Assessing Progress on Nuclear Nonproliferation and Disarmament

UPDATED REPORT CARD: 2016–2019

Alicia Sanders-Zakre and Kelsey Davenport

An Arms Control Association Report

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About the Authors

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Acknowledgements

The authors would like to thank the Arms Control Association's Executive Director Daryl G. Kimball and Kingston Reif, director for disarmament and threat reduction policy, for their assistance in reviewing this report and Allen Harris for the report's layout and design. Special thanks to Elizabeth Philipp, Marcus Taylor and Peter Crail for their work on the first three versions of this report.

This report would not have been possible without the generous support of Arms Control Association members and donors. In particular, we wish to thank the Carnegie Corporation of New York, the John D. and Catherine T. McArthur Foundation, the Ploughshares Fund, and the Prospect Hill Foundation, which provide support for Arms Control Association research and public education programs on nuclear nonproliferation issues.

The authors are responsible for the content of the report, and the assessments do not necessarily represent the views of the Association's Board of Directors or its members.

Cover Photo

United Nations Secretary-General António Guterres addresses the Conference on Disarmament's High-Level Segment 2019, Palais des Nations, February 25, 2019. Photo credit: Antoine Tardy/United Nations

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ACRONYMS

ACA	Arms Control Association
ASEAN	Association of Southeast Asian Nations
CD	Conference on Disarmament
CPPNM	Convention on the Physical Protection of Nuclear Materials
CTBT	Comprehensive Test Ban Treaty
CTBTO	Comprehensive Test Ban Treaty Organization
CWC	Chemical Weapons Convention
EU	European Union
Euratom	European Atomic Energy Community
FMCT	Fissile Material Cutoff Treaty
GICNT	Global Initiative to Combat Nuclear Terrorism
HEU	highly enriched uranium
IAEA	International Atomic Energy Agency
ICBM	intercontinental ballistic missile
IMS	International Monitoring System
INFCIRC	IAEA Information Circular
INF Treaty	Intermediate-Range Nuclear Forces Treaty
IPNDV	International Partnership for Nuclear Disarmament Verification
IPPAS	International Physical Protection Advisory Service
IRBM	intermediate-range ballistic missile
ITDB	Incident and Trafficking Database
JCPOA	Joint Comprehensive Plan of Action
LEU	low-enriched uranium
LRSO	long-range standoff weapon
MEWMDFZ	Middle East Weapons-of-Mass-Destruction-Free Zone
MRBM	medium-range ballistic missile
MTCR	Missile Technology Control Regime
New START	New Strategic Arms Reduction Treaty
NPT	Nuclear Nonproliferation Treaty
NPR	Nuclear Posture Review
NSA	negative security assurance
NSG	Nuclear Suppliers Group
NWFZ	Nuclear-Weapon-Free Zone
OEG	Operational Experts Group of the Proliferation Security Initiative
PSI	Proliferation Security Initiative
SLBM	submarine-launched ballistic missile
SNSI	Strengthening Nuclear Security Implementation Initiative
SSBN	nuclear-powered ballistic missile submarine
TPNW	Treaty on the Prohibition of Nuclear Weapons
UN	United Nations
WMD	weapons of mass destruction
WMDFZ	Weapons-of-Mass-Destruction-Free Zone

Executive Summary

This report is the fourth in a series that assesses the extent to which 11 key states are fulfilling, promoting, or undermining 10 standards identified as critical elements of the nonproliferation and disarmament regime. Collectively, states fared worse on the majority of criteria when compared with the prior edition covering the 2013–2016 period. While there have been some modest gains on safeguards, there has been significant backsliding on the standards related to arms control and risk reduction. All states with nuclear weapons are taking steps to invest in new delivery systems and several are expanding the role of nuclear weapons in their security doctrines. These findings raise concerns that the risk of nuclear use is increasing and that critical nonproliferation and disarmament norms are eroding.

Specifically, the report finds:

- All of the states that possess nuclear weapons failed to make progress in reducing their nuclear arsenals over the course of this report. While Russia and the United States met their obligations under the New Strategic Arms Reduction Treaty to reduce deployed strategic warheads to 1,550 by February 2018, that treaty was negotiated in 2010 and there is no new agreement between Washington and Moscow to extend the treaty or pursue negotiations on additional limits. Additionally, the recognized nuclear-weapon states and states that developed nuclear weapons outside of the nuclear Nonproliferation Treaty (NPT) are investing in new nuclear weapons delivery systems, and several states—China, India, Pakistan, and North Korea—expanded their arsenals over the period assessed in this report.

- Of the 11 states assessed in this report, the overall grades for the United States and Russia dropped the most, from a B average in 2016 to a C+ average in 2019. The drop in grades is primarily due to Russia's violation of the 1987 Intermediate Range Nuclear Forces Treaty, and the U.S. decision to withdraw from that treaty in response. In addition, both states expanded the circumstances under which they would use nuclear weapons and are investing heavily in new, destabilizing delivery systems. Together, these developments increase the risk of nuclear use.

- Several states have taken actions that led to increased alert levels for their nuclear forces. India deployed sea-based nuclear warheads and Pakistan developed tactical nuclear-capable ballistic missiles, both of which require mating warheads to missiles, earning them lower grades in this edition of the report. Several of the nuclear-weapon states also earned lower grades for opposing UN resolutions calling for lower alert levels.

- States failed to strengthen negative security assurances during the timeframe of this report. While there is rhetorical support from some of the states assessed in this report for negotiating

legally binding negative security assurances, several states, including the United States, Russia, France, and India, have expanded the scenarios under which they would use nuclear weapons.

- Iran continues to abide by the 2015 multilateral nuclear deal, known as the Joint Comprehensive Plan of Action (JCPOA), despite the U.S. decision to withdraw from the agreement and reimpose sanctions on Tehran in May 2018. While Washington's violation of the JCPOA does not fall into any of the criteria that the United States is assessed on in the scope of this report, the decision weakens nonproliferation norms and undermines U.S. credibility in future negotiations.

- France and the United Kingdom each earned a B, the highest overall grades in this report card. The United Kingdom received a B+ in the prior version of this report, but the lack of support for additional nuclear force reductions and UN efforts to reduce alert levels for nuclear weapons caused its overall grade to drop.

- North Korea continues to fare the worst of the eleven states, earning an overall F grade for the fourth consecutive report card. However, North Korea did nominally improve on certain criteria in this edition of this report for announcing and abiding by a voluntary nuclear and long-range missile test moratorium.

- There were few changes from the 2016 report in the grades on banning nuclear testing. One notable exception is the U.S. grade, which sunk from a B+ to a C-, due in part to the Trump administration's stated intent not to seek ratification of the Comprehensive Test Ban Treaty.

- The grades for all eleven states in the category of ending fissile material production for nuclear weapons remained unchanged from the prior three versions of this report. The five nuclear-weapon states maintain de factor moratoriums on producing fissile material for weapons and while states outside of the NPT continue to do so. Additionally, the stalemate continues at the Conference on Disarmament over the negotiation of a Fissile Material Cutoff Treaty due to objections from Pakistan.

- With the exception of Iran, North Korea and Syria, the majority of states measured continue to adhere to strong nuclear security practices and measures to prevent the illicit trafficking of nuclear or missile-related materials. UN reports provide evidence that Iran, North Korea, and Syria all engaged in illicit trafficking of dual-use materials and technologies.

Introduction

The Arms Control Association has tracked the performance of 11 states across 10 key nonproliferation and disarmament standards since 2010. This is the fourth report in the series. The report's standards are based on the nuclear Nonproliferation Treaty (NPT), which defined the initial nonproliferation and disarmament obligations for states, as well as additional agreements, shared norms and other legal commitments that have fortified the NPT since its adoption in 1970.

The standards vary in specificity. While some standards, such as the requirement of International Atomic Energy Agency (IAEA) safeguards for non-nuclear-weapon states, are very specific, other standards, like reducing nuclear weapon alert levels, set expectations but do not outline specific actions.

Some international norms have changed since the report was first published in 2010 and the grading criteria in this report for two categories, nuclear force reductions and nuclear security, has been updated to reflect those changes, as indicated in the methodology component of this report.

States' responsibilities also differ based on their role in the international community. For example, states possessing nuclear weapons have a responsibility to reduce their arsenals and their nuclear alert levels, while non-nuclear-weapon states are required to maintain IAEA safeguards. States currently operating outside of the normative behavior associated with these standards must be engaged with and reintegrated into the regime.

The report explains how the grades were assigned, with a clear rubric outlining the specific actions associated with each grade-level for each standard. Although in some cases we had to recognize that the existing standards apply differently, or exclusively, to NPT nuclear-weapon or non-nuclear-weapon states, delineating the grading criteria clearly helped to ensure that the 11 states were being graded evenly, including those we chose to examine because they are, or were recently, in violation of their nonproliferation obligations.

This report divides states into three categories: the five nuclear-weapon states recognized in the NPT (China, France, Russia, the United Kingdom and the United States), nuclear-armed states not party to the treaty (India, Israel and Pakistan) and states of concern (Iran and Syria) and North Korea, which developed nuclear weapons in violation of its NPT commitments.

The five nuclear-weapon states are recognized as such under the NPT because they were the only states to have tested nuclear weapons prior to 1967. Article VI of the NPT obligates all states-parties to "pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament."

India, Israel and Pakistan did not sign the NPT and developed nuclear weapons. However, as UN member states, these countries bear a responsibility of preventing the proliferation of technology related to weapons of mass destruction (WMD).

Iran, North Korea and Syria are designated as "states of concern" because of their history of noncompliance with their NPT obligations. All three states have been subject to investigations by the IAEA for actions related to the development of a nuclear weapons program, although only North Korea possesses nuclear weapons.

