, such as nuclear materials regulatory standards or the physical infrastructure, are better measures of the security framework, which is important if the goal—as it is in this case—is to identify areas for policy improvements.

Second, the research team was acutely aware of the lack of quantitative data for measuring nuclear materials security. Only one category of indicators, *Quantities and Sites*, lent itself to numerical assessment: it is, in theory, possible to count the quantities of highly enriched uranium (HEU), separated plutonium, and unirradiated mixed oxide fuel (MOX) within a country's borders, as well as the number of sites where these materials are located. In practice, this information is often incomplete or comes with high levels of uncertainty. Where necessary, researchers relied on the public estimates of credible experts. The other categories in the index are even less amenable to quantitative assessment. The majority of indicators, therefore, consider nuclear materials from a qualitative framework, examining such issues as the quality of the physical security environment and the level of compliance with nuclear materials security obligations.

The research looks primarily at regulatory requirements for security. It was not possible to undertake a so-called bottom-up approach and measure security at sites within each country, not least because of national security concerns. Researching domestic regulations also posed a challenge: some countries do not make public the majority of the regulations regarding nuclear materials security, and two in particular, Israel and North Korea, do not make any regulations public. Owing to these research challenges, the EIU used a variety of techniques to score certain countries (see section 3b, "Indicator Choice").

To limit the degree of subjectivity in these indicators, the EIU created subindicators that were, whenever possible, framed as a binary choice (yes or no, or 0 or 1). For example, we asked if a country has a national authority for implementing the Convention on the Physical Protection of Nuclear Materials (CPPNM). If a country does, it is awarded one point; if it does not, it scores 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. For example, we asked if the country has violated its IAEA safeguards agreement. Scorers could select "no," "yes with a referral to the IAEA board of governors," or "yes with a referral to the UN Security Council."

Despite the care taken in designing these measures, no index of this kind can ever be perfect. Some countries are particularly non-transparent in matters of nuclear materials security; in those cases, we scored indicators using expert judgment or relied on proxy measures, such as the sophistication of a country's military operations (in cases where we were confident that weapons-usable nuclear materials were protected by the armed forces). Some of the underlying assumptions are open to debate, including our judgment that possessing large quantities of weapons-usable nuclear materials necessarily raises the risk of theft or diversion. The same can be said of our *societal factors* domain. It is not obvious that corruption, which is typically driven by economic gain, is an indicator of the potential risk of nuclear materials theft, although past studies by the EIU and other organizations have shown a high correlation

between corruption and most other societal and public policy shortcomings, including poverty and environmental degradation. For that reason, we have included corruption as an indicator.

The indicators in this index are embedded in a model that offers a wide range of analytical tools, thereby allowing a deeper investigation of measures of nuclear materials security globally. Users can, for example, filter countries by region or by membership in international organizations or multilateral initiatives. Any two countries may be compared directly, and correlations between indicators can be examined. Each country can also be profiled, thus permitting a deeper dive into the status of nuclear materials security. A key feature is that the weights assigned to each indicator can be changed to reflect different assumptions about the importance of categories and indicators. The model also allows the final scores to be benchmarked against external factors that may potentially influence nuclear materials security. For example, the results of the Nuclear Materials Security Index correlate well with an EIU measure of good relations among neighboring countries and with those that are most at peace (as measured by the EIU's Global Peace Index).

The Nuclear Materials Security Index is, we believe, a systematic and objective way of measuring national progress. We hope it will contribute to the debate on how best to secure vulnerable, weapons-usable nuclear materials and shine a light on those countries that are performing well and on those that have more work to do.

2. SCORING CRITERIA AND CATEGORIES

The Nuclear Materials Security Index is a dynamic scoring model of 51 subindicators used to construct 18 indicators across five categories. The model measures the current state of weapons-usable nuclear materials security across 32 countries that possess one kilogram or more of weapons-usable nuclear materials. These countries are called *countries with materials*. The research process focused on the security of HEU (including spent fuel), separated plutonium, and plutonium content in unirradiated MOX. A second, separate model evaluates security commitments in states that either have less than one kilogram of weapons-usable nuclear materials or have no nuclear materials (i.e., *countries without materials*) but that could serve as safe havens, staging grounds, or transit routes. This model covers 144 countries. The number of countries without weapons-usable nuclear materials included in the NTI Index was determined by the scope of EIU's Risk Briefing service. Countries without materials are evaluated across a smaller subset of indicators. The scope of the Index may be expanded in the future to include other materials (e.g., low-enriched uranium, radioactive sources). Although this Index captures some actions that are relevant to proliferation activities, it does not measure the risk of proliferation of nuclear materials, technology, or know-how.

Countries with Weapons-Usable Nuclear Materials Index

The overall score (0–100) for countries in this Index is a weighted average of the five categories. Each category is scored on a scale of 0–100, where 100 stands for the most favorable nuclear materials security conditions. Each category is normalized and weighted on the basis of sums of underlying indicators and subindicators. Weights are based on the recommendations of an advisory panel of international experts (described in section 3b, "Indicator Choice") and stakeholder feedback reflecting 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 Index are as follows:

1. **Quantities & Sites.** This category comprises three indicators: quantities of nuclear materials, sites and transportation, and materials production and elimination trends.

2. **Security & Control Measures.** This category comprises five indicators: on-site physical protection, control and accounting procedures, security personnel measures, physical security during transport, and response capabilities.

3. **Global Norms.** This category comprises three indicators: international legal commitments, voluntary commitments, and nuclear security and materials transparency.

4. **Domestic Commitments & Capacity.** This category comprises four indicators: UN Security Council Resolution (UNSCR) 1540 implementation, domestic nuclear materials security legislation, safeguards adoption and compliance, and independent regulatory agency.

5. **Societal Factors.** This category comprises three indicators: political stability, pervasiveness of corruption, and groups 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 (for further details on this econometric technique, see the discussion of PCA in section 3f, "Model Weights") to ensure relevance and robustness of the chosen indicators and categories.

The categories, indicators, and subindicators are as follows:

1 QUANTITIES & 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 Materials production / elimination trends
  - 1.3.1 Materials production / elimination trends

2 SECURITY & 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 materials control and accounting
  - 2.2.2 Measurement methods
  - 2.2.3 Inventory record
  - 2.2.4 Materials balance areas
- 2.3 Security personnel measures
  - 2.3.1 Security personnel vetting
  - 2.3.2 Security personnel performance demonstration
- 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 Law enforcement response training

2.5.3 Nuclear infrastructure protection plan

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 IAEA membership

3.2.2 Proliferation Security Initiative (PSI) membership

3.2.3 Global Initiative membership

3.2.4 G-8 (Group of Eight) Global Partnership membership

3.2.5 WINS contributions

3.2.6 IAEA Nuclear Security Fund contributions

3.2.7 Bilateral or multilateral assistance

3.2.8 National Nuclear Security Administration (NNSA) Second Line of Defense participation

3.3 Nuclear security and materials transparency

3.3.1 Published regulations and reports

3.3.2 Public declarations and reports about nuclear materials

3.3.3 Invitations for review of security arrangements

3.3.4 Confidence level of estimate of nuclear materials quantity

4 DOMESTIC COMMITMENTS & CAPACITY

4.1 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 adoption and compliance

4.3.1 IAEA safeguards agreement (excluding IAEA 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 SOCIETAL FACTORS

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 Pervasiveness of corruption

5.2.1 Pervasiveness of corruption

5.3 Groups interested in illicitly acquiring materials

5.3.1 Groups interested in illicitly acquiring materials

Countries without Weapons-Usable Nuclear Materials Index

Countries without weapons-usable nuclear materials are assessed against a subset of the categories and indicators used for research on the countries that possess such materials. The overall score (0–100) for countries in this second index is a weighted average of the three categories, where each is scored on a scale of 0–100 and 100 stands for the most favorable global nuclear materials security conditions. Each category is normalized and weighted on the basis of sums of underlying indicators and subindicators. Weights reflect the relative importance and relevance of each indicator and category. Weights in the model are dynamic and can be changed by users.

The three categories of this index are as follows:

- **Global Norms.** This category comprises two indicators: international legal commitments and voluntary commitments.
- **Domestic Commitments & Capacity.** This category comprises three indicators: UNSCR 1540 implementation, domestic nuclear materials security legislation, and safeguards adoption and compliance.
- **Societal Factors.** This category comprises three indicators: political stability, pervasiveness of corruption, and groups interested in illicitly acquiring materials.

Each indicator 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 CPPNM
  - 3.1.2 2005 Amendment to the CPPNM
  - 3.1.3 ICSANT
- 3.2 Voluntary commitments
  - 3.2.1 IAEA membership
  - 3.2.2 PSI membership
  - 3.2.3 Global Initiative membership
  - 3.2.4 G-8 Global Partnership membership
  - 3.2.5 WINS contributions
  - 3.2.6 IAEA Nuclear Security Fund contributions
  - 3.2.7 Bilateral or multilateral assistance
  - 3.2.8 NNSA Second Line of Defense participation

4 DOMESTIC COMMITMENTS & CAPACITY

- 4.1 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 adoption and compliance
  - 4.3.1 IAEA safeguards agreement (excluding IAEA Additional Protocol)
  - 4.3.2 IAEA Additional Protocol
  - 4.3.3 Facility exclusion from safeguards
  - 4.3.4 Safeguards violations

5	SOCIETAL FACTORS
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	Pervasiveness of corruption
5.2.1	Pervasiveness of corruption
5.3	Groups interested in illicitly acquiring materials
5.3.1	Groups interested in illicitly acquiring materials

3. METHODOLOGY

a. General

The Nuclear Materials Security Index comprises categories that are related to the nuclear materials security conditions for each country. The Index differentiates between countries with one kilogram or more of weapons-usable nuclear materials and those with less or no weapons-usable nuclear materials. The research process focused on the security of HEU (including spent fuel), separated plutonium, and plutonium content in unirradiated MOX. Countries with materials are assessed across all five categories; countries without weapons-usable materials are assessed across three categories (refer to section 2 for details on the categories and indicators).

To score the indicators for the Nuclear Materials Security Index, the research team gathered data from the following sources:

- Primary legal texts and legal reports
- Academic and government publications
- Websites of government authorities, international organizations, and non-governmental organizations
- Interviews with experts, as needed
- EIU Unit proprietary country rankings and reports (specifically “Risk Briefing”)
- Local and international news media reports

See the bibliography for more information on central sources.

b. Indicator Choice

i. Role of the International Experts Panel

The criteria used in this study were chosen collaboratively by NTI, the EIU, and a panel of international experts.

ii. Technical Experts

Nuclear Threat Initiative Project Team

- Page Stoutland
- Deepti Choubey
- Michelle Nalabandian

With additional support from

- Joan Rohlfing
- Deborah Rosenblum
- Corey Hinderstein
- Samantha Pitts-Kiefer
- Philippe De Koning

International Panel of Experts

- **Dauren Aben**, Senior Research Fellow, Kazakhstan Institute for Strategic Studies, under the President of the Republic of Kazakhstan. (Kazakhstan)
- **Carlos Augusto Feu Alvim da Silva**, Director, Economy and Energy; former secretary of the Brazilian–Argentine Agency for Accounting and Control of Nuclear Materials. (Brazil)
- **Matthew Bunn**, Associate Professor of Public Policy, Belfer Center for Science and International Affairs, John F. Kennedy School of Government, Harvard University. (United States)
- **John Carlson**, Counselor, NTI; former director general of the Australian Safeguards and Non-Proliferation Office. (Australia)

- **Anatoly S. Diakov**, Professor of Physics, Moscow Institute of Physics and Technology. (Russia)
- **Roger Howsley**, Executive Director, World Institute for Nuclear Security, Austria.
- **Khairul**, Supervisor of Physical Protection, Serpong Nuclear Research Center, National Nuclear Energy Agency. (Indonesia)
- **Aidan Manktelow**, Director, EIU Corporate Network; former manager, EIU Risk Briefing. (United Kingdom)
- **Frans Mashilo**, Senior Manager, Security Services, South African Nuclear Energy Corporation. (South Africa)
- **Anita Nilsson**, Executive Director, AN & Associates; Advisor, Federation of American Scientists; Senior Fellow of the CITS, University of Georgia; former director, IAEA Office of Nuclear Security. (Sweden)
- **Ramamurti Rajaraman**, Emeritus Professor of Physics, Jawaharlal Nehru University; Co-Chair, International Panel on Fissile Materials. (India)
- **Scott D. Sagan**, Caroline S. G. Munro Professor of Political Science and Senior Fellow, Center for International Security and Cooperation. (United States)
- **Wu Jun**, Deputy Director of Center for Strategic Study, China Academy of Engineering Physics. (China)

iii. Roles and Responsibilities

The mission of the expert panel was to provide input for the development of a robust and transparent methodology for the Nuclear Materials Security Index. The index comprises a set of indicators that, when taken together, reflect the country's overall nuclear materials security status. Therefore, selecting indicators that span the topic (i.e., no major element has been left out) and for which quantitative or qualitative assessments are possible was critical. The expert panel met twice—first to select indicators at the start of the project and later to discuss research issues and indicator weightings. The panel of experts do not officially represent their countries, nor did they undertake the research or assign scores for any of the countries.

By reviewing recent reports pertaining to quantities of nuclear materials and taking into account recent developments, 32 countries were identified as having one kilogram or greater quantities of HEU (including spent fuel), separated plutonium, or plutonium content in unirradiated MOX.

The following countries had one kilogram or more of weapons-usable nuclear materials:

Argentina
Australia
Austria
Belarus
Belgium
Canada
China
Czech Republic
France
Germany
Hungary
India
Iran
Israel
Italy
Japan
Kazakhstan
Mexico
Netherlands
North Korea
Norway
Pakistan
Poland
Russia
South Africa
Sweden
Switzerland
Ukraine
United Kingdom
United States
Uzbekistan
Vietnam

The NTI Nuclear Materials Security Index also assessed 144 countries that have less than one kilogram of weapons-usable nuclear materials or have no weapons-usable nuclear materials. These countries are as follows:

Afghanistan
Albania
Algeria
Angola
Armenia
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
Denmark
Djibouti
Dominican Republic
Ecuador
Egypt
El Salvador
Equatorial Guinea
Eritrea
Estonia
Ethiopia
Fiji
Finland
Gabon
Gambia
Georgia
Ghana
Greece
Guatemala
Guinea
Guinea-Bissau
Guyana
Haiti
Honduras
Iceland
Indonesia
Iraq
Ireland
Jamaica
Jordan
Kenya
Kuwait
Kyrgyz Republic
Laos
Latvia
Lebanon
Lesotho
Liberia
Libya
Lithuania
Luxembourg
Macedonia
Madagascar
Malawi
Malaysia
Mali
Malta
Mauritania
Mauritius
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 Príncipe
Saudi Arabia
Senegal
Serbia
Seychelles
Sierra Leone
Singapore
Slovakia
Slovenia
Solomon Islands
Somalia
South Korea
Spain
Sri Lanka
Sudan
Suriname
Swaziland
Syria
Taiwan
Tajikistan
Tanzania
Thailand
Timor-Leste
Togo
Tonga
Trinidad and Tobago
Tunisia
Turkey
Turkmenistan
Uganda
United Arab Emirates
Uruguay
Vanuatu
Venezuela
Yemen
Zambia
Zimbabwe

c. Data Review and Validation Process

i. States

After researching the 18 indicators and gathering all relevant information, NTI and the EIU provided the 32 countries that possess weapons-usable nuclear materials with an opportunity to review and comment on the EIU's preliminary results. The goal of this exercise was to ensure accuracy, because much of the research involved topics that were not always fully transparent. The research team also recognized that some countries might be willing, upon request, to provide more detailed information than is normally available to the public.

To make this process as simple as possible, the EIU developed a form that presented the data in an easy-to-use fashion for most of the Index indicators. (Not all indicators, however, were subjected to this confirmation process.) 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 and corruption. The confirmation form displayed up to 29 of the indicators. It also listed the range of possible answers for each indicator and identified the answer that the EIU assigned for the country. The confirmation form allowed the reviewer to either agree or disagree with the answer, and it provided a comment box where an alternative answer and justification could be offered. The EIU used the submitted responses to reevaluate its scores. In some cases, respondents provided information that allowed the EIU to lower a state's

score, whereas in other cases, scores were raised. When the responses were unclear, the EIU contacted individuals for clarification. Country representatives had from mid June to late October 2011 to respond to the data review and validation exercise.

Of the 32 countries, 17 (more than 50 percent) responded to the data review and validation process. Those countries were Australia, Belarus, Belgium, Canada, Czech Republic, Hungary, Italy, Japan, Kazakhstan, Mexico, the Netherlands, Norway, Poland, Sweden, Switzerland, the United Kingdom, and the United States.

ii. International Panel of Experts

The experts assisted with the selection of indicators and guided the assignment of weights to both the categories and indicators. The experts were not expected to represent their countries' interests and did not participate in the scoring, nor did they contribute information on individual countries.

However, some members of the international experts panel elected to review data collected by the EIU after the initial stage of research. Any questions or issues were returned to the researchers for further investigation.

iii. Technical Advisors

The EIU received expert guidance from the following technical advisors throughout the research process:

- **Victoria Longmire**, former safeguards manager for the Los Alamos Plutonium Facility
- **Lonnie Moore**, Senior Security Specialist, Gregg Protection Services; former program manager and project team leader for the U.S. Department of Energy Materials Protection, Control, and Accounting and Global Threat Reduction Initiative programs
- **Kenneth Thomas**, former project leader for the Program of Technical Assistance in Safeguards to the IAEA

The technical advisors contributed to indicator design, scoring schemes, and individual country scores. They also reviewed the preliminary research and provided expert input.

d. Data Modeling

Data were collected across 51 subindicators for countries with materials and 31 subindicators for countries without weapons-usable materials. The subindicators range from binomial observations (0,1) to rankings across nine possible levels. Each subindicator is constructed such that a higher value associates with a higher level of nuclear materials security. For example, for the subindicator *number of sites*, a country with 100 or more nuclear materials sites is assigned a level of 0, whereas a country with one site is assigned a value of 3. The subindicators all contribute to an indicator (i.e., subindicator values are summed to determine the value of the indicator). Countries with materials have 18 indicators, and countries without materials have 8 indicators.