North Korea's NPT status is disputed. It formally declared its withdrawal from the treaty in 2003, but some dispute the legal legitimacy of the withdrawal. North Korea has conducted six nuclear tests and is continuing to develop its nuclear and missile programs.

Iran and Syria are members of the NPT but past actions caused proliferation concern. Syria is still under investigation by the IAEA about compliance with its safeguards agreement. Little progress has been made in resolving IAEA concerns, particularly given the ongoing Syrian war.

In late 2015, the IAEA completed its investigation of possible military dimensions of the Iranian nuclear program. The IAEA assessed that Iran's past activities were indicative of a nuclear weapons program prior to 2003 but has found no evidence that those activities continued past 2009. Iran agreed to limit its nuclear program when it negotiated the 2015 Joint Comprehensive Plan of Action (JCPOA) with six other parties. The IAEA has assessed in over a dozen reports that Iran continues to implement its nuclear-related obligations under the JCPOA, including provisionally implementing an additional protocol safeguards agreement.

These 11 states are not the only ones that can and should uphold and strengthen the nonproliferation and disarmament regime. Notable actions and positions of additional states are indicated at the end of this report.

Our assessment does not attempt to rank the 10 major standards and obligations in order of importance or effectiveness. Instead, we have chosen to present our assessment of states' performance in each category and to provide an average grade for each state as a rough measure of overall performance for the past three years.

It is also important to note that our report card is intended to provide a snapshot of the key states' performance within the past three years on these 10 well-recognized standards. It does not attempt to grade them on their historical nuclear disarmament, nonproliferation, and nuclear security records. The standards and obligations that constitute the regime have changed over time, and such an approach would involve imposing a current-day assessment on decades of history.

Moreover, the standard established by the international community with respect to nuclear stockpile numbers is, as Article VI of the NPT states, "effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament," and this report grades movement in that direction, rather than overall numbers.

We hope this report will help provide a common basis for discussion about what more needs to be achieved by these and other states—individually and collectively—to further reduce and eventually eliminate the threats posed by nuclear weapons. Over time, such periodic report cards might also serve to track longer-term progress and trends.

Finally, it is important to note that the standards in our report do not necessarily represent our ideal strategy for addressing the nuclear weapons threat. In our view, the existing obligations and commitments in certain categories are clearly insufficient, and key states' performances are inadequate to the task. It is imperative that states agree to meet more stringent standards and more ambitious goals and that the pace of progress be accelerated. While we recognize the need for bolder action, this report does not recommend steps that should be taken to accelerate progress.

Thus, we present this report card as a tool for helping to hold states accountable to their existing nuclear disarmament, nonproliferation, and nuclear security commitments and to help guide effective action to prevent the further spread or use of these most deadly and destructive weapons.

Nuclear Nonproliferation Standards

Methodology

This report is the 2019 iteration of the Arms Control Association's Nuclear Nonproliferation and Disarmament Report Card. It updates report cards published in 2010, 2013, and 2016 using the same basic methodology. The reports use letter grades to assess how the 11 states examined fare in abiding by the 10 nuclear nonproliferation and disarmament standards. The specific criteria outlined for each grade (A through F) serves as a baseline for allocating that grade. In general, the criteria for each standard will be consistent with the following actions:

Grade	Criteria
A	State is currently adhering to or exceeding the international standard.
B	State has taken significant steps to adhere to the international standard.
C	State has taken limited or declaratory steps to adhere to the international standard.
D	State has taken no action to adhere to the international standard.
F	State has taken steps inconsistent with or has rejected the international standard.

In some cases, additional positive actions in line with the standard may receive a plus (+) rating, for example, if actions were taken that may also be consistent with some of the criteria associated with a higher grade, but the state did not meet the baseline criteria to qualify for it. States may receive a minus (–) for taking actions contrary to the standard, even if a state meets the baseline criteria for the grade it has received. Although many of the standards examined are inter-related, a state's grade in one standard does not generally affect its grade in another.

Overall grades for each state and each standard are then calculated on the basis of a standard grade-point average with the following numerical values corresponding to each grade:

GRADE	A	A–	B+	B	B–	C+	C	C–	D+	D	D–	F+	F
VALUE	4.0	3.7	3.3	3.0	2.7	2.3	2.0	1.7	1.3	1.0	0.7	0.3	0.0

However, in calculating the overall grade, states had to meet or exceed the numerical value associated with each grade. For example, to receive a "B" a state must have earned a 3.0 or higher. Values were not rounded up.

The assessments themselves are primarily informed by the declared policies the state itself, such as positions regarding treaties and agreements, multilateral arrangements it has joined, or domestic laws it has enacted to address nuclear nonproliferation issues. This report also draws on assessments by international organizations such as the IAEA and the committee established under UN Security Council Resolution 1540 (1540 Committee), unclassified intelligence judgments, and independent evaluations, as many of these standards involve issues

for which official state policies and practices are not a matter of public record.

The time frame covered in this report is July 2016 to March 2019. Because this report is measuring the status of the 10 standards for each of the 11 states, however, it is not limited to actions specifically taken during that time, but includes national positions still held or continuing efforts to implement disarmament and nonproliferation goals. In some cases, particularly with regard to suspicions or evidence of proliferation, the time frame expands into the past few years for two reasons: a pattern of proliferation is far more indicative of state intent or complicity than isolated examples in a given year, and evidence to substantiate such proliferation takes some time before it becomes public.

Standards and Criteria

Arms Control Association research staff has identified 10 core standards that the international community has recognized as critical elements of the nuclear nonproliferation and disarmament regime. Each of these standards plays an important role in addressing the complex nature of the threat from nuclear weapons, but they are not necessarily equally vital in the path toward a world without nuclear weapons. Moreover, these standards are not static. As international conditions change and efforts to address nuclear proliferation adapt to new circumstances, the criteria by which these standards may be measured will necessarily change, and new standards agreed by the international community may become part of the body of established norms.

In this report, criteria for two of the standards—nuclear force reductions and nuclear security—were updated to reflect changing norms. As such, there is not an exact comparison between grades on these criteria in past reports and the 2019 version. While updating the standards does make it more difficult to discern trends over time, the updates were necessary to reflect the changes to the nonproliferation and disarmament regime.

1. Banning Nuclear Testing

A ban on nuclear explosive testing initially was called for by Indian Prime Minister Jawaharlal Nehru in April 1954 and has since been among the world's top arms control priorities. Since 1963, nuclear tests have been prohibited in the atmosphere, underwater, in outer space, and in various nuclear-weapon-free zones (NWFZs). Yet, not until the Comprehensive Test Ban Treaty (CTBT) opened for signature in 1996 did the international community have an international legal instrument banning all nuclear test explosions.[1] The treaty, which has yet to enter into force despite being signed by 184 states, of which 168 have ratified, is intended to be a significant obstacle to additional states acquiring nuclear weapons and nuclear-armed states adding new nuclear weapons designs to their arsenals.

The 2000 NPT Review Conference recognized the CTBT's early entry into force as the first among 13 "practical steps" toward implementing Article VI of the NPT.[2] The UN Security Council reinforced this priority in Resolution 1887, which called on all states to refrain from testing and to sign and ratify the CTBT. The most recent NPT review conference final document in 2010, specifically called on all nuclear-weapon states to ratify the CTBT "with all expediency," noting that those states "have the special responsibility to encourage Annex 2 countries…to sign and ratify."[3] The 44 Annex 2 countries negotiated the text of the treaty, and ratification by all of these states is necessary for its entry into force. Eight Annex 2 states have yet to ratify the treaty.[4]

The UN General Assembly First Committee annually considers a resolution highlighting the value of the treaty and urging states that have yet to ratify the CTBT to do so. In addition, in September 2016, the UN Security Council passed Resolution 2310, with 14 votes in favor and one abstention. Resolution 2310 stressed the "vital importance and urgency" of achieving entry into force, and urged all states not yet party to the treaty to ratify it. Resolution 2310 also formally recognizes the September 15, 2016 statement from the permanent five members for the council expressing the view that any nuclear test explosion would "defeat the object and purpose of the treaty."

A country's commitment to banning nuclear testing is assessed if it has adopted the CTBT. The assessment also takes into account whether countries that possess nuclear weapons act consistently with the treaty's aims by declaring a moratorium on

Grade	Criteria: Banning Nuclear Testing	
A	State has signed and ratified the CTBT.	
B	*If in possession of nuclear weapons:* State has signed the CTBT, indicated its intent to ratify the treaty, and declared a testing moratorium.	*If not in possession of nuclear weapons:* State has signed the CTBT and signed and ratified the NPT.
C	*If in possession of nuclear weapons:* State has signed the CTBT and declared a testing moratorium, but has indicated that it does not currently intend to ratify the treaty.	*If not in possession of nuclear weapons:* State has signed and ratified the NPT.
D	State is not a member of the NPT and has not signed the CTBT.	
F	State has carried out a nuclear test in the time frame of this report or has declared its intent to carry out nuclear testing.	

nuclear testing. It will also be noted if a country strengthens or increases engagement with the CTBT, such as bringing international monitoring stations online during the timeframe covered by the report.

2. Ending the Production of Fissile Material for Weapons

Proposals to control the production of fissile materials (highly enriched uranium [HEU] and plutonium) for weapons purposes have been offered since the mid-1940s. In 1993 the UN General Assembly passed a resolution calling for a "non-discriminatory, multilateral and internationally and effectively verifiable treaty" prohibiting the production of fissile material for nuclear weapons and other explosive devices.[5] Such a ban would, at a minimum, cap the amount of material available to make nuclear weapons.