The scoring scheme for each component of the NTI Nuclear Materials Security Index (countries with weapons-usable materials) is listed in the following table:

REFERENCE	INDICATOR	UNIT
	Overall score	*Score of 0–100 (100 = most favorable nuclear materials security conditions)*
1	**QUANTITIES & SITES**	**Score of 0–100 (100 = most favorable nuclear materials security conditions)**
1.1	**Quantities of nuclear materials**	**Score of 0–8 (8 = most favorable nuclear materials security conditions)**
1.1.1	Quantities of nuclear materials	Rating of 0–8
1.2	**Sites and transportation**	**Score of 0–6 (6 = most favorable nuclear materials security conditions)**
1.2.1	Number of sites	Rating of 0–3
1.2.2	Bulk-processing facility	Rating of 0–1
1.2.3	Frequency of materials transport	Rating of 0–2
1.3	**Materials production / elimination trends**	**Score of 0–2 (2 = most favorable nuclear materials security conditions)**
1.3.1	Materials production / elimination trends	Rating of 0–2
2	**SECURITY & CONTROL MEASURES**	**Score of 0–100 (100 = most favorable nuclear materials security conditions)**
2.1	**On-site physical protection**	**Score of 0–5 (5 = most favorable nuclear materials security conditions)**
2.1.1	Mandatory physical protection	Rating of 0–1
2.1.2	On-site reviews of security	Rating of 0–1
2.1.3	Design Basis Threat	Rating of 0–1
2.1.4	Security responsibilities and accountabilities	Rating of 0–1
2.1.5	Performance-based program	Rating of 0–1
2.2	**Control and accounting procedures**	**Score of 0–5 (5 = most favorable nuclear materials security conditions)**
2.2.1	Legal and regulatory basis for materials control and accounting	Rating of 0–2
2.2.2	Measurement methods	Rating of 0–1
2.2.3	Inventory record	Rating of 0–1
2.2.4	Materials balance areas	Rating of 0–1
2.3	**Security personnel measures**	**Score of 0–4 (4 = most favorable nuclear materials security conditions)**
2.3.1	Security personnel vetting	Rating of 0–3
2.3.2	Security personnel performance demonstration	Rating of 0–1

REFERENCE	INDICATOR	UNIT
2.4	**Physical security during transport**	**Score of 0–2 (2 = most favorable nuclear materials security conditions)**
2.4.1	Physical security during transport	Rating of 0–2
2.5	**Response capabilities**	**Score of 0–6 (6 = most favorable nuclear materials security conditions)**
2.5.1	Emergency response capabilities	Rating of 0–3
2.5.2	Law enforcement response training	Rating of 0–1
2.5.3	Nuclear infrastructure protection plan	Rating of 0–2
3	**GLOBAL NORMS**	**Score of 0–100 (100 = most favorable nuclear materials security conditions)**
3.1	**International legal commitments**	**Score of 0–5 (5 = most favorable nuclear materials security conditions)**
3.1.1	CPPNM	Rating of 0–2
3.1.2	2005 Amendment to the CPPNM	Rating of 0–1
3.1.3	ICSANT	Rating of 0–2
3.2	**Voluntary commitments**	**Score of 0–5 (5 = most favorable nuclear materials security conditions)***
3.2.1	IAEA membership	Rating of 0–1
3.2.2	PSI membership	Rating of 0–1
3.2.3	Global Initiative membership	Rating of 0–1
3.2.4	G-8 Global Partnership membership	Rating of 0–1
3.2.5	WINS contributions	Rating of 0–1
3.2.6	IAEA Nuclear Security Fund contributions	Rating of 0–1
3.2.7	Bilateral or multilateral assistance	Rating of 0–1
3.2.8	NNSA Second Line of Defense participation	Rating of 0–1
3.3	**Nuclear security and materials transparency**	**Score of 0–6 (6 = most favorable nuclear materials security conditions)**
3.3.1	Published regulations and reports	Rating of 0–2
3.3.2	Public declarations and reports about nuclear materials	Rating of 0–1
3.3.3	Invitations for review of security arrangements	Rating of 0–1
3.3.4	Confidence level of estimate of nuclear materials quantity	Rating of 0–2

* Score for indicator 3.2 capped at five.

REFERENCE	INDICATOR	UNIT
4	**DOMESTIC COMMITMENTS & CAPACITY**	**Score of 0–100 (100 = most favorable nuclear materials security conditions)**
4.1	**UNSCR 1540 implementation**	Score of 0–5 (5 = most favorable nuclear materials security conditions)
4.1.1	UNSCR 1540 reporting	Rating of 0–1
4.1.2	Extent of UNSCR 1540 implementation	Rating of 0–4
4.2	**Domestic nuclear materials security legislation**	Score of 0–2 (2 = most favorable nuclear materials security conditions)
4.2.1	CPPNM implementation authority	Rating of 0–1
4.2.2	National legal framework for CPPNM	Rating of 0–1
4.3	**Safeguards adoption and compliance**	Score of 0–6 (6 = most favorable nuclear materials security conditions)
4.3.1	IAEA safeguards agreement (excluding IAEA Additional Protocol)	Rating of 0–2
4.3.2	IAEA Additional Protocol	Rating of 0–1
4.3.3	Facility exclusion from safeguards	Rating of 0–1
4.3.4	Safeguards violations	Rating of 0–2
4.4	**Independent regulatory agency**	Score of 0–1 (1 = most favorable nuclear materials security conditions)
4.4.1	Independent regulatory agency	Rating of 0–1
5	**SOCIETAL FACTORS**	**Score of 0–100 (100 = most favorable nuclear materials security conditions)**
5.1	**Political stability**	Score of 0–20 (20 = most favorable security conditions)
5.1.1	Social unrest	Rating of 0–4
5.1.2	Orderly transfers of power	Rating of 0–4
5.1.3	International disputes or tensions	Rating of 0–4
5.1.4	Armed conflict	Rating of 0–4
5.1.5	Violent demonstrations or violent civil or labor unrest	Rating of 0–4
5.2	**Pervasiveness of corruption**	Score of 0–4 (4 = most favorable security conditions)
5.2.1	Pervasiveness of corruption	Rating of 0–4
5.3	**Groups interested in illicitly acquiring materials**	Score of 0–2 (2 = most favorable security conditions)
5.3.1	Groups interested in illicitly acquiring materials	Rating of 0–2

The scoring scheme for each component of the NTI Nuclear Materials Security Index (countries without weapons-usable nuclear materials) is as follows:

REFERENCE	INDICATOR	UNIT
	Overall score	*Score of 0–100 (100 = most favorable nuclear materials security conditions)*
3	**GLOBAL NORMS**	**Score of 0–100 (100 = most favorable global nuclear materials security conditions)**
3.1	**International legal commitments**	**Score of 0–5 (5 = most favorable global nuclear materials security conditions)**
3.1.1	CPPNM	Rating of 0–2
3.1.2	2005 Amendment to the CPPNM	Rating of 0–1
3.1.3	ICSANT	Rating of 0–2
3.2	**Voluntary commitments**	**Score of 0–5 (5 = most favorable global nuclear materials security conditions)***
3.2.1	IAEA membership	Rating of 0–1
3.2.2	PSI membership	Rating of 0–1
3.2.3	Global Initiative membership	Rating of 0–1
3.2.4	G-8 Global Partnership membership	Rating of 0–1
3.2.5	WINS contributions	Rating of 0–1
3.2.6	IAEA Nuclear Security Fund contributions	Rating of 0–1
3.2.7	Bilateral or multilateral assistance	Rating of 0–1
3.2.8	NNSA Second Line of Defense participation	Rating of 0–1
4	**DOMESTIC COMMITMENTS & CAPACITY**	**Score of 0–100 (100 = most favorable global nuclear materials security conditions)**
4.1	**UNSCR 1540 implementation**	**Score of 0–5 (5 = most favorable global nuclear materials security conditions)**
4.1.1	UNSCR 1540 reporting	Rating of 0–1
4.1.2	Extent of UNSCR 1540 implementation	Rating of 0–4
4.2	**Domestic nuclear materials security legislation**	**Score of 0–2 (2 = most favorable global nuclear materials security conditions)**
4.2.1	CPPNM implementation authority	Rating of 0–1
4.2.2	National legal framework for CPPNM	Rating of 0–1
4.3	**Safeguards adoption and compliance**	**Score of 0–6 (6 = most favorable global nuclear materials security conditions)**
4.3.1	IAEA safeguards agreement (excluding IAEA Additional Protocol)	Rating of 0–3
4.3.2	IAEA Additional Protocol	Rating of 0–1
4.3.4	Safeguards violations	Rating of 0–2

* Score for indicator 3.2 capped at five.

REFERENCE	INDICATOR	UNIT
5	**SOCIETAL FACTORS**	**Score of 0–100 (100 = most favorable global nuclear materials security conditions)**
5.1	**Political stability**	**Score of 0–20 (20 = most favorable global nuclear materials security conditions)**
5.1.1	Social unrest	Rating of 0–4
5.1.2	Orderly transfers of power	Rating of 0–4
5.1.3	International disputes or tensions	Rating of 0–4
5.1.4	Armed conflict	Rating of 0–4
5.1.5	Violent demonstrations or violent civil or labor unrest	Rating of 0–4
5.2	**Pervasiveness of corruption**	**Score of 0–4 (4 = most favorable global nuclear materials security conditions)**
5.2.1	Pervasiveness of corruption	Rating of 0–4
5.3	**Groups interested in illicitly acquiring materials**	**Score of 0–2 (2 = most favorable global nuclear materials security conditions)**
5.3.1	Groups interested in illicitly acquiring materials	Rating of 0–2

e. Calculating the NTI Nuclear Materials Security Index

Modeling the subindicators, indicators, and categories in the Index results in overall scores of 0–100 for each country, where 100 represents the most favorable nuclear materials security conditions and 0 the least favorable. The subindicators listed are classified into indicators, and their values are summed to determine the value of the indicator. That is,

indicator score = ∑ individual subindicators

For countries with weapons-usable nuclear materials, the indicators are classified into five categories: Quantities and Sites (3 indicators), Security and Control Measures (5 indicators), Global Norms (3 indicators), Domestic Commitments and Capacity (4 indicators), and Societal Factors (3 indicators). For countries without weapons-usable nuclear materials, the indicators are classified into three categories: Global Norms (2 indicators), Domestic Commitments and Capacity (3 indicators), and Societal Factors (3 indicators). The category values are a weighted total of the indicators in the category,

category score = ∑ weighted individual indicators,

and 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 176 states for any given indicator. The normalized value is then transformed to a 0–100 score to make it directly comparable with other indicators.

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 countries with weapons-usable materials and countries without weapons-usable materials can then be ranked according to these parameters.

To ensure the relevance of the choice of indicators and categories, principal components analysis was performed for the Countries with Weapons-Usable Nuclear Materials Index. Details of this process are given in the next section.

f. Model Weights

The weights assigned to each category and indicator can be changed to reflect different assumptions about their relative importance. Three sets of weights are provided in the Index data model. The weights defined by NTI and the EIU are the default setting. They reflect input on the relative value of each category and indicator from the international expert panel members, NTI, and the EIU. 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.

Weight Profile Defined by NTI and the EIU for Countries with Weapons-Usable Nuclear Materials

CATEGORY	WEIGHT
Quantities & Sites	1
Security & Control Measures	2
Global Norms	1
Domestic Commitments & Capacity	1
Societal Factors	1.5

REFERENCE	INDICATOR	WEIGHT
1	**Quantities & Sites**	
1.1	Quantities of nuclear materials	1.5
1.2	Sites and transportation	2
1.3	Materials production / elimination trends	1
2	**Security & Control Measures**	
2.1	On-site physical protection	2
2.2	Control and accounting procedures	1
2.3	Security personnel measures	2
2.4	Physical security during transport	2
2.5	Response capabilities	1
3	**Global Norms**	
3.1	International legal commitments	2
3.2	Voluntary commitments	1
3.3	Nuclear security and materials transparency	2
4	**Domestic Commitments & Capacity**	
4.1	UNSCR 1540 implementation	1
4.2	Domestic nuclear materials security legislation	2
4.3	Safeguards adoption and compliance	.75
4.4	Independent regulatory agency	1
5	**Societal Factors**	
5.1	Political stability	1
5.2	Pervasiveness of corruption	1
5.3	Groups interested in illicitly acquiring materials	.75

Weight Profile Defined by NTI and the EIU for Countries without Weapons-Usable Nuclear Materials

CATEGORY	WEIGHT
Global Norms	2
Domestic Commitments & Capacity	2
Societal Factors	1

REFERENCE	INDICATOR	WEIGHT
3	**Global Norms**	
3.1	International legal commitments	2
3.2	Voluntary commitments	1
4	**Domestic Commitments & Capacity**	
4.1	UNSCR 1540 implementation	1
4.2	Domestic nuclear materials security legislation	2
4.3	Safeguards adoption and compliance	.75
5	**Societal Factors**	
5.1	Political stability	1
5.2	Pervasiveness of corruption	1
5.3	Groups interested in illicitly acquiring materials	.75

Principal Components Analysis

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

There are at least three approaches to weighting indicators in an index: (1) equal weighting of all indicators, (2) expert-assigned weights and (3) PCA weights.

The first approach—in which all indicators are weighted equally—has the advantage of simplicity and no subjective judgment. A disadvantage of this approach is that it assumes that all indicators are equally significant. A second approach, which is used for the NTI/EIU weights, uses expert judgment to assign weights to indicators, thereby determining their relative importance in the overall index. This brings a real-world perspective to an index, and is important if an index is to guide policy actions. The final approach is to use PCA weights, which 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 does not consider indicators' perceived importance.

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

In other words, it aims to minimize redundancy between variables and maximize the variance with respect to the outcome. The weight is calculated by taking the principle component (eigenvector) associated with the highest eigenvalue (explained variance).

This is a way of decomposing the data into independent components ordered by informational content, and according to Ram 1982[34] is a natural choice for an index weighting. An important assumption for valid PCA is that variance is meaningful and not the result of data with large measurement error, and that the dynamics of interest (nuclear materials security) are along the direction with the largest variance.

A one-stage analysis can solve for the weights, where the data is combined irrespective of category.

One-stage analysis:

1. Perform PCA analysis on all of the indicators at once, ignoring category membership.
2. Take the principle component associated with the highest eigenvalue.
3. Normalize this to be between 0 and 1 (or in case of negative weights, sum of absolute value is 1).
4. Renormalize the weights so that they can be applied to the model's current normalized data.
5. Apply the weights to the data, create a score per country, and rank the countries.

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 accounted for. Equal weights across indicators is a sign of very little redundancy across sub-groups and similar importance in explaining variation in the index, suggesting that the index was appropriately divided into subgroups.

REFERENCE	INDICATOR	PCA WEIGHT
1	**Quantities & Sites**	
1.1	Quantities of nuclear materials	0
1.2	Sites and transportation	1
1.3	Materials production / elimination trends	2
2	**Security & Control Measures**	
2.1	On-site physical protection	8
2.2	Control and accounting procedures	9
2.3	Security personnel measures	2
2.4	Physical security during transport	3
2.5	Response capabilities	5
3	**Global Norms**	
3.1	International legal commitments	7
3.2	Voluntary commitments	9
3.3	Nuclear security and materials transparency	9
4	**Domestic Commitments & Capacity**	
4.1	UNSCR 1540 implementation	9
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4.3	Safeguards adoption and compliance	10
4.4	Independent regulatory agency	4
5	**Societal Factors**	
5.1	Political stability	9
5.2	Pervasiveness of corruption	5
5.3	Groups interested in illicitly acquiring materials	0

[34] Rati Ram, "Composite indices of physical quality of life, basic needs fulfilment, and income: A 'principal component' representation," *Journal of Development Economics* 11, no. 2 (October 1982): 227–47.

g. Model Correlations

Correlating the NTI Nuclear Materials Security Index for countries with weapons-usable nuclear materials to "output" (dependent) variables reveals some potentially interesting associations. Correlations measure the strength of a relationship between two variables. Scatterplots, which can be found on the "Scatter" worksheet in the Index data model, show the correlations between the NTI Nuclear Materials Security Index and a number of variables. Correlation analysis for four of these variables can be found below:

1. **Global Peace Index (GPI).** GPI (EIU 2011 data) gauges ongoing domestic and international conflict, safety and security in society, and levels of militarization. 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. The results indicate a high negative correlation (–0.71) between a country's GPI and the overall NTI Nuclear Materials Security Index score. This result has a certain logic because a low GPI score corresponds to a higher level of peace and implies a higher level of nuclear materials security. The correlation is negative because as GPI increases (meaning a country is less at peace), the NTI Nuclear Materials Security Index decreases (meaning nuclear materials security conditions are less favorable).

2. **Democracy Index.** The EIU's Democracy Index, which is based on a 0–10 scale (where the least democratic countries receive a score of 10), includes ratings for 60 indicators grouped into five categories: electoral process and pluralism, civil liberties, functioning of government, political participation, and political culture. Each category has a rating on a 0–10 scale, and the overall index of democracy is the simple average of the five category indices. The correlation between the Democracy Index and the overall NTI Nuclear Materials Security Index score is 0.74. The correlation shows that countries with greater levels of democracy tend to have higher levels of nuclear materials security.

3. **Relations with neighbors.** This indicator is a qualitative assessment of relations with neighboring countries and is taken from the GPI. Countries are ranked from 1 to 5, where 1 is "very low" and 5 is "very high." The correlation between the relations with neighbors variable and the overall NTI Nuclear Materials Security Index score is 0.81. The correlation shows that countries with better relations with neighboring countries tend to have better nuclear materials security.

4. **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 in terms of standard of living. For countries with weapons-usable nuclear materials, the correlation between GDP per capita and the overall NTI Nuclear Materials Security Index score is 0.63, indicating a fairly strong positive relationship. The correlation shows that as GDP per capita increases, a country's overall Index score is likely to increase as well. For countries without weapons-usable nuclear materials, the correlation between GDP per capita and the overall NTI Nuclear Materials Security Index score is 0.44. This score indicates that the relationship between the overall index and GDP per head is not as strong.

4. RESEARCH BEHIND SELECTED INDICATORS

This section focuses on the research behind selected indicators, and it includes an explanation for the scoring schemes behind several of the more complex variables created by the EIU. Scoring criteria for all of the indicators are included in section 5.

a. Approach

The EIU employed country experts and regional and legal specialists with a wide variety of linguistic skills to undertake the research. Researchers were asked to gather data from primary legal texts; academic and government 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 depended on publicly available information and a measure of transparency in the area of nuclear materials security. The research process proved challenging, both because of the difficulty in sourcing data and official information related to nuclear materials security and, in some cases, because of a lack of publicly available information.

b. Challenging Indicators

Quantities of Nuclear Materials

This indicator seeks to capture each country's combined total quantity of HEU, separated plutonium, and unirradiated MOX. 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 is either reported as such by a state or calculated as 5 to 8 percent of total MOX quantities. Quantities include materials in weapon components.

The key challenge in researching quantities of weapons-usable nuclear materials is the general lack of transparency in this area. The majority of states do not declare all of their nuclear materials (including materials in weapon components). The EIU primarily relied on three sources for data: Information Circular (INFCIRC) 549 declarations (civilian plutonium, civilian MOX, and civilian HEU); the James Martin Center for Nonproliferation Studies, or CNS (civilian HEU); and the International Panel on Fissile Materials (IPFM) *Global Fissile Material Report 2010* (military HEU and plutonium). In many cases, the latter two 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 5.0 to 10.0 kilograms would be reported by the EIU as 7.5 kilograms).

In some cases, data review and validation by states provided the EIU with significantly different figures than those reported by our key sources. Canada, for example, is reported by CNS to have "less than 1,500 kilograms."[35] Although this statement is in fact true, Canada's data review and validation put this figure at less than 500 kilograms. This discrepancy highlights the challenges in ascertaining the exact quantities of these materials.

One additional challenge arose. Nuclear materials are frequently transported, sometimes internationally. Materials are shipped to nuclear fuel cycle facilities, often in other countries. Shipments of this nature are not consistently reported. In some cases, the purpose of international transport is repatriation—the state is returning some of its material to the country of origin. The repatriation of nuclear materials is generally reported, although typically not for some time after the event. Of the data sources that the EIU relied on for data on quantities of materials, only CNS updates its data more than once per year, meaning that the published quantities of separated plutonium (military and civilian), military HEU, and MOX do not necessarily reflect changes in quantities involving shipments of materials.

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.

[35] James Martin Center for Nonproliferation Studies, "Civil Highly Enriched Uranium: Who Has What?" Nuclear Threat Initiative, Washington, DC, September 2011. See www.nti.org/db/heu/HEU_who_has_what.pdf.

Number of Sites

This indicator seeks to capture how many sites (both military and civilian) with one kilogram or greater quantities of HEU (including spent fuel), separated plutonium, or MOX the country maintains. Significant challenges arose in researching this indicator. Unsurprisingly, states do not advertise how many facilities they maintain with significant quantities of materials, nor where they are. There are sound national security reasons for not publicizing specific information on quantities. Nevertheless, the lack of transparency in this area meant 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 these estimates, the EIU again determined that it was advisable to band the number of sites, implying that precise figures could not be ascertained.

Materials Production and Elimination Trends

This indicator looks at whether a country's total stock of weapons-usable nuclear materials is increasing, remains unchanged, or is decreasing. Owing in large part to the challenges associated with estimating quantities of weapons-usable nuclear materials, understanding the changes in materials stocks was not straightforward. The EIU took a three-pronged approach. First, secondary research was undertaken to establish which countries are producing materials. A limited number of countries are producing materials, and information on these activities is discussed in the public realm, including in the IPFM *Global Fissile Material Report 2010*. Second, the EIU researched which countries are in the process of, or have recently, repatriated weapons-usable nuclear materials or are in the process of downblending materials. These activities are generally reported, particularly as they are seen as positive actions that a state can take. For those countries that were not understood to be in the process of eliminating materials or producing materials, extensive secondary research was undertaken to determine whether stocks had increased or decreased in the previous two years. Secondary research included comparing data from INFCIRC 549 declarations (when available) and from other reliable data sources on weapons-usable nuclear materials stocks.

Independent Regulatory Agency

According to the IAEA, one of the most important attributes of a regulatory body is its freedom from unwarranted interference in its regulatory functions. The IAEA states, "Each Contracting Party shall take the appropriate steps to ensure 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."[36] Determining the functional independence of a regulatory body was challenging, not least because regulatory bodies in some cases stated that they were independent, but further research indicated that their definition of independent was not in line with the IAEA's definition. The EIU researched each of the 32 countries' regulatory bodies, looking specifically for evidence of effective regulatory independence. The IAEA spells out recognized means of achieving such effective regulatory independence:

- Institutional separation of regulatory and non-regulatory functions
- Fixed terms for regulatory officials
- Constraints on removal of regulatory officials on political grounds
- Separate budgetary and employment authority for the regulatory body
- Reporting to an official or organization without conflicting responsibilities
- Unrestricted access to the press, the media, and the public

The EIU focused its additional research on the first element—institutional separation of regulatory and non-regulatory functions. Nevertheless, the research depends on the reporting of functions by the regulators themselves. It should be noted that functional independence may be required, but various factors (including corruption and one-party political systems) may have a negative impact on independence.

[36] IAEA, "Independence in Regulatory Decision Making." See www-pub.iaea.org/MTCD/Publications/PDF/Pub1172_web.pdf.

Groups Interested in Illicitly Acquiring Materials

This indicator seeks to understand whether any terrorist or criminal groups interested in illicitly acquiring weapons-usable nuclear materials are present in a country. First, the EIU accessed various databases (see the Select Bibliography for more information) and other secondary sources to ascertain which terrorist groups or criminal organizations have a stated interest in acquiring nuclear materials. The EIU then undertook research to discover the countries in which these groups have members present 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 relied on expert input 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 likely incapable of carrying out their aims.

It should be noted that the experts that the EIU consulted did not, in all cases, agree on how to score certain states. Concerns about the availability of information resulted in a reduced weight for this indicator.

c. Challenging Countries

Each country posed unique research challenges. Four countries, however, proved to be particularly challenging to score across the security and control measures category: Iran, Israel, Pakistan, and North Korea. These countries are distinct among those 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 on-site security (indicator 2.1), the EIU used a proxy indicator—military capability or sophistication—to score these countries.

The military capability or sophistication indicator is taken from the Global Peace Index. It is scored as follows:

- A score of 1 means "very low": no investment in military research and development (R&D). Principal equipment is very old or obsolete.
- A score of 2 means "low": minimal investment in military R&D. A high percentage of equipment is old and unsophisticated.
- A score of 3 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 4 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 5 means "very high": huge investment in military R&D and armament production projects. Principal equipment is new and highly sophisticated.

The EIU rescaled the indicator scoring to reflect the 0–4 scale used throughout this research. The maximum score these four countries could receive for indicator 2.1 was 4, where 4 stood for the most favorable nuclear materials security conditions. The absence of information cannot,

in our view, be a positive. As such, those states that were scored using a proxy could not receive the highest possible score of 5 for indicator 2.1. Owing to the fact that a proxy indicator was used, scores for each of the subindicators under 2.1 could not be assigned. Instead, an overall score alone for 2.1 was provided.

For the following subindicators, the scores for these four countries are based on the assumption that the military imposes a strict regime under the direct control of the state:

- 2.3.2 Security personnel performance demonstration
- 2.5.1 Emergency response capabilities
- 2.5.2 Law enforcement response training

For the following indicators and subindicators, expert input was used to score a country:

- **Israel.** 2.3.1 Security personnel vetting
- **North Korea.** 2.2 Control and accounting procedures, 2.3.1 Security personnel vetting, and 2.4.1 Physical security during transport

Israel posed a unique research challenge among this group of countries. Israel maintains a policy of opacity in regard to its nuclear materials—it does not formally acknowledge that it maintains weapons-usable nuclear materials. Israel does not publish any nuclear security–related legislation or regulations that could be used in this research. Moreover, unlike the other challenging countries, the EIU was unable to elicit expert opinion on the state of Israel's nuclear materials security. As already noted, owing to the dearth of publicly available information, the EIU used proxies as a scoring technique for some indicators.

The EIU and its technical experts did not consider it appropriate to use a proxy (military sophistication) or an assumption based on military (or similar body) protection of nuclear sites to score indicator 2.2 (materials control and accounting, or MC&A). 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 and more than the usual amount of secrecy regarding nuclear materials in Israel; thus, the EIU erred on the side of being conservative in its scoring. The burden of proof, as it were, is on Israel to show that it has systems in place. The absence of information cannot, in our view, be a positive; it has to be a negative.

Recognizing the challenges in scoring these countries 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 Israel, North Korea, and Pakistan received the highest possible scores for indicators 2.1 and 2.2, each country's category score and ranking would see the following changes:

SECURITY & CONTROL MEASURES

	Current score	Potential score	Current rank	Potential rank
Israel	78	96 (+18)	15	5 (+10)
North Korea	55	77 (+22)	28	17 (+11)
Pakistan	50	65 (+15)	30	24 (+6)

Nevertheless, each country's overall index ranking would see only a minor change:

OVERALL

	Current score	Potential score	Current rank	Potential rank
Israel	56	61 (+5)	25	25 (no change)
North Korea	37	43 (+6)	32	31 (+1)
Pakistan	41	46 (+5)	31	30 (+1)

5. SOURCES AND DEFINITIONS OF SELECTED INDICATORS

Quantities & Sites

This category comprises three indicators: quantities of nuclear materials, sites and transportation, and materials production and elimination trends.

The category captures the quantity of materials and the number of sites in a particular country. Both of these factors are related to the potential availability of nuclear materials for theft.

INDICATOR OR SUBINDICATOR	SOURCE	INDICATOR DEFINITIONS AND CONSTRUCTION
1.1 Quantities of nuclear materials		**The larger the quantity of material held, the greater the materials management requirements and the greater the potential risk that materials could be stolen. Analysis also includes materials in weapon components.**
1.1.1 Quantities of nuclear materials	James Martin Center for Nonproliferation Studies and IPFM *Global Fissile Material Report 2010*	Scores are based on the country's combined total quantity of HEU, separated plutonium, and unirradiated MOX. Totals are reported in kilograms and tons, and 1 metric ton = 1,000 kilograms. Materials owned by one state but that are present in another state are accounted for under the latter's total. Plutonium content in MOX is either reported as such by a state or is calculated as 5–8% of total MOX quantities. 0 = 500.00 metric tons or greater 1 = 100.00–499.99 metric tons 2 = 10.00–99.99 metric tons 3 = 2.00–9.99 metric tons 4 = 500 kilograms–1.99 metric tons 5 = 100–499 kilograms 6 = 21–99 kilograms 7 = 5–20 kilograms 8 = less than 5 kilograms
1.2 Sites and transportation		**The greater the number of sites with nuclear materials is, the greater the potential risk of security breaches.**

INDICATOR OR SUBINDICATOR	SOURCE	INDICATOR DEFINITIONS AND CONSTRUCTION
1.2.1 Number of sites	EIU analyst qualitative assessment	Countries receive the following scores depending on the number of sites (both military and civilian) with 1 kilogram or greater quantities of HEU (including spent fuel), separated plutonium, or unirradiated MOX that the country maintains: 0 = 100 sites or greater 1 = 11–99 sites 2 = 2–10 sites 3 = 1 site A *site* is defined as a military or civilian location that maintains HEU (including spent fuel); separated plutonium; or unirradiated MOX materials quantities that are equal to or greater than 1 kilogram. 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 kilogram or greater quantities of HEU, separated plutonium, or unirradiated MOX: sites for dismantlement, enrichment, fuel fabrication, or medical isotope production; plutonium production reactor or power reactor sites; sites for reprocessing or R&D; research reactor sites; and sites for storage, testing, or 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. A country receives the following scores depending on whether it has at least one bulk-processing facility handling HEU, separated plutonium, or unirradiated MOX: 0 = Yes 1 = No Bulk-processing facilities include enrichment, reprocessing, and national fuel cycle facilities.
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 is, the lower the potential risk of security breaches. Countries receive the following scores depending on whether nuclear materials are transported either domestically or internationally: 0 = Yes, transported domestically or internationally, and the country is one of nine nuclear-armed states 1 = Yes, transported domestically or internationally 2 = No *or* transported only for repatriation

INDICATOR OR SUBINDICATOR	SOURCE	INDICATOR DEFINITIONS AND CONSTRUCTION
1.3 Materials production / elimination trends	EIU analyst qualitative assessment	**Increasing or decreasing the quantities of nuclear material in a state changes the potential risk of materials being stolen.** Countries receive the following scores depending on trends in their total stock of nuclear materials: 0 = The total stock of nuclear materials is increasing 1 = The total stock of nuclear materials remains unchanged 2 = The total stock of nuclear materials is decreasing Scores are based on the actions of a state within the past two 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 and are unneeded research reactors decommissioned? › Are military vessels that are fueled by HEU being converted to low-enriched uranium? › Is the country returning or giving nuclear materials to another country?

Security & Control Measures

This category comprises five indicators: on-site physical protection, control and accounting procedures, security personnel measures, physical security during transport, and response capabilities.

The category encompasses the core activities directly related to protection and accounting of weapons-usable nuclear materials. It includes indicators of physical protection, control and accounting, security personnel measures, security during transport, and response capabilities.

INDICATOR OR SUBINDICATOR	SOURCE	INDICATOR DEFINITIONS AND CONSTRUCTION
2.1 On-site physical protection		**These measures are essential 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 material facilities will meet strict standards. Countries receive the following scores depending on whether physical protection is 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. Countries receive the following scores depending on whether on-site reviews of security are done in order to keep a license: 0 = No *or* information not publicly available 1 = Yes
2.1.3 Design Basis Threat	EIU analyst qualitative assessment based on official national sources, which vary by country	A Design Basis Threat based on strong assumptions leads to a more rigorous security system. A *Design Basis Threat* refers to 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. Countries receive the following scores depending on whether the regulatory body requires the use of a design basis threat: 0 = No *or* information not publicly available 1 = Yes
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. This subindicator seeks to answer whether the regulator requires that licensees define who is responsible 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. Countries receive the following scores depending on whether the nuclear regulator defines nuclear materials security responsibilities and accountabilities: 0 = No *or* information not publicly available 1 = Yes
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. Countries receive the following scores depending on whether the regulator requires there to be a performance-based program, along with tests and assessments of security: 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.**

INDICATOR OR SUBINDICATOR	SOURCE	INDICATOR DEFINITIONS AND CONSTRUCTION
2.2.1 Legal and regulatory basis for 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. Countries receive the following scores depending on whether there is a domestic legal and regulatory basis for MC&A: 0 = No, there is no domestic legal or regulatory basis for MC&A or information is 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. Countries receive the following scores depending on whether domestic regulations 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 materials inventory is necessary to detect the diversion or theft of nuclear materials. Countries receive the following scores depending on whether 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
2.2.4 Materials balance areas	EIU analyst qualitative assessment based on official national sources, which vary by country	Well-defined and well-controlled geographic locations for nuclear materials enable more accurate accounting and increase the likelihood of detection of diversion or theft of nuclear materials. Countries receive the following scores depending on whether domestic regulations or license conditions require that nuclear materials should be in well-defined and well-controlled geographic 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 the determination of materials balance areas for each nuclear facility. A *materials balance area* is an area established for materials accounting purposes, so that (a) the quantity of nuclear materials in each transfer into or out of each materials balance area can be determined and (b) the physical inventory of nuclear materials in each materials balance area can be determined when necessary in accordance with specified procedures. The factors to be taken into account should include the existence and location of key measurement points, containment and surveillance possibilities, and fixed procedures so that a materials balance can be established. The state body should also approve the facility materials balance areas.

INDICATOR OR SUBINDICATOR	SOURCE	INDICATOR DEFINITIONS AND CONSTRUCTION
2.3 Security personnel measures		**The qualifications of personnel and the strength of the security culture are critical to how well security procedures are followed.**
2.3.1 Security personnel vetting	EIU analyst qualitative assessment based on official national sources, which vary by country	Clear guidelines for the qualification and fitness of security personnel decreases vulnerability to insider threats. Countries receive the following scores depending on whether national guidelines specify that security personnel are subject to the following checks: drug testing, background checks, and psychological or mental fitness checks: 0 = Security personnel are not subject to any of these checks 1 = Security personnel are subject to one of these checks 2 = Security personnel are subject to two of these checks 3 = Security personnel are subject to all three of these checks
2.3.2 Security personnel performance demonstration	EIU analyst qualitative assessment based on official national sources, which vary by country	Requiring performance demonstrations increases the likelihood that security measures are implemented and maintained. Countries receive the following scores depending on whether domestic regulations or license conditions require that there be a demonstration of performance by security personnel at nuclear sites: 0 = No, regulations or license conditions do not require a demonstration of performance 1 = Yes, regulations or license conditions require a demonstration of performance
2.4 Physical security during transport	**EIU analyst qualitative assessment based on official national sources, which vary by country**	**Materials in transit are particularly vulnerable to theft.** Countries receive scores depending on whether the IAEA guidelines regarding transport of nuclear materials encompassed in INFCIRC 225/Rev. 4 are translated into the national regulatory regime: 0 = Domestic regulations are unclear or incomplete 1 = Appropriate guidelines (based on quantities of materials in country) are met 2 = Appropriate guidelines are met and are exceeded in some areas
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 emergency response capabilities, including trained response teams and incident reports, increases the level of preparedness for potential nuclear theft incidents. Countries receive the following scores depending on whether the state's licensing requirements for civilian nuclear facilities require that each facility have nuclear security emergency response capabilities. Capabilities should include a trained response team and a requirement to report an incident to appropriate law enforcement authorities. 0 = Licensing does not require a trained response team or incident reports to appropriate law enforcement authority 1 = Licensing requires incident reports to appropriate law enforcement authority 2 = Licensing requires a trained response team 3 = Licensing requires both a trained response team and incident reports to appropriate law enforcement authority

INDICATOR OR SUBINDICATOR	SOURCE	INDICATOR DEFINITIONS AND CONSTRUCTION
2.5.2 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 nuclear materials theft have a greater chance of success responding to theft incidents than officers who are untrained. Countries receive the following scores depending on whether law enforcement officers are trained to respond in the event of the theft of nuclear materials: 0 = No, law enforcement officers are not trained to respond in the event of the theft of nuclear materials; 1 = Yes, law enforcement officers are trained to respond in the event of the theft of nuclear materials
2.5.3 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 of facilities and additional pressures placed on government officials and personnel. Countries receive the following scores depending on whether the country's regulatory framework states that in the event of a natural disaster there are plans 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.

Global Norms

This category comprises three indicators: international legal commitments, voluntary commitments, and nuclear security and materials transparency.

The category includes actions that contribute to the establishment of global norms for nuclear materials security. It includes important international legal commitments, voluntary participation in a number of global initiatives, and a transparency indicator.

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* CPPNM	IAEA	Parties to the CPPNM commit to providing certain levels of physical protection during international transport of nuclear materials; cooperating in the protection, recovery, and return of stolen nuclear material; and criminalizing offenses involving nuclear material. Countries receive the following scores for CPPNM: 0 = Non-compliant or not a member 1 = Signed 2 = Signed and ratified (or action having the same legal effect)

* Indicates 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
3.1.2* 2005 Amendment to the CPPNM	IAEA	Parties to the 2005 Amendment to the CPPNM commit to expanding the scope of their responsibilities under the CPPNM to protect nuclear material in domestic use, in storage, and during transport, as well as to protect nuclear facilities. Countries receive the following scores for 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* ICSANT	United Nations	Parties to the ICSANT commit to criminalizing acts of nuclear terrorism and promoting cooperation with other states to prevent, investigate, and punish those acts. Countries receive the following scores for the ICSANT: 0 = Non-compliant *or* not a member 1 = Signed 2 = Signed and ratified (or action having the same legal effect)
3.2* Voluntary commitments	G-8 Global Partnership IAEA Partnership for Global Security UNSCR 1540 Committee U.S. Department of State U.S. NNSA WINS	**Voluntary commitments demonstrate a state's support for nuclear materials security as a global agenda.** A country receives one point for each of the following voluntary commitments, up to a maximum of five points: › Is a member of the IAEA › Is a member of the Proliferation Security Initiative › Is a member of the Global Initiative to Combat Nuclear Terrorism › Is a member of the G-8 Global Partnership against the Spread of Weapons and Materials of Mass Destruction › Has provided financial or in-kind contributions to the World Institute for Nuclear Security in the previous two years › Has provided financial contributions to the IAEA Nuclear Security Fund in the previous two years › Has provided financial or practical bilateral or multilateral assistance for other states in the field of nuclear security (exclusive of contributions captured elsewhere in this indicator) in the previous two years › Is a participant in a NNSA Second Line of Defense program (a maximum of one point can be assigned for participation in the following: Megaports or Core program)
3.3 Nuclear security and materials transparency		**Transparency enhances international confidence in security conditions.**

* Indicates 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
3.3.1 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 materials security. Countries receive the following scores depending on whether they publicly release broad outlines of their nuclear security regulations or annual reports on nuclear security issues: 0 = The state does not publish regulations or an annual report 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 demonstrate transparency and help build international confidence. Countries receive the following scores based on whether they 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.
3.3.3 Invitations for review of security arrangements	EIU analyst qualitative assessment	Invitations for review demonstrate the importance a country places on its security obligations and create international confidence in levels of security. Countries receive the following scores depending on whether they issue invitations for review of security arrangements: 0 = No 1 = Yes A state receives a "yes" if it has invited any of the following IAEA missions in the past five years: International Physical Protection Advisory Service mission, International Nuclear Security Advisory Service mission, State System for Accountancy and Control Advisory Service, International Team of Experts, Integrated Regulatory Review Service, or Integrated Nuclear Security Support Plan. A state receives a "yes" if it has received bilateral or multilateral assistance (outside an international organization) to review security arrangements in the past five years.

INDICATOR OR SUBINDICATOR	SOURCE	INDICATOR DEFINITIONS AND CONSTRUCTION
3.3.4 Confidence level of estimate of nuclear materials quantity	Creation of a coding and scoring scheme by the EIU	The confidence level with which nuclear materials quantity estimates are made is directly related to a country's overall transparency. This indicator looks at the confidence level assigned to the estimate of nuclear materials quantities (see indicator 1.1) in the country. For all states that are not nuclear armed, a high confidence-level score was assigned on the basis of the assumption that each state reports quantities to the IAEA. For the nine nuclear-armed states, the EIU applied uncertainty levels reported by the IPFM to the quantities of each material (HEU and separated plutonium). Countries receive the following scores depending on the confidence level assigned to the estimate of nuclear materials quantities (see indicator 1.1) in the country: 0 = Low confidence (greater than 20% uncertainty) 1 = Moderate confidence (6–20% uncertainty) 2 = High confidence (0–5% uncertainty) When the uncertainty associated with civilian and military materials differed, the EIU calculated the aggregate uncertainty across all materials. For one country, North Korea, the confidence level differed greatly between separated plutonium and HEU. In that case, the EIU assigned an overall score as follows: North Korea (HEU—low confidence; separated plutonium—high confidence) → moderate confidence

Domestic Commitments & Capacity

This category comprises four indicators: UNSCR 1540 implementation, domestic nuclear materials security legislation, safeguards adoption and compliance, and independent regulatory agency.

The category includes actions that indicate how well a country has implemented its international commitments. It includes the extent of UNSCR 1540 implementation, the status of nuclear materials security legislation, the extent of safeguards adoption and compliance, and the presence of an independent regulatory agency.