The Geneva-based Conference on Disarmament (CD) reached consensus on a negotiating mandate for a fissile material cutoff treaty (FMCT) in 1995 (the so-called Shannon Mandate), but procedural and substantive divisions within the 65-member body have prevented progress in negotiating such a treaty. UN Security Council Resolution 1887 calls on the CD to negotiate an FMCT and requests all states to "cooperate in guiding" the CD to an "early commencement of substantive work."

At the 2010 NPT Review Conference, states-parties similarly issued a call to "immediately begin" such negotiations and the UN General Assembly typically considers a resolution urging the CD to agree on a program work that includes commencing negotiations on an FMCT. Whether states have earnestly pursued negotiations on an FMCT or obstructed efforts to complete such an agreement is one measure of their commitment to this long-standing goal of the international community.

This report also considers whether a state has pursued such negotiations in line with the Shannon Mandate as agreed in 1995 and taken steps to unilaterally halt fissile material production. Although all CD members will have a role to play in the negotiation of an FMCT, this standard is primarily relevant to those states that have produced fissile material for nuclear weapons and therefore will only apply to them.

3. Nuclear Weapons Alert Levels

States deploy their nuclear weapons in various stages of operational readiness. Some governments field warheads that are primed to launch in a matter of minutes, a status commonly referred to as "prompt-launch" or "high alert." Other governments have put in place mechanisms to extend the time frame to launch to a period of days, including "de-mating" or storing warheads separately from delivery vehicles.

Many observers worry that weapons configured for rapid firing pose greater risks of accidental, miscalculated, or hasty use. An overwhelming majority of states called on nuclear-armed countries to remove their weapons from high alert and take steps to reduce their nuclear weapons readiness levels, meaning they should extend the amount of time needed to fire their systems.[6] NPT states-parties agreed at the 2000 NPT Review Conference to pursue "concrete agreed measures" toward that end and, in 2010, called on the nuclear-weapon states to "consider the legitimate interest of non-nuclear-weapon states in further reducing the operational status of nuclear weapons systems in ways that promote international stability and security." Widespread calls for further de-alerting are complicated by a lack of agreement on specific steps

Grade	Criteria: Ending Fissile Material Production for Weapons
A	State has supported negotiations on an FMCT consistent with the Shannon Mandate and has formally pledged not to produce fissile material for nuclear weapons.
B	State has supported negotiations on an FMCT consistent with the Shannon Mandate and is not currently known to be producing fissile material for nuclear weapons.
C	State has expressed general support for an FMCT, but has opposed aspects of the Shannon Mandate.
D	State has expressed opposition to negotiating an FMCT or blocked CD consensus to begin FMCT negotiations.
F	State continues to produce or is believed to be producing fissile material for nuclear weapons or has not ruled out such production.

Grade	Criteria: Reducing Nuclear Weapons Alert Levels
A	State is believed to maintain its warheads off alert, with its nuclear weapons de-mated from their delivery systems, and has measures in place to ensure proper authorization for their use.
B	State is believed to institute procedural measures to delay the time frame to employ nuclear weapons for an extended period and ensure proper authorization for their use.
C	State maintains nuclear warheads that are on high alert and has measures in place to ensure proper authorization for their use.
D	State is not known to have measures in place to ensure proper authorization for the use of nuclear weapons.
F	Nuclear warheads are believed to be targeted at another country.

toward that goal and a lack of transparency on the part of nuclear-armed states regarding the time frame needed to employ nuclear weapons.

To measure adherence to this standard, this report will consider the extent to which a state has physical and procedural measures in place to delay the time frame to launch nuclear weapons and ensure proper authorization for their use. This assessment will also take into account whether a country's nuclear weapons are believed to be targeted against another state, a practice that the NPT nuclear-weapon states halted in the 1990s to prevent their accidental use against another country and which was welcomed by UN General Assembly resolutions.

The UN General Assembly typically considers two resolutions related to alert levels, one on reducing readiness that calls for states to take steps to ensure all nuclear weapons are removed from high alert status, and one on reducing nuclear danger that calls on states to review nuclear doctrines and take steps to de-alert and de-target nuclear weapons. State support for these resolutions is taken into account.

4. Nuclear Force Reductions

As part of the NPT, nuclear-weapon states committed to make progress toward ending the nuclear arms race and engaging in efforts toward nuclear disarmament. Non-nuclear-weapon states understood those commitments to be essential part of their bargain to forswear nuclear arms and their decision to agree to extend the treaty indefinitely in 1995.[7] At the 2000 NPT Review Conference, states-parties agreed that nuclear-weapon states should carry out further reductions of strategic and nonstrategic nuclear arms. The states-parties also agreed that the "principle of irreversibility" should apply to those reductions and that they be carried out in a transparent manner to enhance confidence and prevent cheating. Furthermore, in one of the action steps outlined in the 2010 NPT Review Conference Final Document, the nuclear-weapon states committed to "further efforts to reduce and ultimately eliminate all types of nuclear weapons, deployed and non-deployed, including through unilateral, bilateral, regional, and multilateral measures."[8]

Grade	Criteria: Nuclear Force Reductions
A	State has taken steps in the time frame of this report to reduce the number of nuclear weapons in its possession. Nuclear weapons reductions were carried out under formal verification measures, the warheads were verifiably dismantled and state is fully complying with any obligations to reduce its nuclear arsenal.
B	State has taken steps in the time frame of this report to reduce the number of nuclear weapons in its possession. Nuclear weapons reductions were carried out under formal verification measures, but warheads were not verifiably dismantled and state is fully complying with any obligations to reduce its nuclear arsenal.
C	State has taken steps in the time frame of this report to reduce the number of nuclear weapons in its possession. Nuclear weapons reductions were not carried out under formal verification measures and state is fully complying with any obligations to reduce its nuclear arsenal.
D	State is not known to have taken steps in the time frame of this report to reduce the number of nuclear weapons in its possession, or state has violated or withdrawn from its agreed-upon force reductions.
F	State has continued to increase the size of its nuclear arsenal.

This assessment will take into account declared and reported steps taken by states to reduce their nuclear arsenals, including nonstrategic weapons where applicable. It will consider whether such reductions are carried out in a manner that is transparent and irreversible, including the existence of formal verification measures, and whether warheads removed from deployment are dismantled. This standard will measure only ongoing efforts to reduce nuclear arsenals, and it does not take into account the existing size of those arsenals. This is not intended to prejudice those that have undertaken reductions to lower levels but to encourage the continued pursuit of verifiable and irreversible reductions urged by the international community.

Prior versions of this report did not take into account a country's compliance with its nuclear reduction commitments. In this version, the criteria have been revised to reflect the consequences of violating or withdrawing from prior commitments to reduce nuclear arsenals.

All of the states possessing nuclear weapons covered in this report are investing in new and updated nuclear weapons delivery systems. This section will also report on and assess the impact of new capabilities.

Each state's position on the Treaty on the Prohibition of Nuclear Weapons (TPNW), negotiated in 2017, will be noted in the report, but not taken into account in the grading as the TPNW is not yet an established standard for measuring disarmament commitments. The TPNW may be included in the grading process in future reports.

5. Negative Security Assurances

A negative security assurance (NSA) is a pledge by nuclear-weapon states not to use or threaten to use nuclear weapons against non-nuclear-weapon states. It is intended to reinforce nonproliferation by reassuring states that have foresworn nuclear weapons that they are not at risk of nuclear attack. The value of NSAs was recognized in Resolution 1887, which "affirms that such security assurances strengthen the nuclear

Grade	Criteria: Negative Security Assurances
A	State has issued legally binding NSAs.
B	State has issued non-legally binding NSAs.
C	State has issued non-legally binding NSAs, but leaves open the possibility of using nuclear weapons in response to non-nuclear attacks or threats from states that do not possess nuclear weapons.
D	State has not issued any NSAs.
F	State has openly threatened non-nuclear-weapon states with nuclear weapons use.

nonproliferation regime." In 1995 the UN Security Council adopted Resolution 984, recognizing unilateral NSAs by the five nuclear-weapon states. Although the five countries have reiterated these pledges, they are not legally binding. Moreover, some nuclear-weapon states have indicated that the use of nuclear weapons would be considered against non-nuclear-weapon states under certain circumstances. Still, the principle behind such assurances has been reaffirmed in NPT review conference documents, including in 1995, 2000, and 2010. The UN General Assembly also typically passes a resolution calling for effective international arrangements to assure non-nuclear-weapon states that nuclear-weapon states will not use, or threaten to use, nuclear weapons against them.

This report will assess whether nuclear-armed states have issued NSA pledges, the binding nature of those pledges, and whether they have reserved the right to use nuclear weapons in response to conventional weapons threats from states that do not possess nuclear weapons. Because states that have adopted a no-first-use policy have indicated that they would only use nuclear weapons in response to a nuclear attack, they will be considered to have exhibited a very strong commitment to this standard.

6. Nuclear-Weapon-Free Zones

The concept of creating zones free of nuclear weapons began in the 1950s and has since become recognized by the international community as an important nuclear nonproliferation mechanism.[9] The potential for such regional efforts is recognized in Article VII of the NPT, which states that the treaty does not affect the right of states to conclude agreements "to assure the total absence of nuclear weapons in their respective territories." NPT review conference documents since the treaty's entry into force have endorsed the adoption of such zones, including the 1995 Resolution on the Middle East calling for the creation of a zone free of nuclear weapons and other weapons of mass destruction in that region. That decision was integral to the indefinite extension of the treaty. At the 2010 NPT Review Conference, states-parties decided that a conference on a Middle East WMD-free zone (WMDFZ) should be convened by 2012, but the mandate for pursing such a conference lapsed in 2015 when the NPT review conference failed to reach consensus on a final document.