INDICATOR OR SUBINDICATOR	SOURCE	INDICATOR DEFINITIONS AND CONSTRUCTION
4.1 UNSCR 1540 implementation		**UNSCR 1540 obliges action on materials security, and its implementation demonstrates a state's commitment level.**
4.1.1* UNSCR 1540 reporting	UN 1540 Committee	Compliance with UNSCR 1540 reporting requirements demonstrates commitment to the resolution's security objectives. Countries receive the following scores depending on whether they have provided the required 1540 report to the UN Security Council: 0 = The state has not produced a UNSCR 1540 report 1 = The state has produced a UNSCR 1540 report

* Indicates 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 EIU, based on documents from the UN 1540 Committee	Implementation of UNSCR 1540 demonstrates commitment to the resolution's security objectives and improves security procedures and culture. Countries receive scores reflecting the extent of implementation of UNSCR 1540. 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: 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) The following scoring scheme was used for countries without materials: 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) 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. The 121 elements related to nuclear security in the matrix that have been implemented are indicated by an "X." The EIU summed the number of elements with an "X" designation, thus providing a numerical score for implementation. 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 an estimated level of implementation. For countries without weapons-usable materials, 91 elements in the matrix were evaluated.
4.2 Domestic nuclear materials security legislation		**The implementation of security measures is rooted in domestic nuclear materials security legislation.**
4.2.1* 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. 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 implementing the legislative and regulatory framework. Countries receive the following scores depending on whether there is a national authority for implementation of the CPPNM: 0 = No 1 = Yes

* Indicates that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without.
° Indicates 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
4.2.2* 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. This indicator looks at whether the legal elements specified by the CPPNM are enshrined in domestic legislation. Countries receive the following scores depending on whether they have fulfilled all obligations for a national legal framework for the CPPNM: 0= No 1= Yes
4.3 Safeguards adoption and compliance		**States compliant with safeguards measures take seriously responsibilities related to nuclear materials.**
4.3.1° IAEA safeguards agreement (excluding IAEA Additional Protocol)	IAEA	Conclusion of a safeguards agreement demonstrates commitment to a state's security responsibilities. Countries receive the following scores depending on whether they have concluded an IAEA safeguards agreement (excluding the Additional Protocol): 0 = No 1 = Yes, INFCIRC 66 or voluntary offer agreement 2 = Yes, comprehensive safeguards agreement The following is the scoring scheme for countries without materials: 0= No 1= Small quantities protocol 2= Modified small quantities protocol 3= Comprehensive safeguards agreement
4.3.2* IAEA Additional Protocol	IAEA	Ratification of the Additional Protocol demonstrates a high level of commitment to a state's nuclear security responsibilities. Countries receive the following scores depending on whether they have 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 country's commitment to its nuclear security responsibilities. Countries receive the following scores depending on whether they exclude any enrichment or reprocessing facilities from international or European Atomic Energy Community 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

* Indicates that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without.
° Indicates 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
4.3.4* Safeguards violations (*Note:* In the Countries without Weapons-Usable Nuclear Materials Index, safeguards violations are captured under 4.3.3.)	IAEA	Safeguards violations undermine a country's commitment to its nuclear security responsibilities. Countries receive the following scores depending on whether they have been subject to safeguards violations in the past two years: 0 = Referral to the UN Security Council 1 = Referral to the IAEA Board of Governors 2 = No violations
4.4 Independent regulatory agency	**EIU analyst qualitative assessment based on official national sources, which vary by country**	**An independent regulatory structure helps to ensure compliance with regulations related to nuclear materials.** Countries receive the following scores depending on whether they have an independent regulatory agency, as defined by the IAEA, that is responsible for security: 0 = No 1 = Yes According to the IAEA, "Each Contracting Party shall take the appropriate steps to ensure 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."[1]

[1] IAEA, "Independence in Regulatory Decision Making." See http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1172_web.pdf.
* Indicates that the indicator or subindicator was scored for both countries with weapons-usable nuclear materials and countries without.

Societal Factors

This category comprises three indicators: political stability, pervasiveness of corruption, and groups interested in illicitly acquiring materials.

Societal factors can affect the nuclear materials security conditions in a country. These factors include the level of political stability, the pervasiveness of corruption, and the existence of groups interested in illicitly acquiring nuclear materials.

INDICATOR OR SUBINDICATOR	SOURCE	INDICATOR DEFINITIONS AND CONSTRUCTION
5.1 Political stability		**A lack of political stability may enable lapses in materials security. Political stability is assessed for a two-year forecast period.**
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 seeking to acquire nuclear material to operate. Countries receive the following scores depending on 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. Countries receive the following scores depending on how clear, established, and accepted constitutional mechanisms are 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 (e.g., if election results are not accepted by all sides).

* Indicates 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 conflicts in a country's neighborhood could have destabilizing implications for the polity and, hence, for nuclear materials security. Countries receive the following scores depending on whether there is a risk that international disputes or tensions will negatively affect the polity in the next two years: 0 = Very high 1 = High 2 = Moderate 3 = Low 4 = No threat In addition to armed conflict in neighboring countries, tensions with important trade or strategic partners, resulting in economic sanctions or other barriers to trade, could have destabilizing implications for the polity 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. Countries receive the following scores depending on whether they are at present subject to the following types of armed conflict or there is at least a moderate risk of such conflict in the next two years: 0 = Yes, territorial conflict (opposition has effective control over a region or regions) 1 = Yes, sporadic and incursional conflict 2 = Yes, incursional conflict (government remains in control but opposition engages in frequent armed incursions) 3 = Yes, 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 incursional conflict with non-state actors to conventional conflict with secessionist entities or other states.

* Indicates 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
5.1.5* 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 acquire nuclear materials. Countries receive the following scores depending on whether violent demonstrations or violent civil or labor unrest are likely to occur in 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.
5.2 Pervasiveness of corruption		**Corruption affects the potential for theft of materials and the rigor with which nuclear materials security measures are implemented.**
5.2.1* Pervasiveness of corruption	EIU, "Risk Briefing"	Countries receive the following scores depending on how pervasive corruption is among public officials: 0 = Very high 1 = High 2 = Moderate 3 = Low 4 = Very low The following factors are considered in this assessment: length 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., misusing public office for private benefit, accepting bribes, or dispensing favors and patronage for private gain).
5.3 Groups interested in illicitly acquiring materials		**The presence and capabilities of certain groups, particularly those with the goal of illicitly acquiring nuclear materials, raises the risk of theft of nuclear materials.**
5.3.1* Groups interested in illicitly acquiring materials	See Select Bibliography for details	Countries receive the following scores depending on whether there are terrorist or criminal groups interested in illicitly acquiring nuclear materials: 0 = Such groups exist 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 groups exist but are likely incapable of carrying out their aims 2 = No such groups are known to exist

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

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International Security Advisory Board. "Report on Proliferation Implications of Global Expansion of Civilian Nuclear Power." U.S. Department of State, Washington, DC, April 2008. See www.ne.doe.gov/pdfFiles/rpt_ISAB_GlobalExpansionofCivilNuclearPower_Apr2008.pdf. *Note:* The report also includes Australia in this category, but since the report's publication in 2008, Australia has stated that it has no plans to develop nuclear power.

ABOUT THE INTERNATIONAL PANEL OF EXPERTS

In developing the NTI Index, both the EIU and NTI recognized the need for a global dialogue and consensus on priorities for combating the threat posed by vulnerable weapons-usable nuclear materials. The EIU and NTI convened highly respected nuclear materials security experts from nuclear- and non-nuclear-weapon states, from countries with and without materials, and from developed and developing nations. Throughout the process, this expert panel has ensured that the NTI Index has an international point of view.

The panel included people from Australia, Brazil, China, India, Indonesia, Kazakhstan, Russia, Sweden, South Africa, the United Kingdom, and the United States. A representative from the World Institute for Nuclear Security and a former IAEA official also participated. They assisted with the selection of indicators and weights given to prioritize each category and its indicators. The role of the experts was not to represent their country's interests or to score individual countries, nor was it to contribute information to help evaluate individual countries.

Participation on the panel does not imply endorsement of every aspect of the NTI Index or its findings and recommendations.

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ABOUT NTI AND THE EIU

NUCLEAR THREAT INITIATIVE
www.nti.org

The Nuclear Threat Initiative (NTI) is a non-profit, non-partisan organization with a mission to strengthen global security by reducing the risk of use and by preventing the spread of nuclear, biological, and chemical weapons and to work to build the trust, transparency, and security that are preconditions to the ultimate fulfillment of the Non-Proliferation Treaty's goals and ambitions.

Founders Ted Turner and former U.S. senator Sam Nunn serve as co-chairs of the board of directors, which includes members from China, India, Japan, Jordan, Pakistan, Russia, Sweden, the United Kingdom, and the United States. Board members include a former U.S. secretary of defense, members of the legislative bodies of the United Kingdom and the United States, a member of the Jordanian royal family, a Nobel Prize–winning economist, a world-renowned nuclear physicist, the former commander of U.S. strategic nuclear forces, and other international security experts.

NTI activities are directed by Nunn and President Joan Rohlfing and are informed by the advisors to the Board of Directors, all leading figures in science, business, and international security.

ECONOMIST INTELLIGENCE UNIT
www.eiu.com

The Economist Intelligence Unit (EIU) is the business information arm of The Economist Group, publisher of *The Economist*. Through a global network of more than 900 analysts and contributors, the EIU continuously assesses and forecasts political, economic, and business conditions in more than 200 countries. As the world's leading provider of country intelligence, the EIU helps executives, governments, and institutions by providing timely, reliable, and impartial analysis.

SELECTED COUNTRY SUMMARIES

This section includes country summaries for the 32 countries with weapons-usable nuclear materials. All country summaries, including the 144 countries without weapons-usable nuclear materials, can be easily accessed online at **www.ntiindex.org**.

Each summary provides a snapshot of a country's scores and rankings overall and in each of the major index categories. Rankings preceded with an "=" sign indicate a tie with another country.

For each country, indicators are placed into one of three categories: green indicating an above average score, yellow indicating average, and red indicating below average. Countries seeking to improve their materials security conditions can focus their efforts on those indicators that are in the yellow and red categories.

All country summaries, including the 144 countries without weapons-usable nuclear materials, can be easily accessed online at www.ntiindex.org.

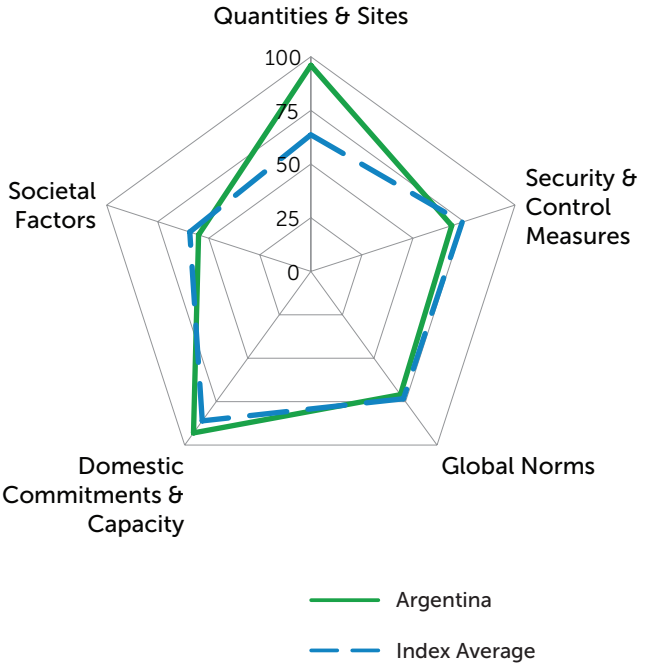
Argentina
Australia
Austria
Belarus
Belgium
Canada
China
Czech Republic
France
Germany
Hungary
India
Iran
Israel
Italy
Japan
Kazakhstan
Mexico
Netherlands
North Korea
Norway
Pakistan
Poland
Russia
South Africa
Sweden
Switzerland
Ukraine
United Kingdom
United States
Uzbekistan
Vietnam

ARGENTINA

	Score / 100	Rank / 32
OVERALL SCORE	**74**	**=16**
1) QUANTITIES & SITES	96	=1
2) SECURITY & CONTROL MEASURES	69	22
3) GLOBAL NORMS	71	=20
4) DOMESTIC COMMITMENTS & CAPACITY	93	=20
5) SOCIETAL FACTORS	55	20

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Group(s) interested in illicitly acquiring materials	100
Independent regulatory agency	100
Domestic nuclear materials security legislation	100
Voluntary commitments	100
Response capabilities	100
Control and accounting procedures	100
On-site physical protection	100
Material production / elimination trends	100
Sites and transportation	100
Quantities of nuclear materials	88
Safeguards adoption and compliance	83
UNSCR 1540 implementation	80
Security personnel measures	75
Nuclear security and materials transparency	67

AVERAGE (Scores between 34 and 66)

International legal commitments	60
Political stability	50

BELOW AVERAGE (Scores less than 34)

Pervasiveness of corruption	25
Physical security during transport	0

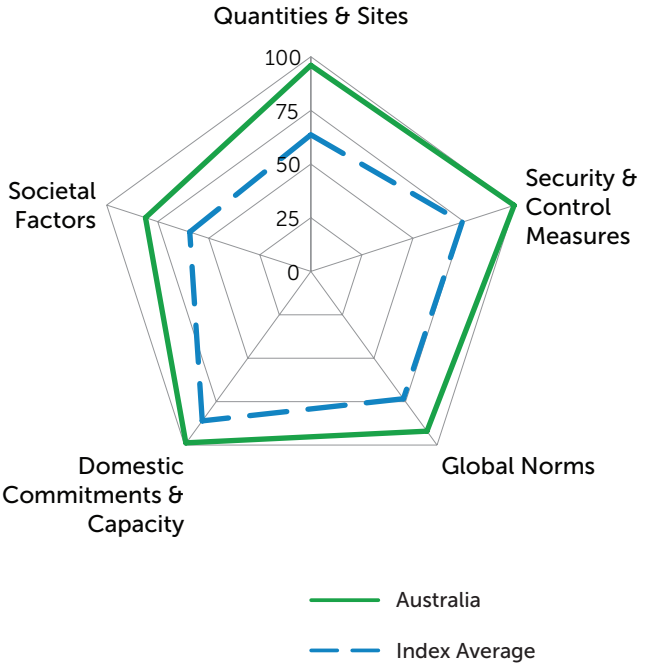
For more information, visit **www.ntiindex.org**

AUSTRALIA

	Score / 100	Rank / 32
OVERALL SCORE	**94**	**1**
1) QUANTITIES & SITES	96	=1
2) SECURITY & CONTROL MEASURES	100	=1
3) GLOBAL NORMS	92	6
4) DOMESTIC COMMITMENTS & CAPACITY	100	=1
5) SOCIETAL FACTORS	81	=5

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Pervasiveness of corruption	100
Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
Nuclear security and materials transparency	100
Voluntary commitments	100
Response capabilities	100
Physical security during transport	100
Security personnel measures	100
Control and accounting procedures	100
On-site physical protection	100
Material production / elimination trends	100
Sites and transportation	100
Quantities of nuclear materials	88
Political stability	85
International legal commitments	80

AVERAGE (Scores between 34 and 66)

Group(s) interested in illicitly acquiring materials	50

BELOW AVERAGE (Scores less than 34)

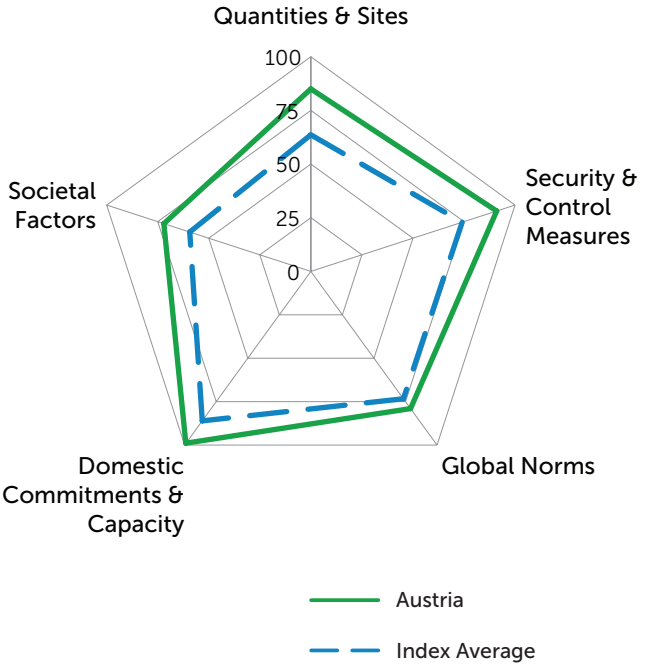
For more information, visit **www.ntiindex.org**

AUSTRIA

	Score / 100	Rank / 32
OVERALL SCORE	**85**	**5**
1) QUANTITIES & SITES	85	=10
2) SECURITY & CONTROL MEASURES	91	5
3) GLOBAL NORMS	79	=13
4) DOMESTIC COMMITMENTS & CAPACITY	100	=1
5) SOCIETAL FACTORS	72	=11

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
International legal commitments	100
Physical security during transport	100
Security personnel measures	100
Control and accounting procedures	100
Sites and transportation	100
Quantities of nuclear materials	88
Political stability	85
On-site physical protection	80
Pervasiveness of corruption	75
Nuclear security and materials transparency	67
Response capabilities	67

AVERAGE (Scores between 34 and 66)

Voluntary commitments	60
Group(s) interested in illicitly acquiring materials	50
Material production / elimination trends	50

BELOW AVERAGE (Scores less than 34)

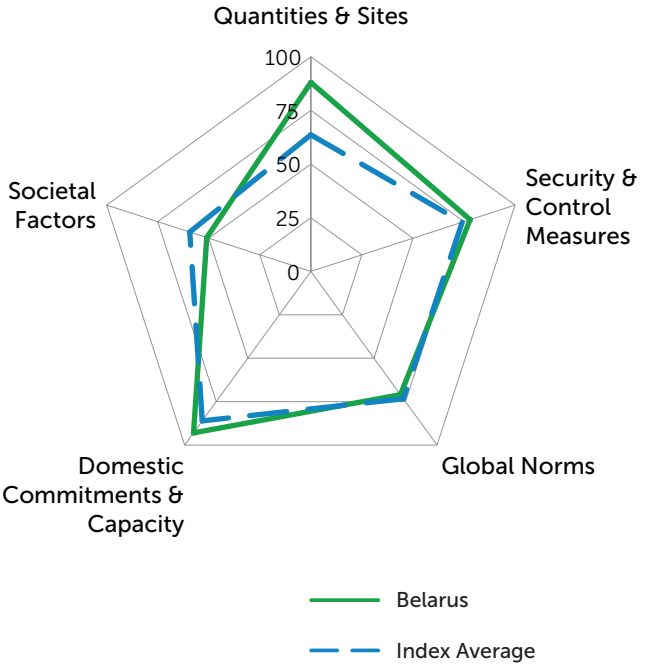
For more information, visit **www.ntiindex.org**

BELARUS

	Score / 100	Rank / 32
OVERALL SCORE	**74**	**=16**
1) QUANTITIES & SITES	88	=8
2) SECURITY & CONTROL MEASURES	78	=15
3) GLOBAL NORMS	71	=20
4) DOMESTIC COMMITMENTS & CAPACITY	93	=20
5) SOCIETAL FACTORS	51	22

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Group(s) interested in illicitly acquiring materials	100
Independent regulatory agency	100
Domestic nuclear materials security legislation	100
Security personnel measures	100
Material production / elimination trends	100
Sites and transportation	100
Safeguards adoption and compliance	83
Response capabilities	83
UNSCR 1540 implementation	80
International legal commitments	80
Control and accounting procedures	80
On-site physical protection	80
Nuclear security and materials transparency	67

AVERAGE (Scores between 34 and 66)

Quantities of nuclear materials	63
Voluntary commitments	60
Physical security during transport	50
Political stability	40

BELOW AVERAGE (Scores less than 34)