In the 2000 and 2010 NPT review conferences, states-parties agreed that the establishment of NWFZs "enhances global and regional peace and security, strengthens the nuclear nonproliferation regime and contributes towards realizing the objectives of nuclear disarmament." States-parties to NWFZ treaties have convened three conferences in 2005, 2010, and 2015 to discuss the implementation of treaties establishing zones and foster cooperation between zones. A fourth conference is being proposed for 2020.

Outside the NPT, the UN General Assembly has adopted annual resolutions promoting the establishment of specific zones and the creation of such zones in general. Separate resolutions calling for a

Grade	Criteria: Nuclear-Weapon-Free Zones	
A	As an NPT nuclear-weapon state, the country has ratified the relevant protocols of all established NWFZs.	As an NPT non-nuclear-weapon state, the country has either signed and ratified NWFZ in its region or has declared itself NWFZ.
B	As an NPT nuclear-weapon state, the country has ratified the relevant protocols of at least three of the established NWFZs.	As an NPT non-nuclear-weapon state, the country has signed an established NWFZ in its region, taken steps to implement one, or proposed an NWFZ in its region to include multiple countries or as a single state.
C	As an NPT nuclear-weapon state, the country has ratified the relevant protocols of at least one of the established NWFZs.	As an NPT non-nuclear-weapon state, the country has supported the establishment of NWFZs in general, but has taken no steps to conclude or abide by NWFZ arrangements itself.
D	As an NPT nuclear-weapon state, the country has ratified no relevant protocols to the established NWFZs.	As an NPT non-nuclear-weapon state, the country has taken no steps to support the establishment of NWFZs in any location.
F	The state has opposed formal proposals to establish an NWFZ in its region or elsewhere or violated an existing NWFZ arrangement.	

NWFZ and a WMDFZ in the Middle East are generally introduced on an annual basis, although the text, particularly on the WMDFZ, varies from year to year.

Moreover, the international community has recognized that such zones need not all be regional in character. UN General Assembly Resolution 3261 F, adopted in 1974, notes that such zones can also be formed by small groups of states and "even individual countries."

The creation of these zones is not limited to non-nuclear-weapon states. Each established zone includes protocols to be agreed upon by the five nuclear-weapon states in which they pledge not to use, deploy, transfer, or test nuclear weapons anywhere in the region. Such a provision is intended to reinforce the principle that nuclear weapons would be entirely absent from such a zone and to serve as an incentive for states to create a zone in order to be protected from a nuclear attack. Periodically, the UN General Assembly considers resolutions on specific zones that call on nuclear-weapon states that have not yet done so to ratify the protocols to the zones. These resolutions are generally adopted without a vote.

In recognition of the divergent responsibilities for nuclear-weapon and non-nuclear-weapon states with regard to NWFZs, this standard will be measured by the extent to which non-nuclear-weapon states actively pursue such arrangements and nuclear-weapon states agree to the relevant protocols. The nuclear-armed states that never signed the NPT are still considered non-nuclear-weapon states for the purpose of this criterion.

7. IAEA Safeguards

The NPT requires non-nuclear-weapon states to apply IAEA safeguards to all of the nuclear facilities and activities where source or special fissionable material exists. Known as full-scope safeguards because they apply to a state's entire peaceful nuclear complex, these measures have become a condition for trade in nuclear materials and technology.[10] The IAEA General Conference has frequently adopted resolutions calling on all non-nuclear-weapon states to adopt full-scope safeguards, and the UN Security Council issued a similar call in Resolution 1887.[11]

Since the early 1990s, however, the international community has recognized that full-scope safeguards are insufficient for providing assurance against undeclared nuclear activities in a state. The failure of traditional IAEA safeguards to detect illicit nuclear activities in Iraq, as well as problems in verifying North Korea's nuclear program, prompted the strengthening of agency safeguards and the development of the 1997 Model Additional Protocol. That protocol, which states adopt as an enhancement to their safeguards agreements, provides the agency with greater authority and tools to investigate all of a state's nuclear activities. The protocol is currently a voluntary measure, but the agency has maintained that, without it, "the IAEA cannot provide credible assurance about the absence of nuclear material or activity."[12] The final consensus document of the 2000 NPT Review Conference encouraged all states-parties to adopt additional protocols "as soon as possible," a call NPT members reiterated in 2010. UN Security Council Resolution 1887 calls on all states to implement the protocol, "which together with comprehensive safeguards agreements constitute essential elements of the IAEA safeguards system." This report will consider the extent to which non-nuclear-weapon states, whether or not members of the NPT, have adopted safeguards. Several states not party to the NPT have concluded safeguards agreements with the IAEA. These agreements are based on INFCIRC/66, which is less comprehensive than the full-scope safeguards agreements that the IAEA concludes with NPT member states, known as INFCIRC/153.

Grade	Criteria: IAEA Safeguards
A	State has full-scope IAEA safeguards and an additional protocol in force.
B	State has full-scope IAEA safeguards in force.
C	State has an INFCIRC/66-type safeguards agreement in force.
D	State has not concluded any safeguards agreement with the IAEA.
F	State has been found in the time frame of this report to be in non-compliance with its safeguards agreement or to have otherwise failed to cooperate with IAEA inspections.

Although all nuclear-weapon states have adopted voluntary safeguards on their civilian nuclear activities, they are not applicable to the assessment in this report because these confidence building measures do not perform the same nonproliferation function as non-nuclear-weapon state safeguards. However, that does not diminish their importance for promoting the universalization of IAEA safeguards and the Model Additional Protocol in particular.

8. Nuclear Weapons-Related Export Controls

In recent years, there has been increasing international recognition of the important role that export controls play in preventing state and nonstate proliferators from acquiring and sharing goods and technology relevant to nuclear weapons development and the means to deliver them. Controls have traditionally been implemented on an informal basis by groups of like-minded states that supply such technologies, particularly the 46-member Nuclear Suppliers Group (NSG) and the 34-member Missile Technology Control Regime (MTCR).[13] NSG member states voluntarily adhere to consensus guidelines, which regulate the export of nuclear materials

Grade	Criteria: Nuclear Weapons-Related Export Controls
A	State is a member of the NSG and MTCR or an adherent to their guidelines.
B	State is a member of the NSG or MTCR or an adherent to their guidelines.
C	State has taken some steps to implement export controls on goods and technology relevant to nuclear weapons development and their means of delivery on a national basis or is an NSG or MTCR member that has failed to fully enforce its export control commitments.
D	State has taken no known steps to implement export controls on goods and technology relevant to nuclear weapons development and their means of delivery.
F	State is known or widely suspected to be engaged in ongoing efforts to export goods or technology in violation of NSG or MTCR guidelines, import or export materials in violation of UN Security Council nonproliferation resolutions, or breach the export control laws of other countries.

and dual use technology. The MTCR guidelines recommend export controls on technologies relevant to nuclear-capable delivery systems. In 2004 the UN Security Council required states to adopt export controls on all nonconventional weapons-related goods and technologies and their means of delivery with the adoption of Resolution 1540. In 2016, the Security Council passed Resolution 2325, which reviewed the progress on Resolution 1540 and called for strengthened implementation of its requirements.

Further, the council has incorporated the NSG Trigger List and MTCR Guidelines in its sanctions resolutions on Iran and North Korea, giving further weight to the utility of those export control regimes. The 2010 NPT Review Conference encouraged states-parties "to make use of multilaterally negotiated and agreed guidelines and understandings in developing their own national export controls."[14]

This standard will be measured by the extent to which states have committed to abide by international export control standards established by the NSG and MTCR or, short of that, their efforts to implement the nuclear and missile-related controls consistent with the requirements in Resolution 1540. This report does not assess the strength of the national controls states have in place to meet their export control commitments, although it will take into account patterns of export control violations by a state or its nationals.

9. Nuclear Security Commitments

Over the past two decades, concerns have intensified over the prospect that unsecured nuclear materials might be stolen and smuggled to nonstate actors or states seeking nuclear weapons. Although nuclear security had long been seen primarily as a state's domestic responsibility, such risks have led to more extensive efforts to develop international nuclear security standards, to mandate that all states develop national nuclear security measures, and to assist countries in that process. On an international basis, much of that work has been carried out by the IAEA, which has developed action plans and standards for nuclear security and convened international conventions to seek legally binding commitments for that purpose.[15] These standards include the IAEA Code of Conduct on the Safety and Security of Radioactive Sources (IAEA Code of Conduct), which includes nuclear security guidelines that many states have made political commitments to follow. It also includes the Convention on the Physical Protection of Nuclear Material (CPPNM), which establishes standards for how states should protect nuclear materials designated for peaceful purposes during international transit. CPPNM members adopted an amendment in 2005 that extended those standards to nuclear material in domestic storage and transit. That amendment entered into force in 2016. In 2004, UN Security Council Resolution 1540 established an international mandate for all states to implement laws, regulations, and authorities to account for, protect, and secure nuclear material and facilities.

NPT member states also endorsed specific actions related to nuclear security in the 2010 NPT Review Conference Final Document, urging parties to implement the IAEA Code of Conduct, encouraging members to adhere to the CPPNM and adopt its amendment as soon as possible, and calling on all CPPNM parties to ratify its amendment.

Grade	Criteria: Nuclear Security Commitments
A	State has adopted domestic nuclear security measures consistent with international standards, including IAEA nuclear security fundamentals, ratified the CPPNM and its amendment, and has joined multilateral initiatives to strengthen nuclear security.
B	State has adopted domestic nuclear security measures consistent with international standards and ratified the CPPNM. State has ratified the CPPNM amendment or joined multilateral initiatives to strengthen nuclear security.
C	State has adopted domestic nuclear security measures consistent with international standards and ratified the CPPNM.
D	State has not adopted domestic nuclear security measures consistent with international standards and has not ratified the CPPNM.
F	State is known or widely believed to have illicitly transferred nuclear material to another state or nonstate actor in the time frame of this report.

Recognizing that nuclear security is largely a task for states to undertake with internal efforts to protect such material from unauthorized access, measuring the strength of those actions is outside the scope of this report. Rather, this study will measure the commitments states have made to adhere to international standards to improve their own national nuclear security architecture and the extent to which they are cooperating with others to raise such standards globally. Therefore, as a baseline, this standard will be measured by whether a state has ratified the CPPNM and its 2005 amendment (the 2005 amendment reached necessary ratifications to enter into force in 2016, as such, states that were not yet party to the CPPNM prior to this date will be assessed as to whether or not they have joined the amended treaty) and taken steps to put in place nuclear security regulations consistent with the requirements of Resolution 1540. It will also measure whether a state has agreed to implement international nuclear security standards contained in the IAEA Code of Conduct and engaged in multilateral cooperation to provide or receive assistance related to securing nuclear material and facilities.

Since the last report, the criteria in this category has been updated to reflect whether or not each country has committed to incorporate IAEA nuclear security recommendations on physical protection of nuclear materials and facilities. The IAEA's recommendations are non-binding, but growing support by states pledging to adhere to these guidelines and incorporate them into national frameworks elevates it to a new international standard.

If the country participated in the nuclear security summits, a series of head-of-state level meetings held biannually from 2010-2016 to focus on securing and minimizing fissile materials in peaceful programs, that will be noted in the report, as will significant unilateral steps that the country may have taken as part of the process, such as receiving IAEA International Physical Protection Advisory Service (IPPAS) missions. However, since participation in the nuclear security summits was by invitation it will not impact the grade in the category.

10. Criminalization and Illicit Trafficking Commitments

Following the attacks of September 11, 2001, and the expressed interest of al Qaeda and other terrorist groups in acquiring nuclear weapons, the threat of nuclear terrorism became increasingly acute. Therefore, in addition to securing nuclear materials and facilities to prevent unauthorized access, the international community developed mechanisms to directly address the efforts of actors that may be engaged in nuclear terrorism-related activities. These mechanisms are intended to bolster efforts by law enforcement and other responsible authorities to counter nonstate actors seeking to acquire nuclear materials for illicit purposes by putting in place appropriate domestic penal measures, preventing proliferation financing, and facilitating the international sharing of information on nuclear smuggling.

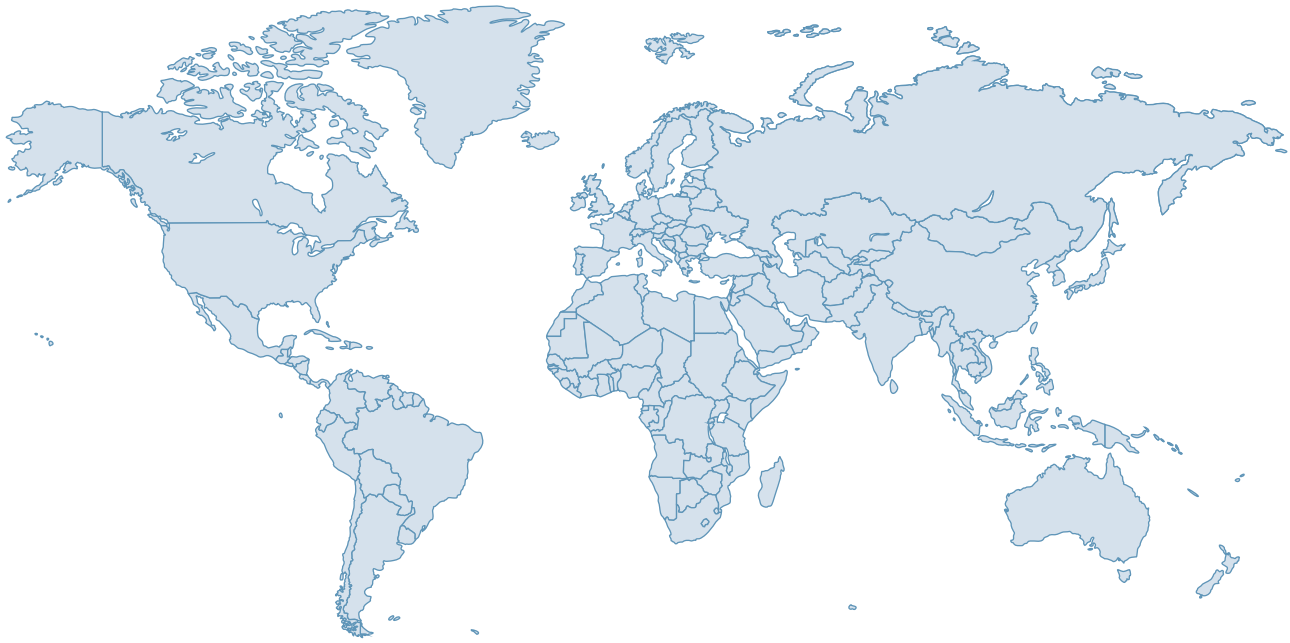
A requirement to enact domestic legislation to criminalize unauthorized nuclear activities, establish appropriate penalties, and assign enforcement authorities was a central feature in Resolution 1540 and the International Convention for the Suppression of Acts of Nuclear Terrorism (the Nuclear Terrorism Convention),[16] which was adopted in 2005 by the UN General Assembly. The latter also calls for enhanced international cooperation to share information on nuclear terrorism-related activities. A critical tool for such information sharing is the IAEA Incident and Trafficking Database (ITDB), which was established in 1995 as a catalogue comprised of state-reported incidents of unauthorized activities and events involving nuclear and radiological material.

Resolution 1887 calls on all states "to improve their national capabilities to detect, deter, and disrupt illicit trafficking in nuclear materials," a call echoed by the 2010 NPT Review Conference Final Document. The document also encouraged all members become party to the Nuclear Terrorism Convention "as soon as possible."

This report considers whether a state participates in the ITDB to share information on incidents related to the theft or loss of or trafficking in nuclear material and has taken steps to secure its borders and ports to detect and disrupt illicit trafficking. It also takes into account whether a state has joined the Nuclear Terrorism Convention and multilateral efforts to prevent nuclear terrorism, such as the Global Initiative to Combat Nuclear Terrorism (GICNT) and the Proliferation Security Initiative (PSI).

Grade	Criteria: Criminalization and Illicit Trafficking Commitments
A	State participates in the ITDB, has ratified the Nuclear Terrorism Convention, and participates in multilateral cooperative arrangements on preventing nuclear terrorism and illicit trafficking.
B	State participates in the ITDB and has ratified the Nuclear Terrorism Convention or participates in multilateral cooperative arrangements on preventing nuclear terrorism and illicit trafficking.
C	State participates in the ITDB.
D	State does not participate in the ITDB, has not ratified the Nuclear Terrorism Convention, and does not participate in multilateral cooperative arrangements on preventing nuclear terrorism and illicit trafficking.
F	State is known or widely believed to have illicitly provided nuclear or missile-related goods or technology to nonstate actors in the time frame of this report.

State-by-State Reports



State-By-State Grades

Standard	NUCLEAR-WEAPON STATES																			
	China				France				Russia				United Kingdom				United States			
	2010	2013	2016	2019	2010	2013	2016	2019	2010	2013	2016	2019	2010	2013	2016	2019	2010	2013	2016	2019
Banning Nuclear Testing	B	B	B+	B+	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B+	C-
Ending Fissile Material Production for Weapons	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Reducing Nuclear Weapons Alert Levels	A	A	B-	B-	B	B	B-	B-	C	C-	C-	C-	B	B	B	B-	C	C	C	C-
Nuclear Force Reductions*	F	D	F	F	C+	D+	D	D	B-	B+	B-	D	D+	C+	C+	D+	B-	B	B+	D
Negative Security Assurances	B+	B+	B+	B+	C	C	C	C	C	C	C-	C-	C	C	C	C	B	C	C	C-
Nuclear-Weapon-Free Zones	B	B	B+	B	B	B	B+	B	C	B	B+	B	B	B	B+	B	C	C	C+	C
IAEA Safeguards	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nuclear Weapons-Related Export Controls	C-	F	F	F	A	A	A	A	C	C	A	C	A	A	A	A	A	A	A	A
Multilateral Nuclear Security Commitments*	B+	A	A-	A	B+	A	A	A	A-	A-	B-	B-	A	A	A	A	B+	B+	A	A
Criminalization and Illicit Trafficking Commitments	B+	A	A	A	B+	B+	A	A	A	A	A	A-	A	A	A	A	B+	B+	A	A
OVERALL GRADE	**B-**	**B-**	**C+**	**C+**	**B**	**B**	**B**	**B**	**B-**	**B**	**B**	**C+**	**B**	**B+**	**B+**	**B**	**B**	**B-**	**B**	**C+**

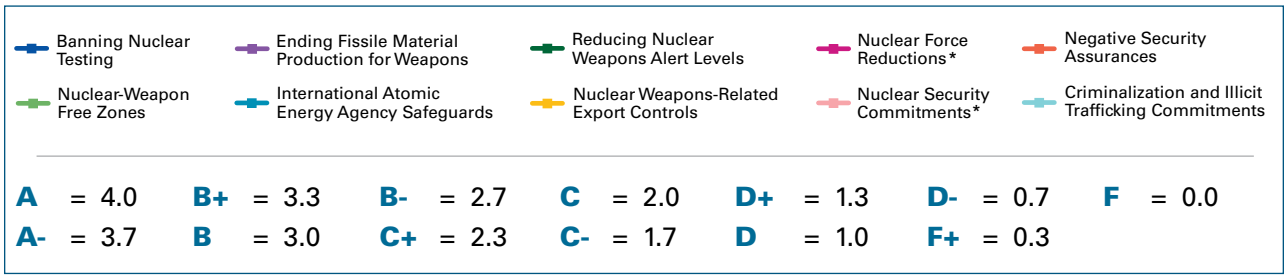
* Grading criteria updated in 2019.