Pervasiveness of corruption	25

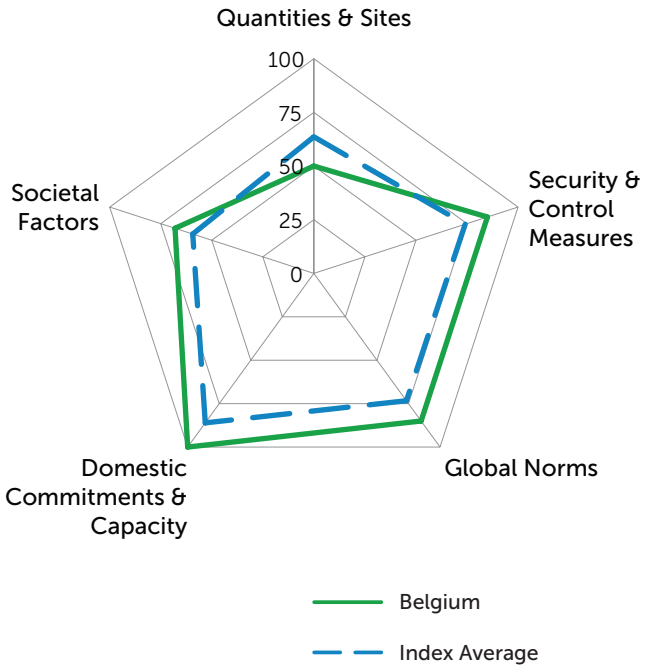
For more information, visit **www.ntiindex.org**

BELGIUM

	Score / 100	Rank / 32
OVERALL SCORE	**78**	**=13**
1) QUANTITIES & SITES	50	23
2) SECURITY & CONTROL MEASURES	85	=8
3) GLOBAL NORMS	85	=10
4) DOMESTIC COMMITMENTS & CAPACITY	100	=1
5) SOCIETAL FACTORS	68	=15

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
Voluntary commitments	100
Physical security during transport	100
Control and accounting procedures	100
On-site physical protection	100
Nuclear security and materials transparency	83
Response capabilities	83
International legal commitments	80
Pervasiveness of corruption	75
Political stability	75

AVERAGE (Scores between 34 and 66)

Group(s) interested in illicitly acquiring materials	50
Security personnel measures	50
Material production / elimination trends	50
Sites and transportation	50
Quantities of nuclear materials	50

BELOW AVERAGE (Scores less than 34)

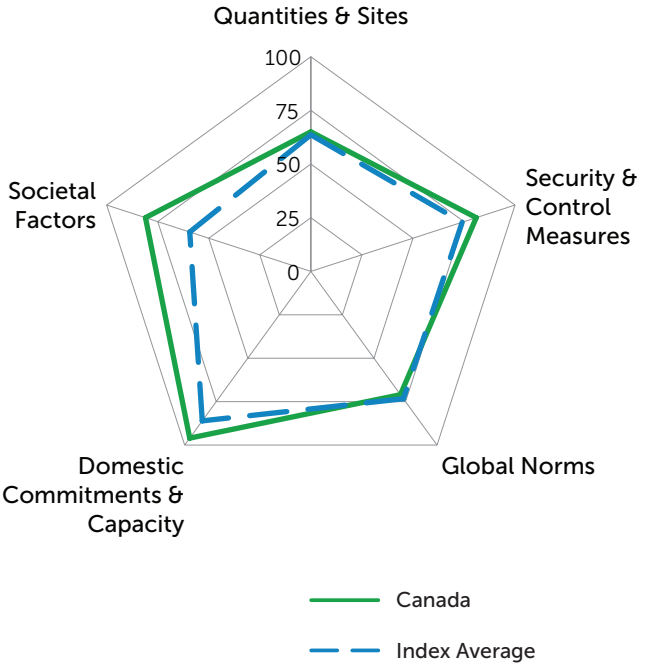
For more information, visit **www.ntiindex.org**

CANADA

	Score / 100	Rank / 32
OVERALL SCORE	**79**	**=10**
1) QUANTITIES & SITES	65	21
2) SECURITY & CONTROL MEASURES	81	=11
3) GLOBAL NORMS	71	=20
4) DOMESTIC COMMITMENTS & CAPACITY	96	=15
5) SOCIETAL FACTORS	81	=5

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Pervasiveness of corruption	100
Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
Voluntary commitments	100
Response capabilities	100
Control and accounting procedures	100
On-site physical protection	100
Material production / elimination trends	100
Political stability	85
UNSCR 1540 implementation	80
Security personnel measures	75
Nuclear security and materials transparency	67

AVERAGE (Scores between 34 and 66)

Quantities of nuclear materials	63
International legal commitments	60
Group(s) interested in illicitly acquiring materials	50
Physical security during transport	50
Sites and transportation	50

BELOW AVERAGE (Scores less than 34)

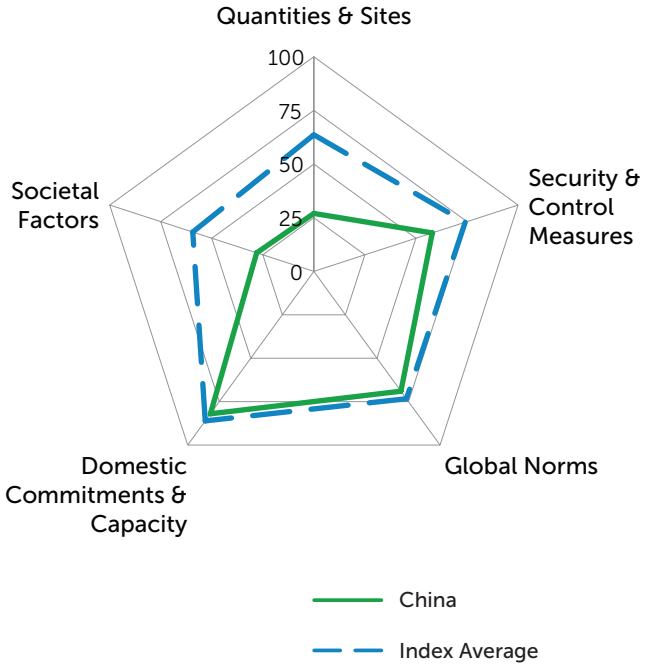
For more information, visit **www.ntiindex.org**

CHINA

	Score / 100	Rank / 32
OVERALL SCORE	**52**	**27**
1) QUANTITIES & SITES	27	26
2) SECURITY & CONTROL MEASURES	58	27
3) GLOBAL NORMS	69	25
4) DOMESTIC COMMITMENTS & CAPACITY	82	26
5) SOCIETAL FACTORS	28	29

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Domestic nuclear materials security legislation	100
International legal commitments	100
Response capabilities	100
Control and accounting procedures	100
Voluntary commitments	80
On-site physical protection	80
Safeguards adoption and compliance	67

AVERAGE (Scores between 34 and 66)

Group(s) interested in illicitly acquiring materials	50
Security personnel measures	50
Material production / elimination trends	50
Political stability	40
UNSCR 1540 implementation	40

BELOW AVERAGE (Scores less than 34)

Nuclear security and materials transparency	33
Quantities of nuclear materials	25
Sites and transportation	17
Pervasiveness of corruption	0
Physical security during transport	0

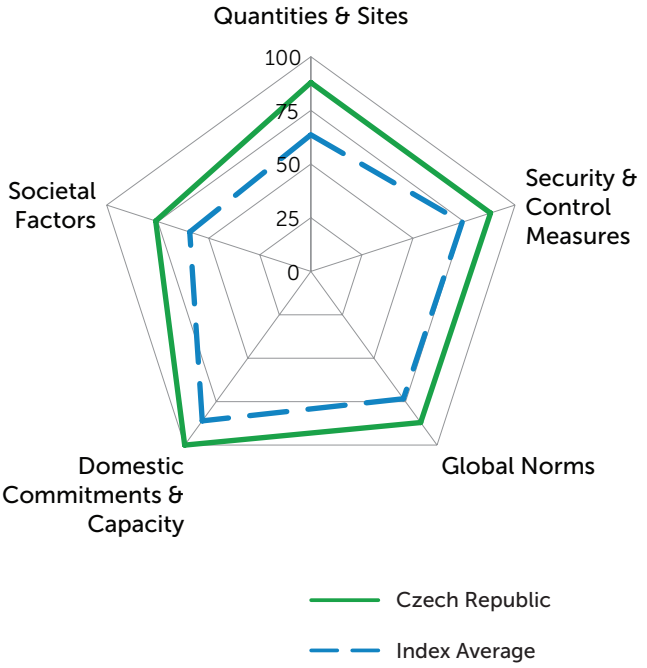
For more information, visit **www.ntiindex.org**

CZECH REPUBLIC

	Score / 100	Rank / 32
OVERALL SCORE	**87**	**3**
1) QUANTITIES & SITES	88	=8
2) SECURITY & CONTROL MEASURES	88	=6
3) GLOBAL NORMS	87	=8
4) DOMESTIC COMMITMENTS & CAPACITY	100	=1
5) SOCIETAL FACTORS	76	8

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Group(s) interested in illicitly acquiring materials	100
Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
Voluntary commitments	100
International legal commitments	100
Response capabilities	100
Security personnel measures	100
Control and accounting procedures	100
On-site physical protection	100
Material production / elimination trends	100
Quantities of nuclear materials	88
Political stability	85
Sites and transportation	83
Nuclear security and materials transparency	67

AVERAGE (Scores between 34 and 66)

Pervasiveness of corruption	50
Physical security during transport	50

BELOW AVERAGE (Scores less than 34)

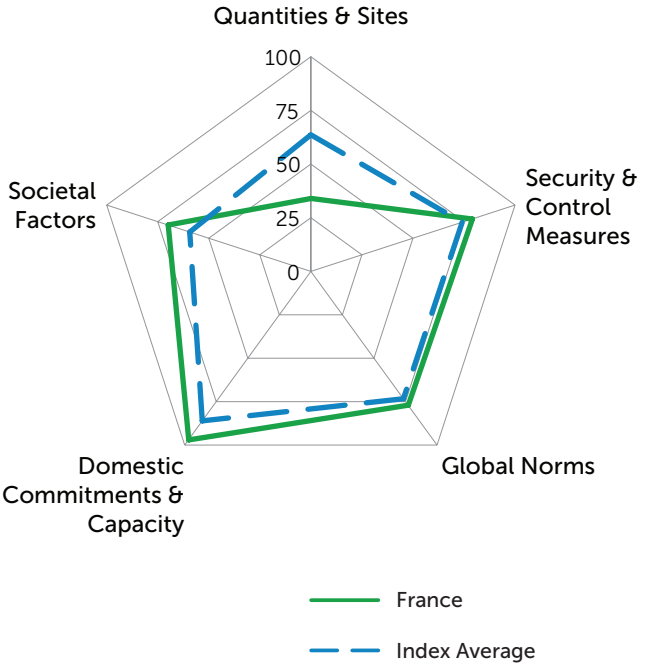
For more information, visit **www.ntiindex.org**

FRANCE

	Score / 100	Rank / 32
OVERALL SCORE	**73**	**=19**
1) QUANTITIES & SITES	34	25
2) SECURITY & CONTROL MEASURES	79	=13
3) GLOBAL NORMS	77	=16
4) DOMESTIC COMMITMENTS & CAPACITY	97	=13
5) SOCIETAL FACTORS	70	=13

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
Voluntary commitments	100
Control and accounting procedures	100
On-site physical protection	100
Material production / elimination trends	100
Safeguards adoption and compliance	83
Nuclear security and materials transparency	83
Response capabilities	83
Political stability	80
Pervasiveness of corruption	75
Security personnel measures	75

AVERAGE (Scores between 34 and 66)

International legal commitments	60
Group(s) interested in illicitly acquiring materials	50
Physical security during transport	50

BELOW AVERAGE (Scores less than 34)

Sites and transportation	17
Quantities of nuclear materials	13

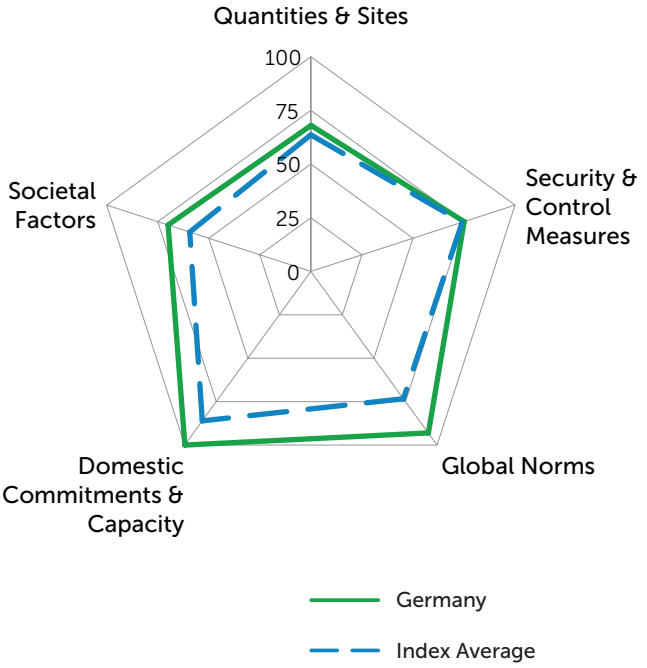
For more information, visit **www.ntiindex.org**

GERMANY

	Score / 100	Rank / 32
OVERALL SCORE	**79**	**=10**
1) QUANTITIES & SITES	68	=18
2) SECURITY & CONTROL MEASURES	75	19
3) GLOBAL NORMS	93	=3
4 DOMESTIC COMMITMENTS & CAPACITY	100	=1
5) SOCIETAL FACTORS	70	=13

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
Voluntary commitments	100
International legal commitments	100
Response capabilities	100
Control and accounting procedures	100
On-site physical protection	100
Material production / elimination trends	100
Nuclear security and materials transparency	83
Sites and transportation	83
Political stability	80
Pervasiveness of corruption	75

AVERAGE (Scores between 34 and 66)

Group(s) interested in illicitly acquiring materials	50
Physical security during transport	50
Security personnel measures	50

BELOW AVERAGE (Scores less than 34)

Quantities of nuclear materials	25

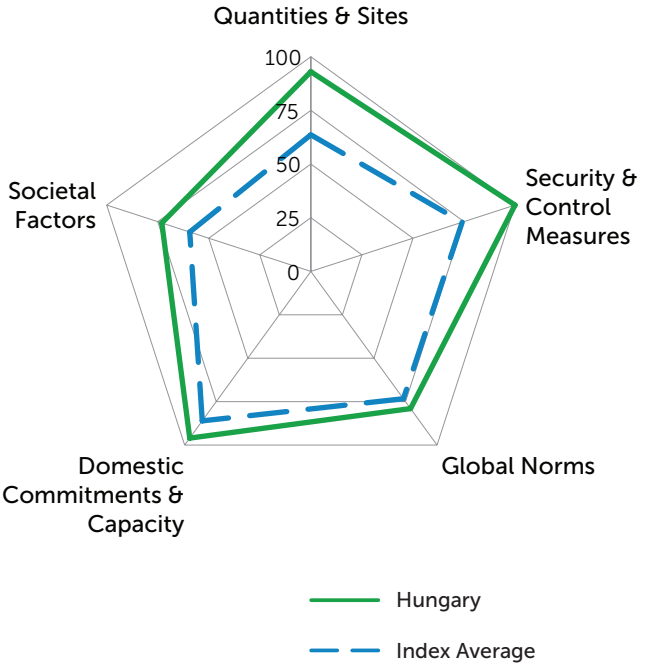
For more information, visit **www.ntiindex.org**

HUNGARY

	Score / 100	Rank / 32
OVERALL SCORE	**89**	**2**
1) QUANTITIES & SITES	93	=4
2) SECURITY & CONTROL MEASURES	100	=1
3) GLOBAL NORMS	79	=13
4) DOMESTIC COMMITMENTS & CAPACITY	96	=15
5) SOCIETAL FACTORS	73	10

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Group(s) interested in illicitly acquiring materials	100
Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
International legal commitments	100
Response capabilities	100
Physical security during transport	100
Security personnel measures	100
Control and accounting procedures	100
On-site physical protection	100
Material production / elimination trends	100
Quantities of nuclear materials	100
Sites and transportation	83
UNSCR 1540 implementation	80
Political stability	75
Nuclear security and materials transparency	67

AVERAGE (Scores between 34 and 66)

Voluntary commitments	60
Pervasiveness of corruption	50

BELOW AVERAGE (Scores less than 34)

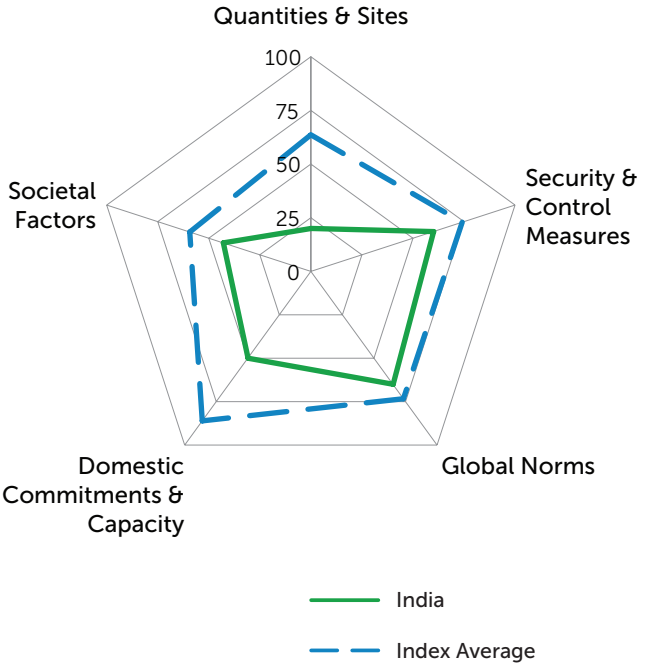
For more information, visit **www.ntiindex.org**

INDIA

	Score / 100	Rank / 32
OVERALL SCORE	**49**	**28**
1) QUANTITIES & SITES	20	=30
2) SECURITY & CONTROL MEASURES	60	=25
3) GLOBAL NORMS	65	26
4) DOMESTIC COMMITMENTS & CAPACITY	50	29
5) SOCIETAL FACTORS	43	26

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

UNSCR 1540 implementation	100
International legal commitments	100
Response capabilities	100
On-site physical protection	100
Control and accounting procedures	80

AVERAGE (Scores between 34 and 66)

Voluntary commitments	60
Political stability	55
Group(s) interested in illicitly acquiring materials	50
Safeguards adoption and compliance	50
Domestic nuclear materials security legislation	50
Security personnel measures	50
Quantities of nuclear materials	38

BELOW AVERAGE (Scores less than 34)

Nuclear security and materials transparency	33
Pervasiveness of corruption	25
Sites and transportation	17
Independent regulatory agency	0
Physical security during transport	0
Material production / elimination trends	0

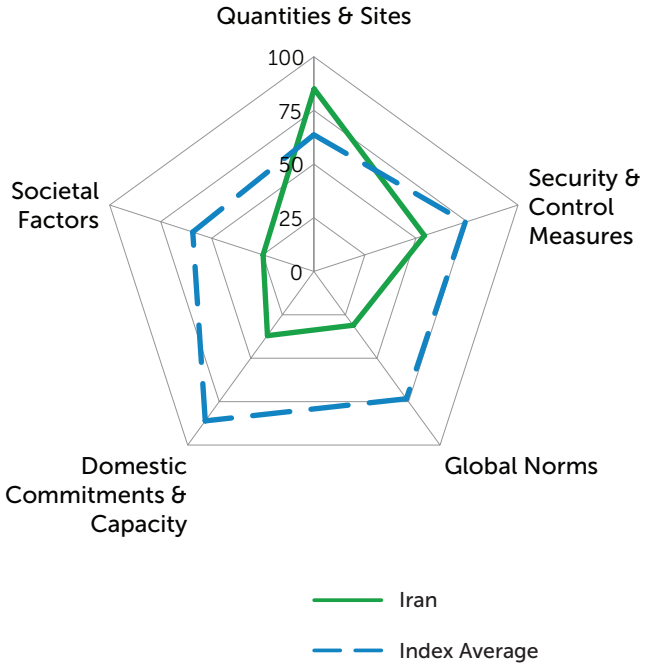
For more information, visit **www.ntiindex.org**