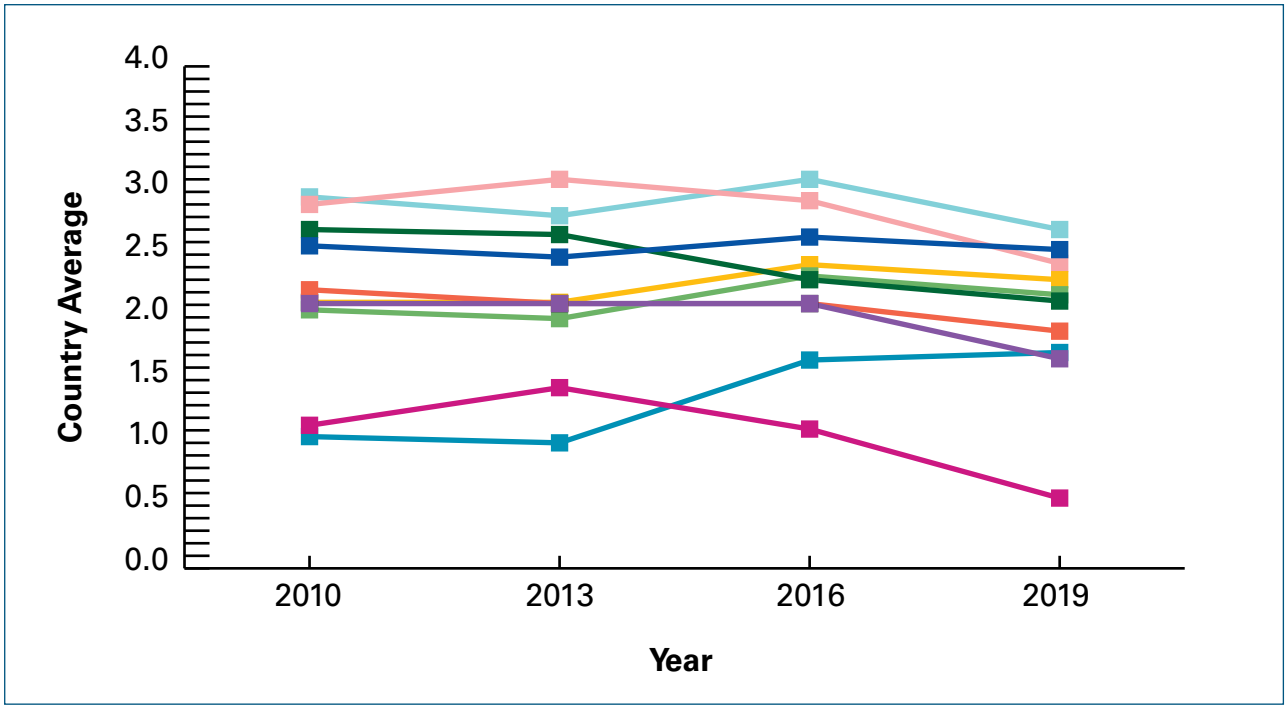
	NON-NPT STATES												STATES OF CONCERN											
Standard	India				Israel				Pakistan				Iran				North Korea				Syria			
	2010	2013	2016	2019	2010	2013	2016	2019	2010	2013	2016	2019	2010	2013	2016	2019	2010	2013	2016	2019	2010	2013	2016	2019
Banning Nuclear Testing	D+	D+	D+	D+	C	C	C+	B-	D+	D+	D+	D+	B-	B-	B+	B+	F	F	F	F+	C	C	C	C
Ending Fissile Material Production for Weapons	F	F	F	F	F	F	F	F	F	F	F	F	N/A	N/A	N/A	N/A	F	F	F	F	N/A	N/A	N/A	N/A
Reducing Nuclear Weapons Alert Levels	A	A	A-	B+	D+	D+	D	D	A	A	B	B-	N/A	N/A	N/A	N/A	D	D	D-	D	N/A	N/A	N/A	N/A
Nuclear Force Reductions*	F	F	F	F	D	D	D-	D-	F	F	F	F	N/A	N/A	N/A	N/A	F	D	F	F	N/A	N/A	N/A	N/A
Negative Security Assurances	B+	B+	B+	C+	D+	D+	D+	D-	B	B	B	B	N/A	N/A	N/A	N/A	F	F	F	F+	N/A	N/A	N/A	N/A
Nuclear-Weapon-Free Zones	C-	C-	C	C	C-	D-	C+	C	C-	C-	C	C	C-	C	C	C+	F	F	F	F	C	C	C	C-
IAEA Safeguards	C+	C	C+	C+	C	C	C	C	C	C	C	C+	F	F	A-	A-	F	F	F	F	F	F	F	F
Nuclear Weapons-Related Export Controls	A-	A-	A	A	A	A	A	A	F	C-	B-	B+	F	F	F	F	F	F	F	F	F	F	F	F
Multilateral Nuclear Security Commitments*	A	A	A	B	B	A	A	B	B-**	B	B+	B	D+	D+	D	D	D	D	D	D	D+	D+	D+	D
Criminalization and Illicit Trafficking Commitments	A	A	A	A	B+	B+	B	B	B	B	B	B	C	C	C	F	D	F	D	F	D+	F	F	F
OVERALL GRADE	**C+**	**C+**	**C+**	**C**	**C-**	**C-**	**C**	**C-**	**C-**	**C-**	**C**	**C**	**D**	**D+**	**C**	**C-**	**F**	**F**	**F**	**F**	**D**	**D-**	**D-**	**D-**

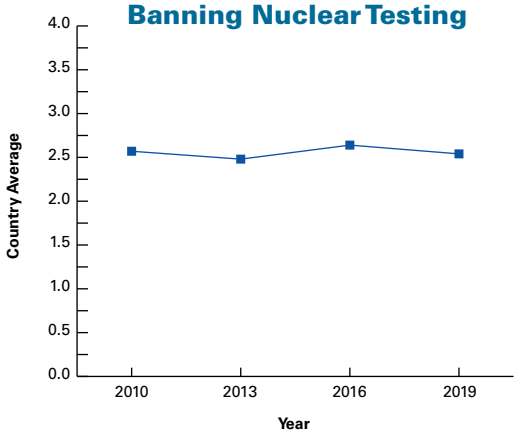
** Pakistan was incorrectly assigned a grade of "A" in the 2010 iteration of this report. Receiving that grade requires ratification of the 2005 amendment to the Convention on the Physical Protection of Nuclear Material, which Pakistan had yet to do. Its adjusted grade is shown here.

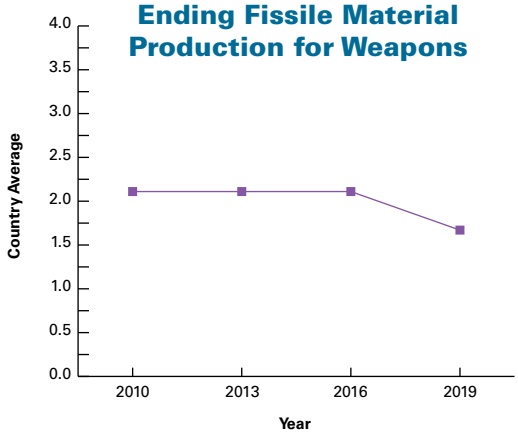
Trends

Since the first edition of this report card was issued by the Arms Control Association in 2010, states have taken more action to strengthen and reinforce certain nonproliferation and disarmament criteria while action in other areas remains stalled. These charts show the average grade for all 11 states across each criteria in the 2010, 2013, 2016, and 2019 editions of this report.

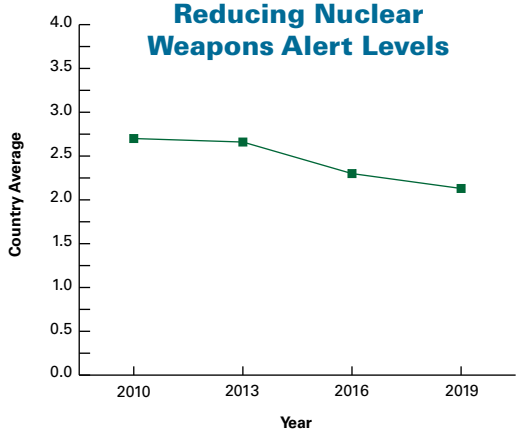




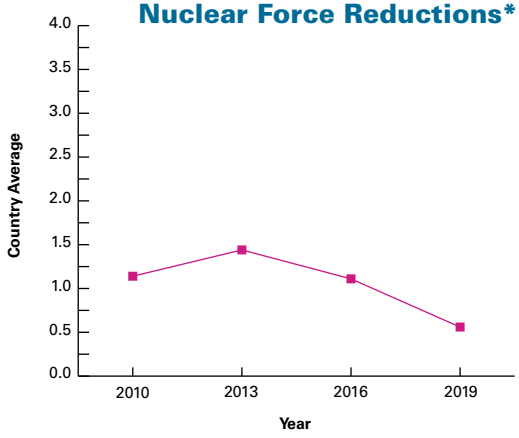




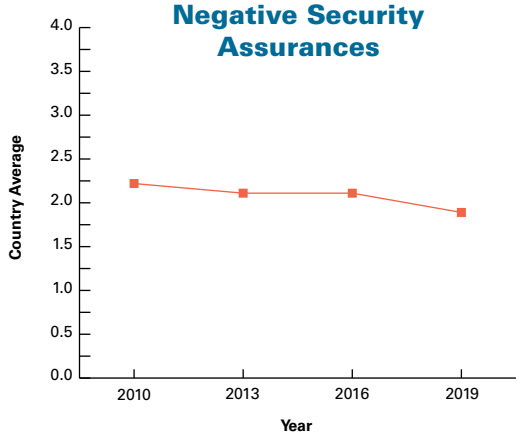
Reducing Nuclear Weapons Alert Levels



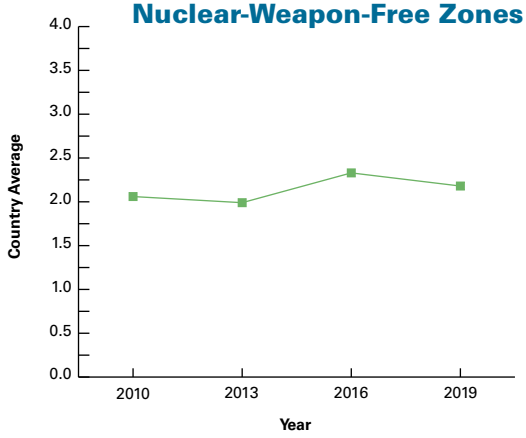
Nuclear Force Reductions*



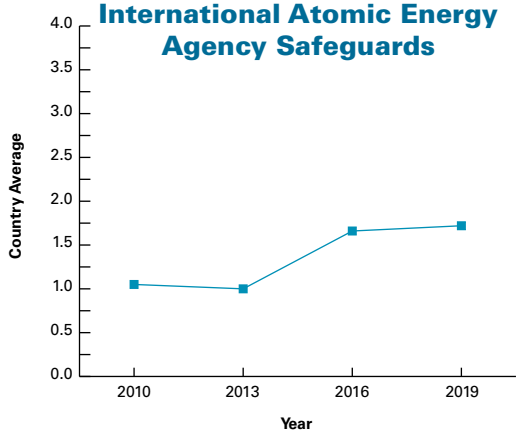
Negative Security Assurances



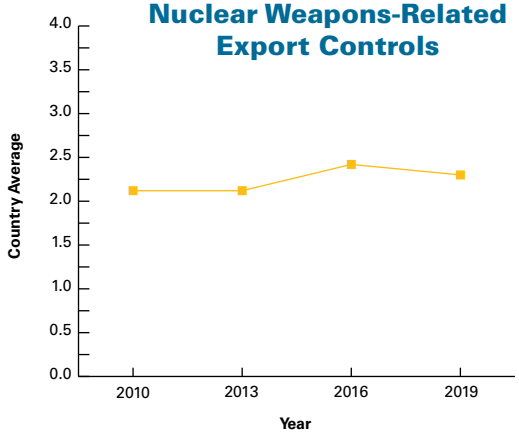
Nuclear-Weapon-Free Zones



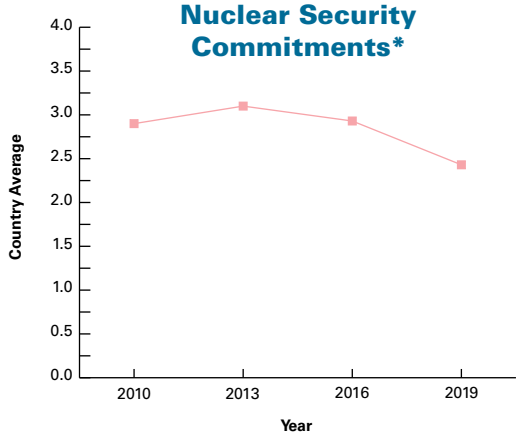
International Atomic Energy Agency Safeguards



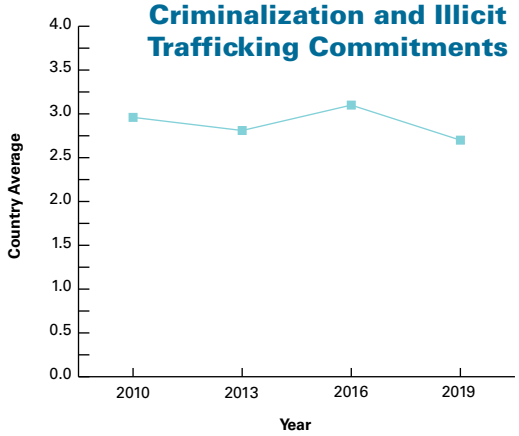
Nuclear Weapons-Related Export Controls



Nuclear Security Commitments*

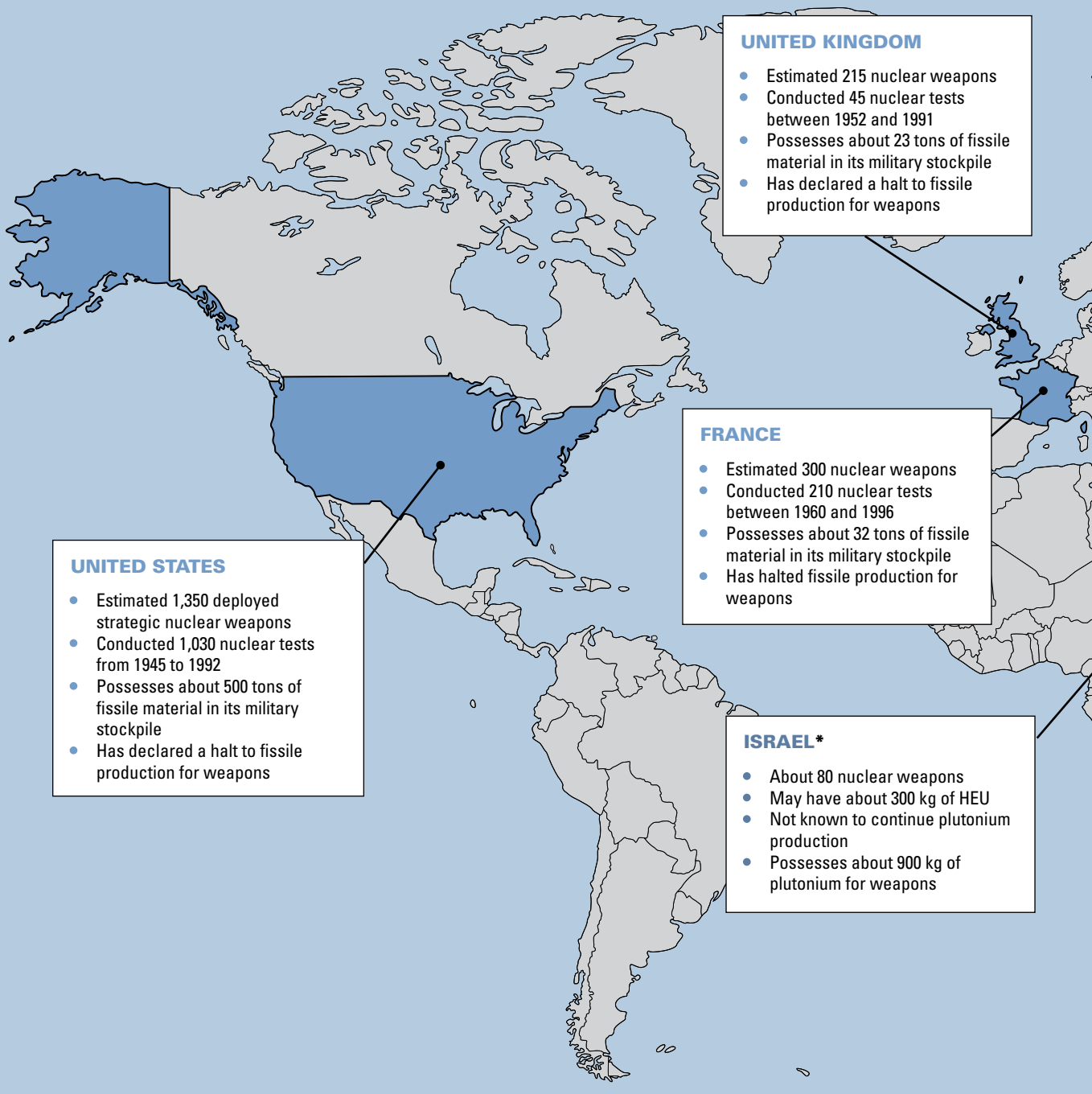


Criminalization and Illicit Trafficking Commitments



* Grading criteria updated in 2019.