IRAN

	Score / 100	Rank / 32
OVERALL SCORE	**46**	**30**
1) QUANTITIES & SITES	85	=10
2) SECURITY & CONTROL MEASURES	54	29
3) GLOBAL NORMS	31	31
4) DOMESTIC COMMITMENTS & CAPACITY	37	30
5) SOCIETAL FACTORS	25	=30

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Sites and transportation	100
Quantities of nuclear materials	88
Response capabilities	83
Security personnel measures	75
Nuclear security and materials transparency	67

AVERAGE (Scores between 34 and 66)

Group(s) interested in illicitly acquiring materials	50
Safeguards adoption and compliance	50
Physical security during transport	50
Material production / elimination trends	50
UNSCR 1540 implementation	40
On-site physical protection	40

BELOW AVERAGE (Scores less than 34)

Political stability	30
Voluntary commitments	20
Control and accounting procedures	20
Pervasiveness of corruption	0
Domestic nuclear materials security legislation	0
International legal commitments	0

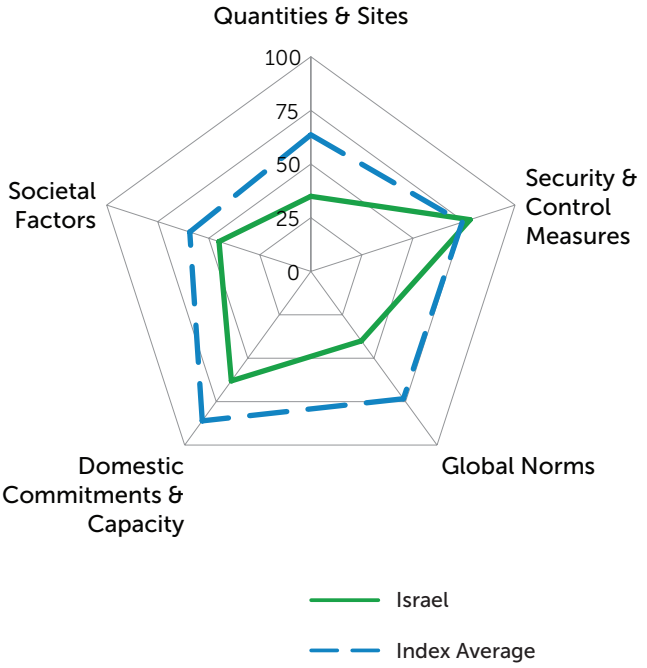
For more information, visit **www.ntiindex.org**

ISRAEL

	Score / 100	Rank / 32
OVERALL SCORE	**56**	**25**
1) QUANTITIES & SITES	35	24
2) SECURITY & CONTROL MEASURES	78	=15
3) GLOBAL NORMS	40	29
4) DOMESTIC COMMITMENTS & CAPACITY	63	28
5) SOCIETAL FACTORS	45	=24

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Physical security during transport	100
Security personnel measures	100
Voluntary commitments	80
On-site physical protection	80
Response capabilities	67

AVERAGE (Scores between 34 and 66)

UNSCR 1540 implementation	60
International legal commitments	60
Group(s) interested in illicitly acquiring materials	50
Pervasiveness of corruption	50
Safeguards adoption and compliance	50
Domestic nuclear materials security legislation	50
Material production / elimination trends	50
Quantities of nuclear materials	50
Political stability	35

BELOW AVERAGE (Scores less than 34)

Sites and transportation	17
Nuclear security and materials transparency	0
Control and accounting procedures	0

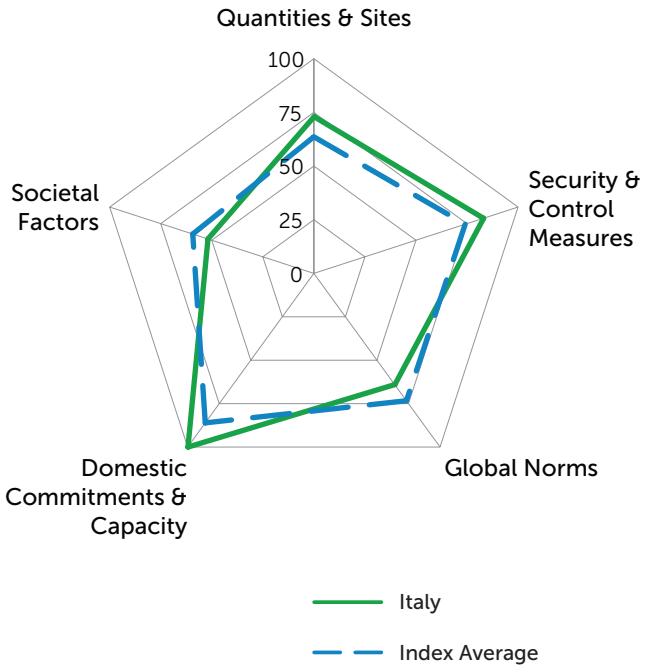
For more information, visit **www.ntiindex.org**

ITALY

	Score / 100	Rank / 32
OVERALL SCORE	**74**	**=16**
1) QUANTITIES & SITES	73	15
2) SECURITY & CONTROL MEASURES	83	10
3) GLOBAL NORMS	64	27
4) DOMESTIC COMMITMENTS & CAPACITY	100	=1
5) SOCIETAL FACTORS	52	21

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
Voluntary commitments	100
Physical security during transport	100
Control and accounting procedures	100
Material production / elimination trends	100
Political stability	80
On-site physical protection	80
Security personnel measures	75
Sites and transportation	67

AVERAGE (Scores between 34 and 66)

Quantities of nuclear materials	63
International legal commitments	60
Group(s) interested in illicitly acquiring materials	50
Nuclear security and materials transparency	50
Response capabilities	50

BELOW AVERAGE (Scores less than 34)

Pervasiveness of corruption	25

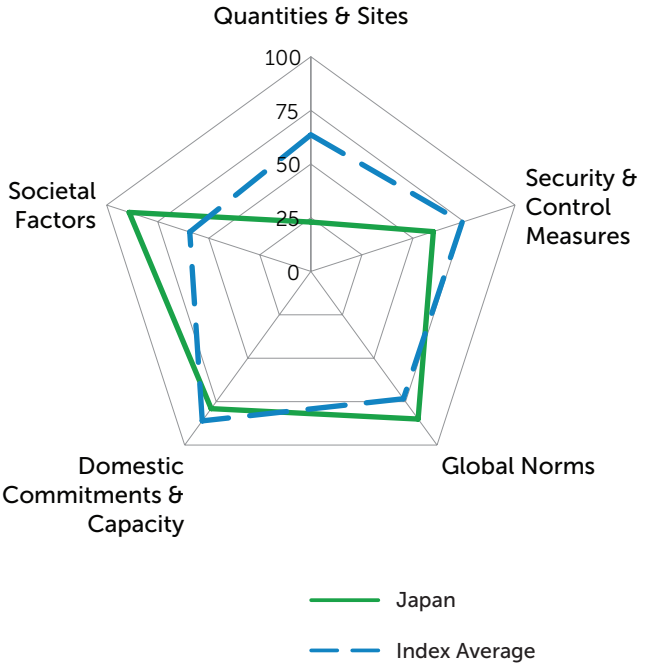
For more information, visit **www.ntiindex.org**

JAPAN

	Score / 100	Rank / 32
OVERALL SCORE	**68**	**23**
1) QUANTITIES & SITES	23	27
2) SECURITY & CONTROL MEASURES	60	=25
3) GLOBAL NORMS	85	=10
4) DOMESTIC COMMITMENTS & CAPACITY	79	27
5) SOCIETAL FACTORS	89	2

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Group(s) interested in illicitly acquiring materials	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
Voluntary commitments	100
Response capabilities	100
On-site physical protection	100
Political stability	95
Nuclear security and materials transparency	83
International legal commitments	80
Control and accounting procedures	80
Pervasiveness of corruption	75

AVERAGE (Scores between 34 and 66)

Physical security during transport	50

BELOW AVERAGE (Scores less than 34)

Sites and transportation	33
Quantities of nuclear materials	25
Independent regulatory agency	0
Security personnel measures	0
Material production / elimination trends	0

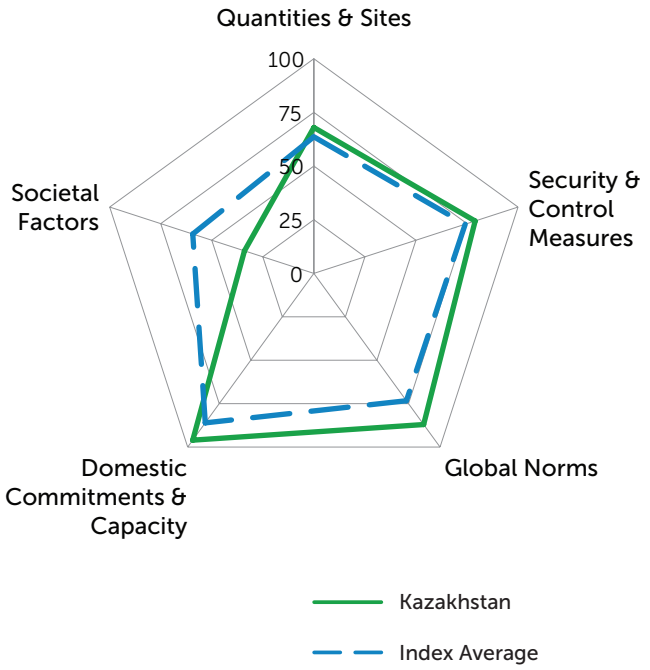
For more information, visit **www.ntiindex.org**

KAZAKHSTAN

	Score / 100	Rank / 32
OVERALL SCORE	**71**	**22**
1) QUANTITIES & SITES	68	=18
2) SECURITY & CONTROL MEASURES	79	=13
3) GLOBAL NORMS	87	=8
4) DOMESTIC COMMITMENTS & CAPACITY	96	=15
5) SOCIETAL FACTORS	34	27

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
Voluntary commitments	100
International legal commitments	100
Control and accounting procedures	100
On-site physical protection	100
Material production / elimination trends	100
Response capabilities	83
Sites and transportation	83
UNSCR 1540 implementation	80
Security personnel measures	75
Nuclear security and materials transparency	67

AVERAGE (Scores between 34 and 66)

Political stability	55
Group(s) interested in illicitly acquiring materials	50
Physical security during transport	50

BELOW AVERAGE (Scores less than 34)

Quantities of nuclear materials	25
Pervasiveness of corruption	0

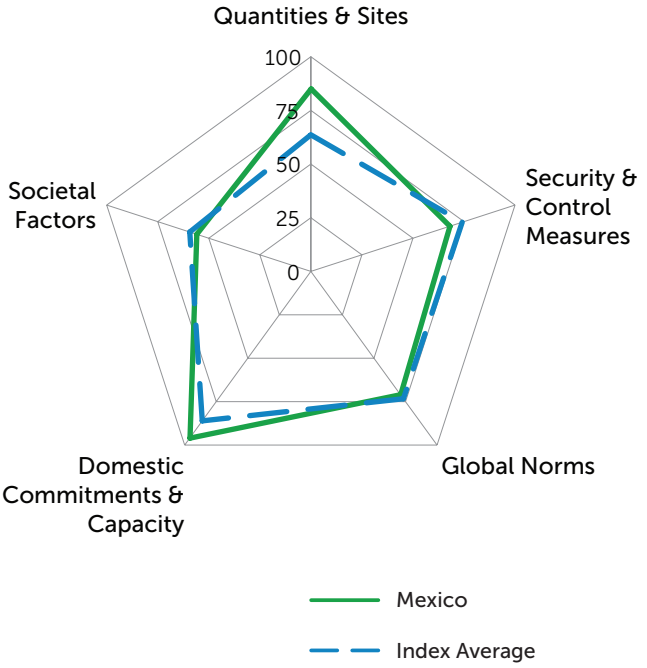
For more information, visit **www.ntiindex.org**

MEXICO

	Score / 100	Rank / 32
OVERALL SCORE	**73**	**=19**
1) QUANTITIES & SITES	85	=10
2) SECURITY & CONTROL MEASURES	68	23
3) GLOBAL NORMS	71	=20
4) DOMESTIC COMMITMENTS & CAPACITY	96	=15
5) SOCIETAL FACTORS	56	19

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Group(s) interested in illicitly acquiring materials	100
Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
Security personnel measures	100
On-site physical protection	100
Sites and transportation	100
Quantities of nuclear materials	88
Response capabilities	83
UNSCR 1540 implementation	80
International legal commitments	80
Nuclear security and materials transparency	67

AVERAGE (Scores between 34 and 66)

Voluntary commitments	60
Control and accounting procedures	60
Political stability	55
Material production / elimination trends	50

BELOW AVERAGE (Scores less than 34)

Pervasiveness of corruption	25
Physical security during transport	0

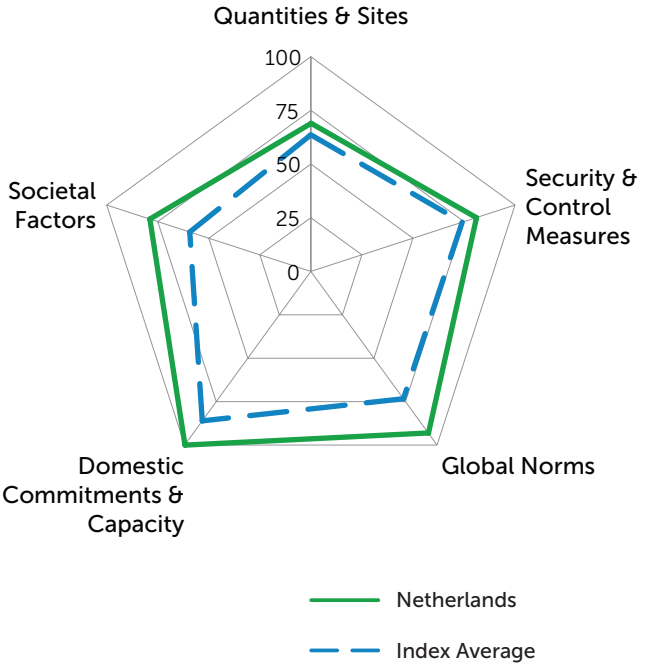
For more information, visit **www.ntiindex.org**

NETHERLANDS

	Score / 100	Rank / 32
OVERALL SCORE	**84**	**6**
1) QUANTITIES & SITES	69	17
2) SECURITY & CONTROL MEASURES	81	=11
3) GLOBAL NORMS	93	=3
4) DOMESTIC COMMITMENTS & CAPACITY	100	=1
5) SOCIETAL FACTORS	79	7

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Pervasiveness of corruption	100
Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
Voluntary commitments	100
International legal commitments	100
Response capabilities	100
Control and accounting procedures	100
On-site physical protection	100
Material production / elimination trends	100
Nuclear security and materials transparency	83
Political stability	80
Security personnel measures	75
Sites and transportation	67

AVERAGE (Scores between 34 and 66)

Group(s) interested in illicitly acquiring materials	50
Physical security during transport	50
Quantities of nuclear materials	50

BELOW AVERAGE (Scores less than 34)

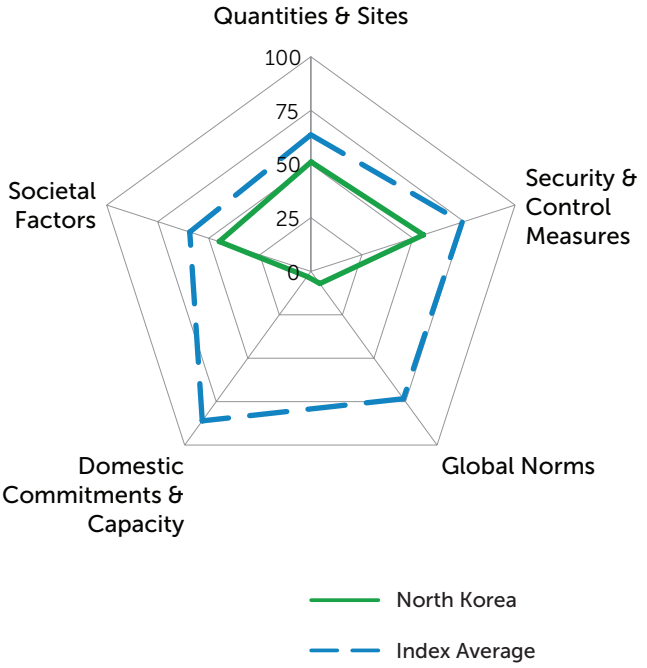
For more information, visit **www.ntiindex.org**

NORTH KOREA

	Score / 100	Rank / 32
OVERALL SCORE	**37**	**32**
1) QUANTITIES & SITES	51	22
2) SECURITY & CONTROL MEASURES	55	28
3) GLOBAL NORMS	7	32
4) DOMESTIC COMMITMENTS & CAPACITY	3	32
5) SOCIETAL FACTORS	45	=24

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Group(s) interested in illicitly acquiring materials	100
Security personnel measures	75
Quantities of nuclear materials	75
Response capabilities	67

AVERAGE (Scores between 34 and 66)

Physical security during transport	50
Material production / elimination trends	50
Control and accounting procedures	40
On-site physical protection	40

BELOW AVERAGE (Scores less than 34)

Sites and transportation	33
Pervasiveness of corruption	25
Political stability	25
Safeguards adoption and compliance	17
Nuclear security and materials transparency	17
Independent regulatory agency	0
Domestic nuclear materials security legislation	0
UNSCR 1540 implementation	0
Voluntary commitments	0
International legal commitments	0

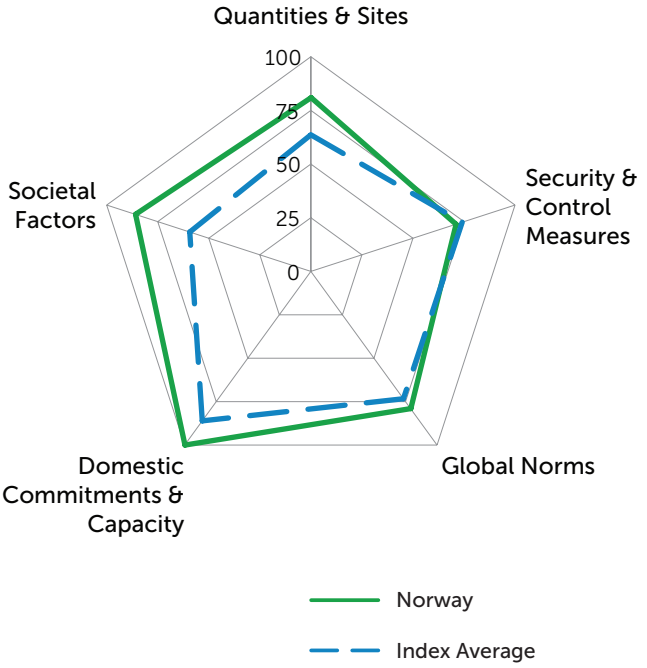
For more information, visit **www.ntiindex.org**

NORWAY

	Score / 100	Rank / 32
OVERALL SCORE	**82**	**=8**
1) QUANTITIES & SITES	81	13
2) SECURITY & CONTROL MEASURES	71	20
3) GLOBAL NORMS	79	=13
4) DOMESTIC COMMITMENTS & CAPACITY	100	=1
5) SOCIETAL FACTORS	86	3

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Pervasiveness of corruption	100
Political stability	100
Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
Voluntary commitments	100
Control and accounting procedures	100
On-site physical protection	100
Quantities of nuclear materials	100
Sites and transportation	83
International legal commitments	80
Nuclear security and materials transparency	67
Response capabilities	67

AVERAGE (Scores between 34 and 66)

Group(s) interested in illicitly acquiring materials	50
Physical security during transport	50
Security personnel measures	50
Material production / elimination trends	50

BELOW AVERAGE (Scores less than 34)

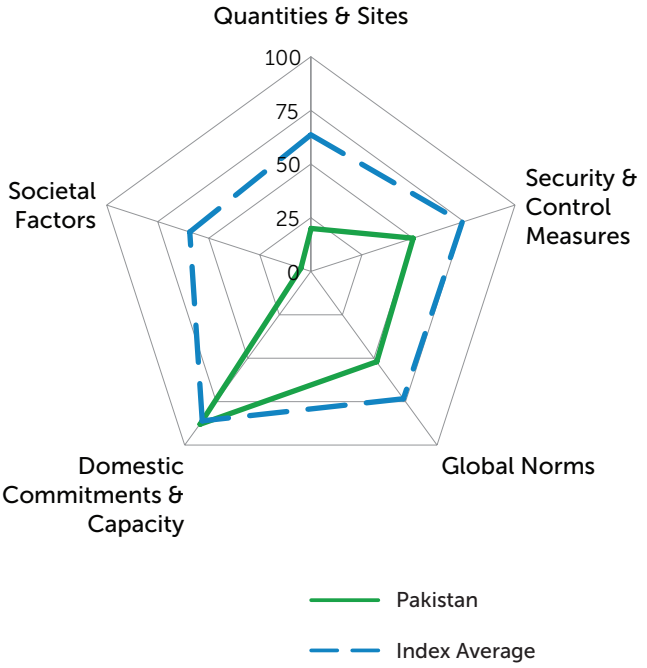
For more information, visit **www.ntiindex.org**

PAKISTAN

	Score / 100	Rank / 32
OVERALL SCORE	**41**	**31**
1) QUANTITIES & SITES	20	=30
2) SECURITY & CONTROL MEASURES	50	30
3) GLOBAL NORMS	52	28
4) DOMESTIC COMMITMENTS & CAPACITY	88	24
5) SOCIETAL FACTORS	5	32

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	80
Voluntary commitments	80
Security personnel measures	75
Response capabilities	67

AVERAGE (Scores between 34 and 66)

Control and accounting procedures	60
On-site physical protection	60
Safeguards adoption and compliance	50
Nuclear security and materials transparency	50
International legal commitments	40
Quantities of nuclear materials	38

BELOW AVERAGE (Scores less than 34)

Sites and transportation	17
Political stability	15
Group(s) interested in illicitly acquiring materials	0
Pervasiveness of corruption	0
Physical security during transport	0
Material production / elimination trends	0

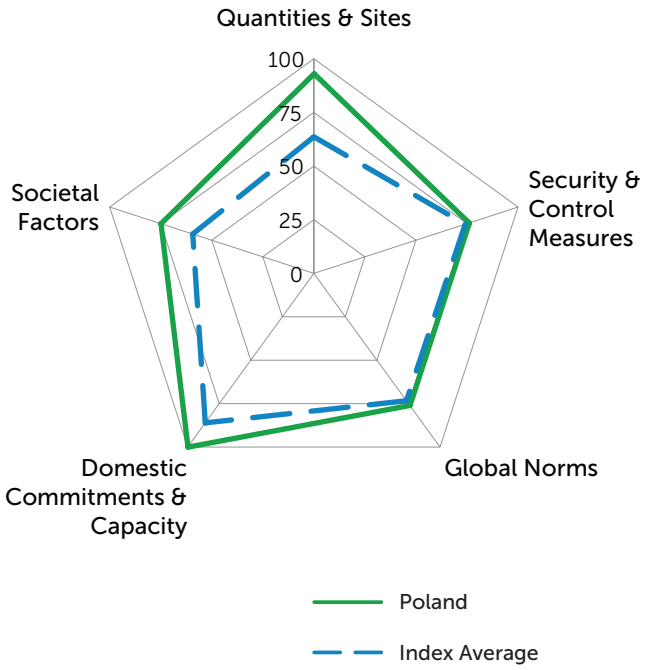
For more information, visit **www.ntiindex.org**

POLAND

	Score / 100	Rank / 32
OVERALL SCORE	**82**	**=8**
1) QUANTITIES & SITES	93	=4
2) SECURITY & CONTROL MEASURES	76	=17
3) GLOBAL NORMS	76	18
4) DOMESTIC COMMITMENTS & CAPACITY	100	=1
5) SOCIETAL FACTORS	75	9

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Group(s) interested in illicitly acquiring materials	100
Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
International legal commitments	100
Response capabilities	100
Control and accounting procedures	100
Material production / elimination trends	100
Quantities of nuclear materials	100
Sites and transportation	83
Political stability	80
Voluntary commitments	80
On-site physical protection	80
Security personnel measures	75

AVERAGE (Scores between 34 and 66)

Pervasiveness of corruption	50
Nuclear security and materials transparency	50
Physical security during transport	50

BELOW AVERAGE (Scores less than 34)

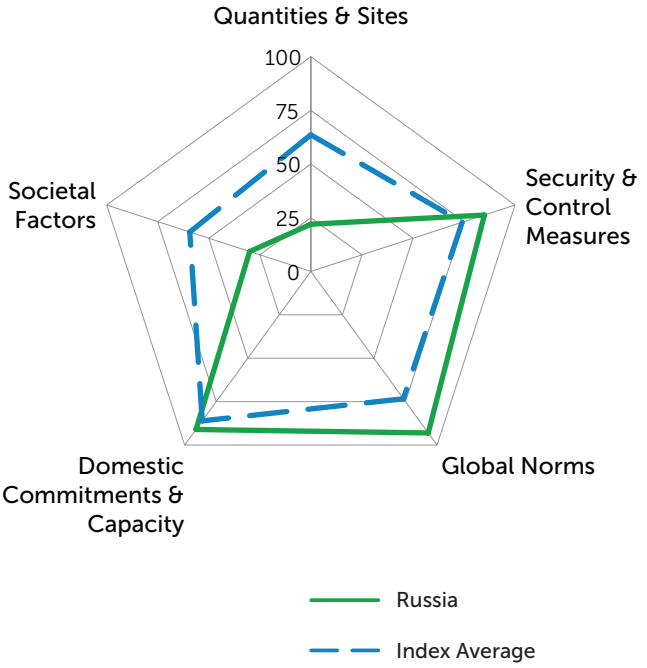
For more information, visit **www.ntiindex.org**

RUSSIA

	Score / 100	Rank / 32
OVERALL SCORE	**65**	**24**
1) QUANTITIES & SITES	22	=28
2) SECURITY & CONTROL MEASURES	85	=8
3) GLOBAL NORMS	93	=3
4) DOMESTIC COMMITMENTS & CAPACITY	91	23
5) SOCIETAL FACTORS	30	28

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Domestic nuclear materials security legislation	100
Voluntary commitments	100
International legal commitments	100
Security personnel measures	100
Control and accounting procedures	100
On-site physical protection	100
Material production / elimination trends	100
Nuclear security and materials transparency	83
Response capabilities	83
UNSCR 1540 implementation	80
Safeguards adoption and compliance	67

AVERAGE (Scores between 34 and 66)

Group(s) interested in illicitly acquiring materials	50
Physical security during transport	50
Political stability	45

BELOW AVERAGE (Scores less than 34)

Pervasiveness of corruption	0
Sites and transportation	0
Quantities of nuclear materials	0

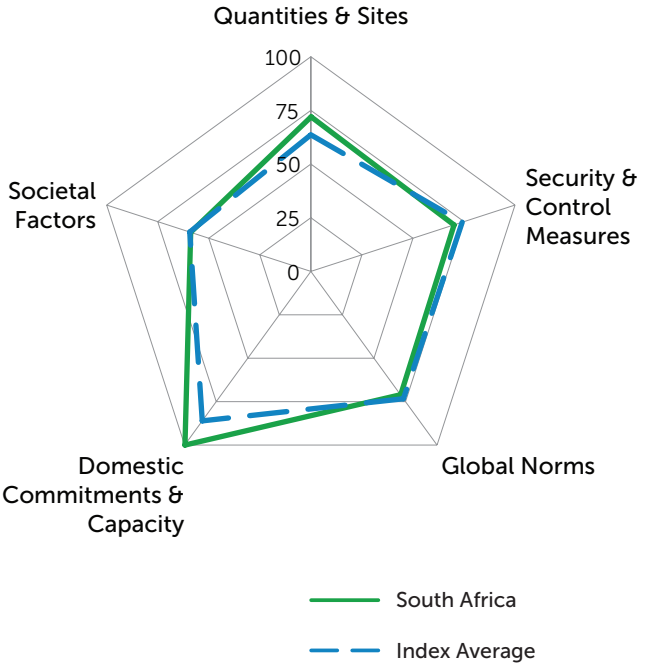
For more information, visit **www.ntiindex.org**

SOUTH AFRICA

	Score / 100	Rank / 32
OVERALL SCORE	**73**	**=19**
1) QUANTITIES & SITES	72	16
2) SECURITY & CONTROL MEASURES	70	21
3) GLOBAL NORMS	71	=20
4) DOMESTIC COMMITMENTS & CAPACITY	100	=1
5) SOCIETAL FACTORS	59	17

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
Response capabilities	100
Security personnel measures	100
Control and accounting procedures	100
Sites and transportation	100
International legal commitments	80
On-site physical protection	80
Political stability	75
Nuclear security and materials transparency	67

AVERAGE (Scores between 34 and 66)

Voluntary commitments	60
Group(s) interested in illicitly acquiring materials	50
Pervasiveness of corruption	50
Material production / elimination trends	50
Quantities of nuclear materials	50

BELOW AVERAGE (Scores less than 34)

Physical security during transport	0

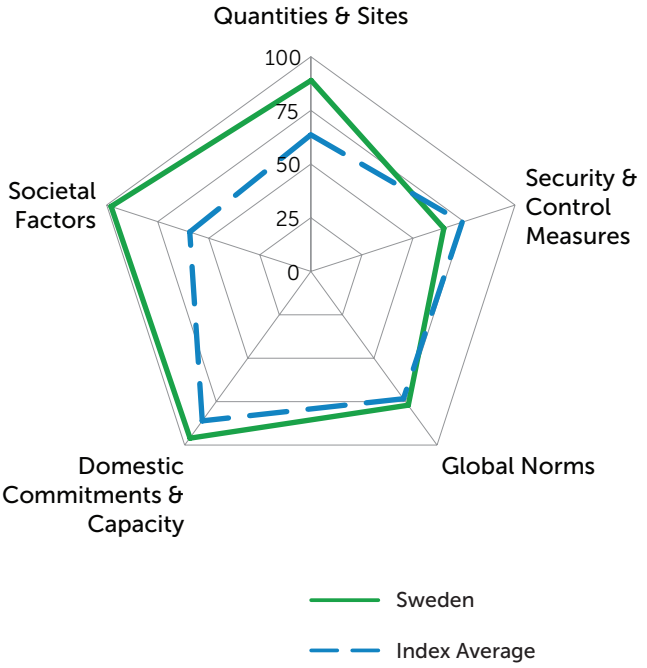
For more information, visit **www.ntiindex.org**

SWEDEN

	Score / 100	Rank / 32
OVERALL SCORE	**83**	**7**
1) QUANTITIES & SITES	89	7
2) SECURITY & CONTROL MEASURES	65	24
3) GLOBAL NORMS	77	=16
4) DOMESTIC COMMITMENTS & CAPACITY	96	=15
5) SOCIETAL FACTORS	98	1

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Group(s) interested in illicitly acquiring materials	100
Pervasiveness of corruption	100
Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
Voluntary commitments	100
Control and accounting procedures	100
On-site physical protection	100
Sites and transportation	100
Quantities of nuclear materials	100
Political stability	95
Nuclear security and materials transparency	83
UNSCR 1540 implementation	80
Security personnel measures	75
Response capabilities	67

AVERAGE (Scores between 34 and 66)

International legal commitments	60
Material production / elimination trends	50

BELOW AVERAGE (Scores less than 34)

Physical security during transport	0

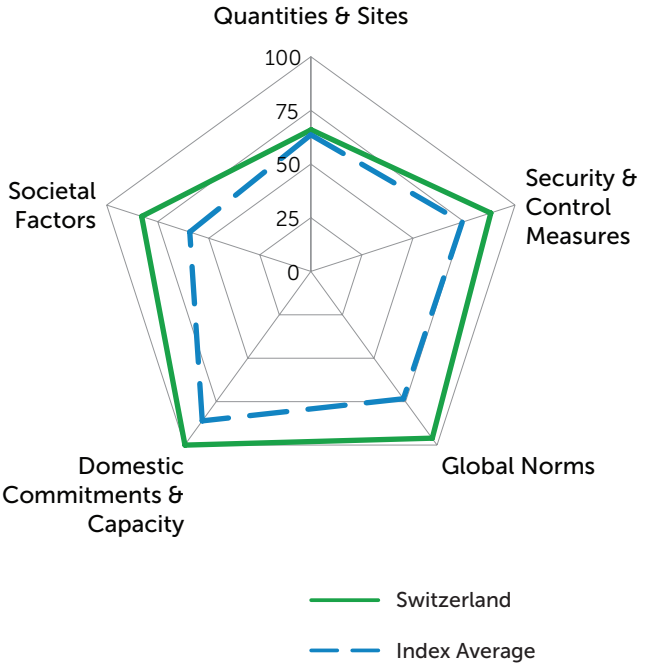
For more information, visit **www.ntiindex.org**

SWITZERLAND

	Score / 100	Rank / 32
OVERALL SCORE	**86**	**4**
1) QUANTITIES & SITES	66	20
2) SECURITY & CONTROL MEASURES	88	=6
3) GLOBAL NORMS	96	2
4) DOMESTIC COMMITMENTS & CAPACITY	100	=1
5) SOCIETAL FACTORS	83	4

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Pervasiveness of corruption	100
Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
Nuclear security and materials transparency	100
International legal commitments	100
Physical security during transport	100
Security personnel measures	100
Control and accounting procedures	100
Political stability	90
Response capabilities	83
Voluntary commitments	80
Quantities of nuclear materials	75
Sites and transportation	67

AVERAGE (Scores between 34 and 66)

On-site physical protection	60
Group(s) interested in illicitly acquiring materials	50
Material production / elimination trends	50

BELOW AVERAGE (Scores less than 34)

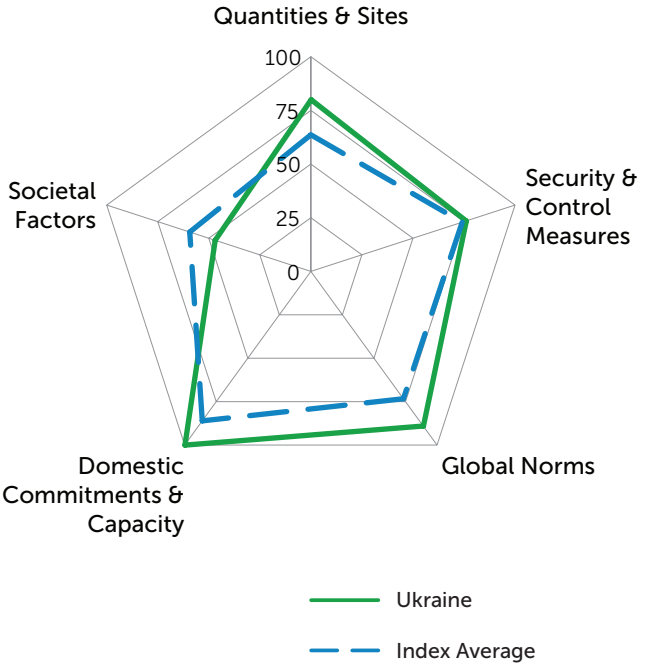
For more information, visit **www.ntiindex.org**

UKRAINE

	Score / 100	Rank / 32
OVERALL SCORE	**76**	**15**
1) QUANTITIES & SITES	80	14
2) SECURITY & CONTROL MEASURES	76	=17
3) GLOBAL NORMS	89	7
4) DOMESTIC COMMITMENTS & CAPACITY	100	=1
5) SOCIETAL FACTORS	47	23

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Group(s) interested in illicitly acquiring materials	100
Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
International legal commitments	100
Response capabilities	100
Control and accounting procedures	100
Material production / elimination trends	100
Nuclear security and materials transparency	83
Sites and transportation	83
Voluntary commitments	80
On-site physical protection	80
Security personnel measures	75

AVERAGE (Scores between 34 and 66)

Quantities of nuclear materials	63
Political stability	55
Physical security during transport	50

BELOW AVERAGE (Scores less than 34)

Pervasiveness of corruption	0

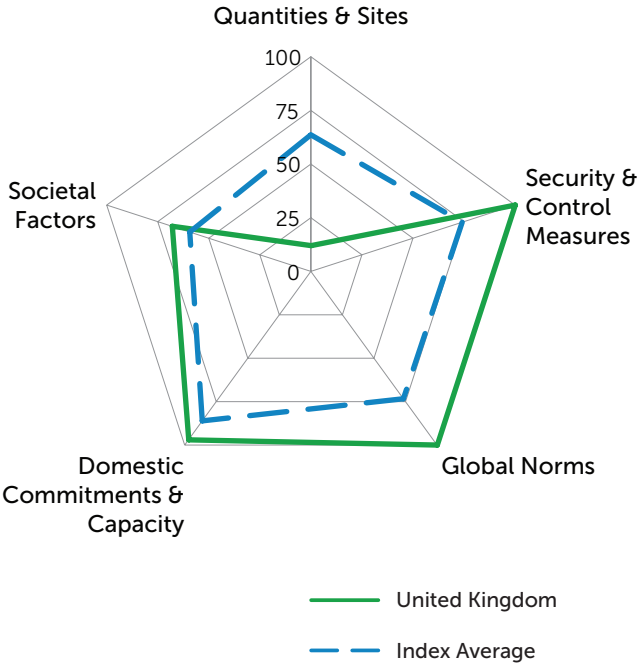
For more information, visit **www.ntiindex.org**

UNITED KINGDOM

	Score / 100	Rank / 32
OVERALL SCORE	**79**	**=10**
1) QUANTITIES & SITES	12	32
2) SECURITY & CONTROL MEASURES	100	=1
3) GLOBAL NORMS	100	1
4) DOMESTIC COMMITMENTS & CAPACITY	97	=13
5) SOCIETAL FACTORS	68	=15

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Domestic nuclear materials security legislation	100
UNSCR 1540 implementation	100
Nuclear security and materials transparency	100
Voluntary commitments	100
International legal commitments	100
Response capabilities	100
Physical security during transport	100
Security personnel measures	100
Control and accounting procedures	100
On-site physical protection	100
Safeguards adoption and compliance	83
Pervasiveness of corruption	75
Political stability	75

AVERAGE (Scores between 34 and 66)

Group(s) interested in illicitly acquiring materials	50

BELOW AVERAGE (Scores less than 34)

Sites and transportation	17
Quantities of nuclear materials	13
Material production / elimination trends	0

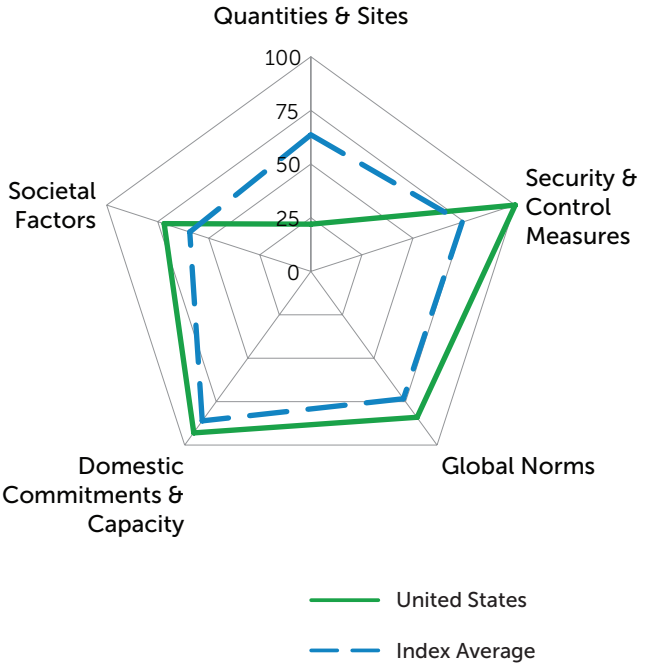
For more information, visit **www.ntiindex.org**

UNITED STATES

	Score / 100	Rank / 32
OVERALL SCORE	**78**	**=13**
1) QUANTITIES & SITES	22	=28
2) SECURITY & CONTROL MEASURES	100	=1
3) GLOBAL NORMS	84	12
4) DOMESTIC COMMITMENTS & CAPACITY	93	=20
5) SOCIETAL FACTORS	72	=11

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Domestic nuclear materials security legislation	100
Nuclear security and materials transparency	100
Voluntary commitments	100
Response capabilities	100
Physical security during transport	100
Security personnel measures	100
Control and accounting procedures	100
On-site physical protection	100
Material production / elimination trends	100
Political stability	85
Safeguards adoption and compliance	83
UNSCR 1540 implementation	80
Pervasiveness of corruption	75

AVERAGE (Scores between 34 and 66)

International legal commitments	60
Group(s) interested in illicitly acquiring materials	50

BELOW AVERAGE (Scores less than 34)

Sites and transportation	0
Quantities of nuclear materials	0

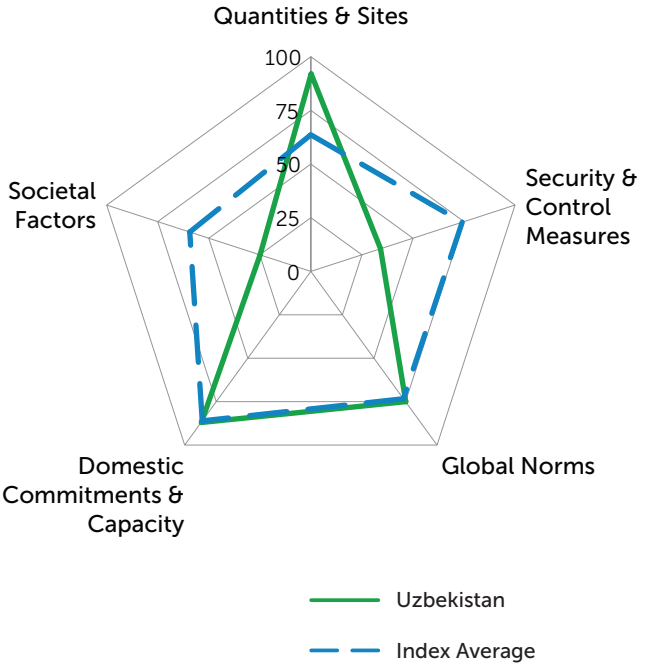
For more information, visit **www.ntiindex.org**

UZBEKISTAN

	Score / 100	Rank / 32
OVERALL SCORE	**55**	**26**
1) QUANTITIES & SITES	92	6
2) SECURITY & CONTROL MEASURES	34	32
3) GLOBAL NORMS	75	19
4) DOMESTIC COMMITMENTS & CAPACITY	87	25
5) SOCIETAL FACTORS	25	=30

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Independent regulatory agency	100
Safeguards adoption and compliance	100
Domestic nuclear materials security legislation	100
Material production / elimination trends	100
Sites and transportation	100
Voluntary commitments	80
International legal commitments	80
Control and accounting procedures	80
On-site physical protection	80
Quantities of nuclear materials	75
Nuclear security and materials transparency	67

AVERAGE (Scores between 34 and 66)

Group(s) interested in illicitly acquiring materials	50
UNSCR 1540 implementation	40

BELOW AVERAGE (Scores less than 34)

Response capabilities	33
Political stability	30
Pervasiveness of corruption	0
Physical security during transport	0
Security personnel measures	0

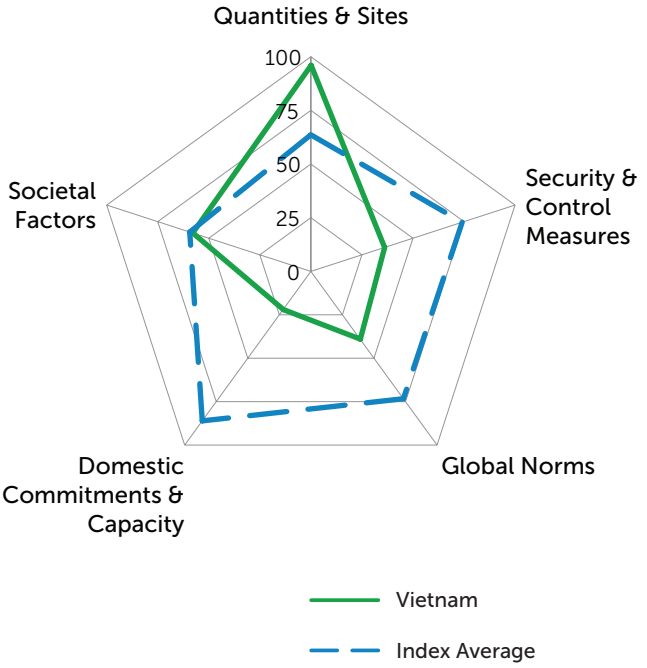
For more information, visit **www.ntiindex.org**

VIETNAM

	Score / 100	Rank / 32
OVERALL SCORE	**48**	**29**
1) QUANTITIES & SITES	96	=1
2) SECURITY & CONTROL MEASURES	36	31
3) GLOBAL NORMS	39	30
4) DOMESTIC COMMITMENTS & CAPACITY	22	31
5) SOCIETAL FACTORS	58	18

"=" denotes tied rank

Scored 0–100 where 100=most favorable nuclear materials security conditions



ABOVE AVERAGE (Scores greater than 66)

Group(s) interested in illicitly acquiring materials	100
Control and accounting procedures	100
Material production / elimination trends	100
Sites and transportation	100
Quantities of nuclear materials	88
Safeguards adoption and compliance	83
Nuclear security and materials transparency	67
Response capabilities	67

AVERAGE (Scores between 34 and 66)

Political stability	60
Voluntary commitments	60
On-site physical protection	60
UNSCR 1540 implementation	40

BELOW AVERAGE (Scores less than 34)

Pervasiveness of corruption	25
Independent regulatory agency	0
Domestic nuclear materials security legislation	0
International legal commitments	0
Physical security during transport	0
Security personnel measures	0

For more information, visit **www.ntiindex.org**

RESOURCES FOR COUNTRIES

Background on organizations that offer information or services to national governments, corporations, and individuals interested in nuclear materials security is provided in this appendix.

INTERNATIONAL ATOMIC ENERGY AGENCY
www.iaea.org

The International Atomic Energy Agency (IAEA) was founded in 1957, as part of the United Nations family, to advance the international interest in nuclear energy. To that end, the IAEA promotes safe, secure, and peaceful uses of nuclear science and technology. This mission is undertaken through three main areas of work: (a) safety and security, (b) science and technology, and (c) safeguards and verification.

As part of its safeguards and verification work, the IAEA applies a system of safeguards to verify that civilian nuclear material is not diverted to nuclear weapons. Many, though not all, civilian enrichment and reprocessing facilities are subject to safeguards administered either by the IAEA or by Euratom (which inspects all civilian material in European Union member states, including the large stocks of separated plutonium at UK and French reprocessing plants, representing the majority of the weapons-usable nuclear materials in the world that are under safeguards).

Most of the HEU and separated plutonium in the world is not subject to IAEA safeguards, because these materials are located in states with nuclear weapons (nuclear-weapon states or non-NPT parties) and these states are not subject to any commitment that the materials will not be used for nuclear weapons. Most such material is in military programs. In the case of civilian facilities and materials, IAEA safeguards are accepted only on a voluntary basis.

Although international safeguards were designed to provide regular inspections of civil nuclear facilities for purposes of detecting whether a participating country has diverted materials to nuclear weapons program, they are not, nor have they ever been, designed to assess physical security measures for the safeguarded facilities.

Separately, as part of its safety and security work, the IAEA also helps states strengthen their nuclear security to combat the risk of nuclear terrorism. The agency has developed widely accepted guidelines and procedures for dealing effectively with nuclear and radiological threats, which are disseminated through security guidance publications, advisory services, training courses, seminars and workshops, and international conferences.

The IAEA's security recommendations are developed through a consensus process that sometimes leads to non-specific security guidelines—in addition, implementation is voluntary. As such these recommendations are currently insufficient but could be used as the basis for future binding international standards for nuclear materials security.

Even the IAEA, the closest agency the world has to a global nuclear watchdog, does not have a comprehensive picture of nuclear material around the world. The information it does have is subject to rules of confidentiality, thereby making it difficult for the IAEA to publish any state-specific assessment of security conditions along the lines of this study. It is essential that the global community begin a dialogue about how to strengthen the IAEA's scope, authority, and budget to enable the agency to effectively oversee a comprehensive nuclear materials security and management system. For a discussion of recommendations for strengthening the IAEA's contribution to the global nuclear order, see the IAEA's "Report of the Commission of Eminent Persons on the Future of the Agency," which was issued on May 23, 2008.

The IAEA offers the following specific services to help enhance individual states' nuclear materials security:

- The **International Nuclear Security Advisory Service** (INSServ) helps to identify a nation's broad nuclear security requirements and the measures needed to meet them.
- The **International Physical Protection Advisory Service** (IPPAS) evaluates existing physical protection in member states, including legal and regulatory reviews and compliance.
- The **IAEA SSAC Advisory Service** (ISSAS) provides recommendations and suggestions for improvements to systems for accountancy and control of nuclear material.
- The **International Team of Experts** (ITE) assesses adherence to or implementation of international instruments relevant to enhancing protection against nuclear terrorism.
- The **Integrated Regulatory Review Service** (IRRS) improves the effectiveness of national regulatory bodies and domestic nuclear safety regulations.
- The **Integrated Nuclear Security Support Plan** (INSSP), tailored to each country, takes a holistic approach to nuclear security capacity building.

WORLD INSTITUTE FOR NUCLEAR SECURITY
www.wins.org

The World Institute of Nuclear Security (WINS) is an international organization that helps improve security of nuclear and high-hazard radioactive materials so that they are secure from unauthorized access, theft, sabotage, and diversion and cannot be used for terrorist or other nefarious purposes. WINS provides an international forum for those accountable for nuclear security to share and promote the implementation of best security practices. Specific services include the following:

- A series of *Best Practice Guides* on nuclear security topics, including security culture, performance metrics for security, security by design, guard-force recruitment, training, and deployment, and more
- Workshops to provide a venue for experts and security practitioners to meet, discuss issues, and share their experiences and lessons learned

UNITED NATIONS SECURITY COUNCIL RESOLUTION 1540 COMMITTEE
www.un.org/sc/1540

The United Nations Security Council Resolution (UNSCR) 1540 Committee evaluates compliance by United Nations member states to UNSCR 1540, which obliges member states to refrain from supporting, by any means, non-state actors from developing, acquiring, manufacturing, possessing, transporting, transferring, or using nuclear, chemical, or biological weapons and their delivery systems. The committee maintains a database of all domestic nuclear security legislation tied to UNSCR 1540 passed in member states.

GLOSSARY

Comprehensive Safeguards Agreements: Agreements made between the International Atomic Energy Agency (IAEA) and non-nuclear-weapon states (NNWSs) to enable the application of safeguards on all source and special fissionable material in all peaceful nuclear activities, as required by the Nuclear Non-Proliferation Treaty. The model text for these agreements is published as IAEA document INFCIRC 153.

Convention on the Physical Protection of Nuclear Material (CPPNM): Convention that obliges parties to ensure that during international transport across their territory, or on ships or aircraft under their jurisdiction, civil nuclear materials are protected according to agreed standards. The CPPNM also provides a framework for international cooperation on the protection, recovery, and return of stolen nuclear material and on the application of criminal sanctions against persons who commit crimes involving nuclear material. The CPPNM opened for signature on March 3, 1980, and entered into force on February 8, 1987.

Enrichment: The process of producing uranium with an increased concentration of the isotope U-235, relative to natural uranium. Natural uranium contains 0.7 percent U-235, whereas nuclear weapons typically require uranium enriched to very high levels. Nuclear power plant fuel typically uses uranium enriched to 3 to 5 percent U-235, material that is not sufficiently enriched to be used for nuclear weapons.

The European Atomic Energy Community (EURATOM): Euratom was established through the Euratom treaty in 1957 to coordinate the member states' research programs for the peaceful use of nuclear energy. Euratom helps to pool knowledge, infrastructure, and funding of nuclear energy and ensures the security of atomic energy supply within the framework of a centralized monitoring system.

G-8 Global Partnership: See Global Partnership against the Spread of Weapons and Materials of Mass Destruction.

Global Initiative to Combat Nuclear Terrorism (GICNT): Initiative that was announced by former U.S. president George W. Bush and former Russian president Vladimir Putin on July 15, 2006, in St. Petersburg, Russia. The GICNT's mission is to strengthen global capacity to prevent, detect, and respond to nuclear terrorism by conducting multilateral activities that strengthen the plans, policies, procedures, and interoperability of partner nations.

Global Partnership against the Spread of Weapons and Materials of Mass Destruction: Partnership initiated at the 2002 G-8 (Group of Eight) Summit in Kananaskis, Canada, to secure, dismantle, and dispose of weapons of mass destruction and related materials and facilities in the former Soviet Union. The Global Partnership against the Spread of Weapons and Materials of Mass Destruction (more commonly known as the G-8 Global Partnership) addresses nonproliferation, disarmament, counterterrorism, and nuclear safety issues through cooperative projects in such areas as the destruction of chemical weapons, the dismantlement of decommissioned nuclear submarines, the security and disposition of fissile materials, and the rechanneling of employment of former weapons scientists to peaceful civilian endeavors.

Highly enriched uranium (HEU): Uranium containing 20 percent or more of the isotope U-235.

International Atomic Energy Agency (IAEA): An autonomous international organization in the United Nations system that was founded in 1957 and is based in Vienna, Austria. The IAEA's mandate is the promotion of peaceful uses of nuclear energy, technical assistance in this area, and verification that nuclear materials and technology stay in peaceful use. Article III of the Nuclear Non-Proliferation Treaty (NPT) requires non-nuclear-weapon states party to the NPT to accept safeguards administered by the IAEA. The IAEA consists of three principal organs: the General Conference (of member states), the Board of Governors, and the Secretariat.

IAEA Additional Protocol: Also known as Information Circular 540 (INFCIRC 540). The protocol was approved by the International Atomic Energy Agency (IAEA) in May 1997, called the "Model Protocol Additional to the Agreement(s) between States(s) and the International Atomic Energy Agency for the Application of Safeguards." The IAEA Additional Protocol supplements the INFCIRC 153. It is a legal document granting the IAEA complementary inspection authority to that provided in underlying safeguards agreements. The principal aim is to enable the IAEA inspectorate to provide assurance about both declared and possible undeclared activities. Under the Additional Protocol, the IAEA is granted expanded rights of access to information and sites, as well as additional authority to use the most advanced technologies during the verification process.

IAEA Nuclear Security Fund: A voluntary funding mechanism, created in March 2002, to which member states of the International Atomic Energy Agency were called on to contribute. The Nuclear Security Fund was established to support, among other things, the implementation of nuclear security activities to prevent, detect, and respond to nuclear terrorism.

International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT): A convention adopted by the United Nations General Assembly in April 2005. The ICSANT opened for signature on September 14, 2005. It addresses the unlawful possession or use of nuclear devices or materials by non-state actors. The ICSANT calls on states to develop a legal framework criminalizing offenses related to nuclear terrorism, as well as for international cooperation in nuclear terrorism investigations and prosecutions.

Mixed Oxide (MOX) Fuel: A type of nuclear fuel used in light water reactors that consists of plutonium blended with uranium (natural, depleted, or reprocessed). The MOX process also enables disposition of military plutonium, with the resulting fuel usable for energy generation.

Non-Proliferation Treaty: Signed in 1968, the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) is the most widely adhered-to international security agreement. The "three pillars" of the NPT are nuclear disarmament, non-proliferation, and peaceful uses of nuclear energy. Article VI of the NPT commits states possessing nuclear weapons to negotiate in good faith toward halting the arms race and the complete elimination of nuclear weapons. The NPT stipulates that non-nuclear-weapons states will not seek to acquire nuclear weapons and will accept International Atomic Energy Agency safeguards on their nuclear activities, while nuclear weapons states commit not to transfer nuclear weapons to other states. All states have a right to the peaceful use of nuclear energy and should assist one another in its development. Initially of a 25-year duration, the NPT was extended indefinitely in 1995.

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

Physical Protection Convention: See Convention on the Physical Protection of Nuclear Material (CPPNM).

Plutonium: A transuranic element with atomic number 94 and symbol Pu. Plutonium is produced when uranium is irradiated in a reactor. It is used primarily in nuclear weapons and, along with uranium, in mixed-oxide (MOX) fuel. Plutonium-239, a fissile isotope, is the most suitable isotope for use in nuclear fuel and weapons.

Proliferation Security Initiative (PSI): A U.S.-led effort to prevent the proliferation of weapons of mass destruction, their delivery systems, and related materials through the use of information sharing and coordination of diplomatic and military efforts. The PSI was announced by former U.S. president George W. Bush in May 2003. Members of the initiative share 13 common principles, which guide PSI efforts.

Reprocessing: The chemical treatment of spent nuclear fuel to separate the remaining usable plutonium and uranium for refabrication into fuel or, alternatively, to extract the plutonium for use in nuclear weapons.

Safeguards: A system of accounting, containment, surveillance, and inspections aimed at verifying that states are in compliance with their treaty obligations concerning the supply, manufacture, and use of civil nuclear materials. The term frequently refers to the safeguards systems maintained by the International Atomic Energy Agency (IAEA) in all nuclear facilities in non-nuclear-weapon states that are parties to the Nuclear Non-Proliferation Treaty. IAEA safeguards aim to detect the diversion of a significant quantity of nuclear material in a timely manner.

Safeguards Agreements: See Comprehensive Safeguards Agreements and Voluntary Offer Safeguards Agreements for the two different kinds of safeguards agreements.

Second Line of Defense: A program of the U.S. Department of Energy's National Nuclear Security Administration that works to prevent illicit trafficking in nuclear and radiological materials. The program aims to secure international land borders, seaports, and airports that may be used as smuggling routes for materials needed for a nuclear device or a radiological dispersal device. Second Line of Defense has two main parts: the Core Program and the Megaports Initiative.

Spent Nuclear Fuel: Also known as irradiated nuclear fuel. Once irradiated, nuclear fuel is highly radioactive and extremely physically hot, necessitating special remote handling. Fuel is considered self-protecting if it is sufficiently radioactive that those who might seek to divert it would not be able to handle it directly without suffering acute radiation exposure.

United Nations Security Council Resolution 1540: A resolution passed by the United Nations Security Council in April 2004 that called on all states to refrain from supporting, by any means, non-state actors who attempt to acquire, use, or transfer chemical, biological, or nuclear weapons or their delivery systems. The resolution also called for a committee (known as the 1540 Committee) to report on the progress of the resolution and asked states to submit reports on steps taken toward conforming to the resolution. In April 2011, the Security Council voted to extend the mandate of the 1540 Committee for an additional 10 years.

Uranium: A naturally occurring radioactive element with atomic number 92 and symbol U. Natural uranium contains isotopes 234, 235, and 238. Uranium for use in nuclear reactors and in nuclear weapons is enriched in U-235.

Voluntary Offer Safeguards Agreements: Safeguards agreements made with the International Atomic Energy Agency (IAEA) by the nuclear-weapon states. The Nuclear Non-Proliferation Treaty does not require the nuclear-weapon states to conclude safeguards agreements, but all have voluntarily offered parts or all of their civilian nuclear fuel cycle for the application of IAEA safeguards, to allay concerns expressed by non-nuclear-weapon states that their nuclear industry could otherwise be at a commercial disadvantage.

World Institute for Nuclear Security (WINS): An international organization based in Vienna and founded in 2008 that is aimed at providing an international forum for those accountable for nuclear security to share and promote the implementation of best security practices.

2005 Amendment to the CPPNM: Amendment that extends the scope of the Convention on the Physical Protection of Nuclear Material (CPPNM) to cover the physical protection of nuclear material in domestic use, in storage, and during transport and of nuclear facilities used for peaceful purposes. It also provides for expanded cooperation between and among states with regard to implementing rapid measures to locate and recover stolen or smuggled nuclear material, mitigating any radiological consequences of sabotage, and preventing and combating related offenses.

A NOTE ON SOURCES

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