Key Figures for 11 Select States



UNITED KINGDOM

- Estimated 215 nuclear weapons
- Conducted 45 nuclear tests between 1952 and 1991
- Possesses about 23 tons of fissile material in its military stockpile
- Has declared a halt to fissile production for weapons

FRANCE

- Estimated 300 nuclear weapons
- Conducted 210 nuclear tests between 1960 and 1996
- Possesses about 32 tons of fissile material in its military stockpile
- Has halted fissile production for weapons

UNITED STATES

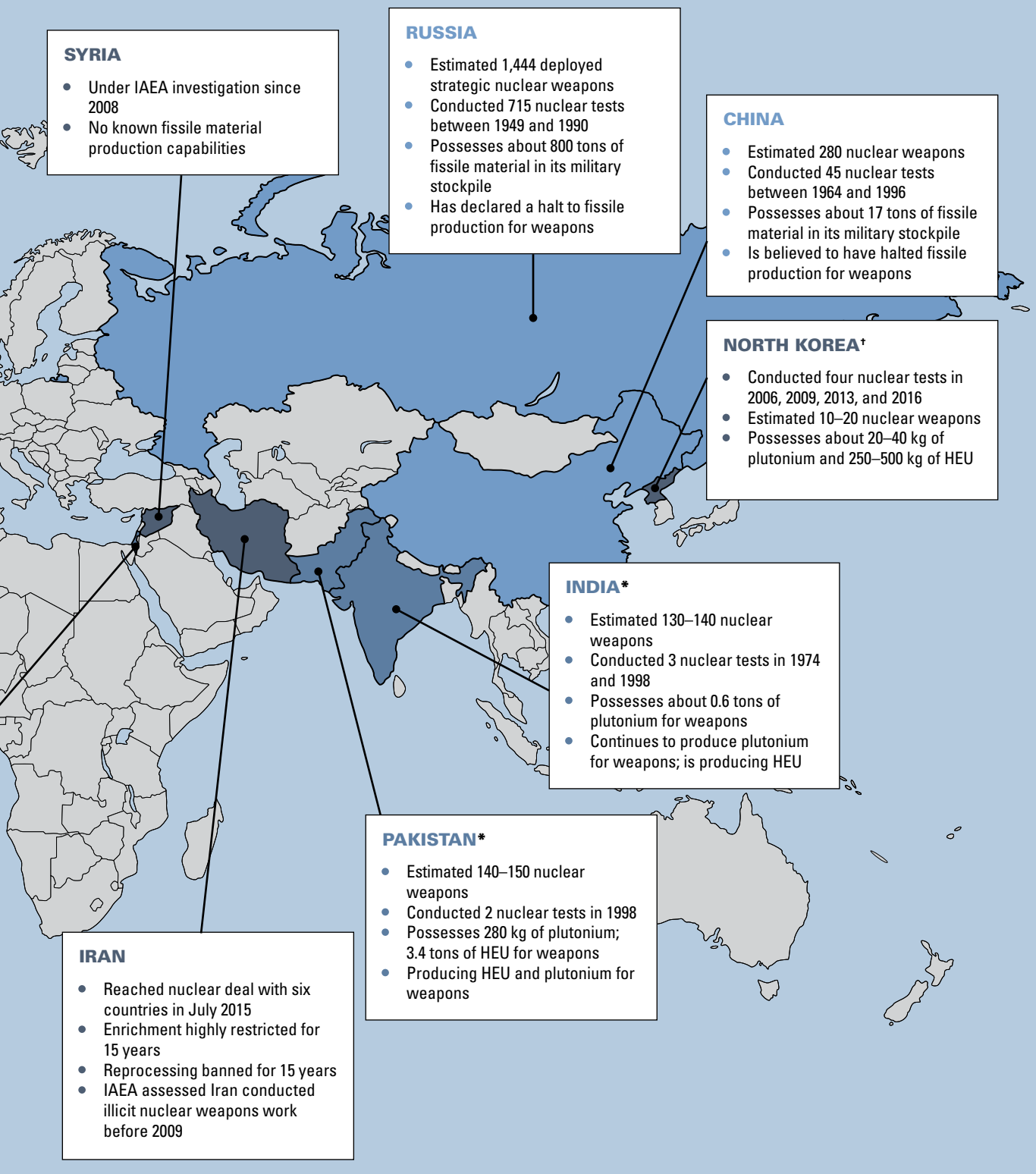
- Estimated 1,350 deployed strategic nuclear weapons
- Conducted 1,030 nuclear tests from 1945 to 1992
- Possesses about 500 tons of fissile material in its military stockpile
- Has declared a halt to fissile production for weapons

ISRAEL*

- About 80 nuclear weapons
- May have about 300 kg of HEU
- Not known to continue plutonium production
- Possesses about 900 kg of plutonium for weapons

* Has not signed the NPT

† Announced withdrawal from NPT in 2003



SYRIA

- Under IAEA investigation since 2008
- No known fissile material production capabilities

RUSSIA

- Estimated 1,444 deployed strategic nuclear weapons
- Conducted 715 nuclear tests between 1949 and 1990
- Possesses about 800 tons of fissile material in its military stockpile
- Has declared a halt to fissile production for weapons

CHINA

- Estimated 280 nuclear weapons
- Conducted 45 nuclear tests between 1964 and 1996
- Possesses about 17 tons of fissile material in its military stockpile
- Is believed to have halted fissile production for weapons

NORTH KOREA†

- Conducted four nuclear tests in 2006, 2009, 2013, and 2016
- Estimated 10–20 nuclear weapons
- Possesses about 20–40 kg of plutonium and 250–500 kg of HEU

INDIA*

- Estimated 130–140 nuclear weapons
- Conducted 3 nuclear tests in 1974 and 1998
- Possesses about 0.6 tons of plutonium for weapons
- Continues to produce plutonium for weapons; is producing HEU

PAKISTAN*

- Estimated 140–150 nuclear weapons
- Conducted 2 nuclear tests in 1998
- Possesses 280 kg of plutonium; 3.4 tons of HEU for weapons
- Producing HEU and plutonium for weapons

IRAN

- Reached nuclear deal with six countries in July 2015
- Enrichment highly restricted for 15 years
- Reprocessing banned for 15 years
- IAEA assessed Iran conducted illicit nuclear weapons work before 2009

China

Overall Grade

C+

China joined the nuclear Nonproliferation Treaty (NPT) in 1992. Despite professing support for disarmament, China is the only nuclear-weapon state expanding its stockpile of nuclear warheads. China's nuclear arsenal is estimated at 280 warheads, and is increasing by about 10 warheads per year.[17] China is also taking steps to upgrade its nuclear arsenal, including by investing in new sea-based nuclear weapons delivery systems. China has a declared no-first-use policy, whereby it states it will not be the first to use nuclear weapons. Although China has adopted export controls and sanctioned proliferators, Chinese entities are still believed to supply nuclear- and missile-related technology to states of proliferation concern.

1. Banning Nuclear Testing: B+

China signed the Comprehensive Test Ban Treaty (CTBT) in September 1996. As an Annex 2 state, China's ratification is necessary for the treaty's entry into force. Beijing continues to abide by a nuclear testing moratorium declared two months before signing the treaty. Prior to that, China conducted 45 nuclear weapons tests, beginning in 1964 and ending in 1996.

Since 1996 China has consistently voiced support for the treaty's entry into force and voted for an annual resolution in support of the CTBT at the UN General Assembly, including in 2018. China also voted in favor of UN Security Council Resolution 2310, which calls for early entry into force of the CTBT, in September 2016.

China continues to strengthen cooperation with the Comprehensive Test Ban Treaty Organization (CTBTO)'s International Monitoring System (IMS) by installing and certifying monitoring stations in the country to send data to the organization in Vienna. The CTBTO has installed 11 monitoring stations in China and began receiving information from the installed stations in January 2014. In December 2016, the CTBTO certified China's first monitoring station, ensuring that it met technical and operational standards and by the end of 2017, it had certified four more stations in China, earning the country a plus grade.[18] At a ceremony marking the stations' certification in January 2018, Chinese Foreign Minister Wang Yi said "we should promote the CTBT as a concrete step towards a global nuclear disarmament process that is acceptable to the international community," but gave no indication of when China will ratify the treaty.[19]

2016 grade: B+
2013 grade: B
2010 grade: B

2. Ending Fissile Material Production for Weapons: B

China reportedly stopped producing fissile material for nuclear weapons by the early 1990s, but Beijing has not issued a formal pledge to end fissile material production.[20]

China publicly supports a fissile material cutoff treaty (FMCT) and commencing negotiations in the Conference on Disarmament (CD) on such a treaty that is consistent with the Shannon Mandate. China participated in the FMCT high-level expert preparatory group which met in 2017 and 2018 and released a report of its work in June 2018. China consistently votes in favor of an annual UN General Assembly First

Chinese President Xi Jinping addresses the opening session of the U.S.-China strategic dialogue in Beijing, June 5, 2016.
(Photo: State Department/ Public Domain)

Committee resolution in support of negotiating an FMCT in accordance with the Shannon Mandate.

China is believed to possess about 14 metric tons of highly enriched uranium and 2.9 metric tons of weapons-grade plutonium as of February 2018.[21] China reported its first separated plutonium for civilian uses to the International Atomic Energy Agency (IAEA) in 2010 and as of 2016, it had 40.9 kilograms of separated plutonium for civilian use. China also enriches uranium to reactor-grade levels for civilian purposes using three centrifuge plants and is expanding its enrichment capability with the goal of obtaining self-sufficiency for the entire fuel cycle.[22] In March 2018, China launched a new generation of uranium enrichment centrifuges, installed at the Hanzhun fuel facility.

2016 grade: B
2013 grade: B
2010 grade: B

3. Reducing Nuclear Weapons Alert Levels: B-

China has historically maintained a low alert level for its nuclear forces, with warheads stored separately from delivery systems, or de-mated, in conjunction with its no-first-use pledge. China's development of new and more advanced nuclear-armed submarines call into question the country's practice of de-mating warheads from missiles, as submarine-launched ballistic missiles typically require the warhead to be mated with the missile.

Little is known about China's nuclear command and control, although the ultimate authority to launch nuclear weapons is believed to rest solely with the president, who is also the chair of the Central Military Commission, which has the authority for nuclear-weapons orders. However, it is possible that the Standing Committee of the Politburo of the Central Committee, China's highest political authority, would also be consulted.[23]

China is modernizing its nuclear submarine force by developing the Jin-class submarine, which gives the country its first continuous at-sea deterrent. China possesses four Jin-class type 094 submarines and is developing the next version of the submarine, the type 096, to be constructed in the early 2020s. The Jin-class submarines are armed with the JL-2 submarine-launched ballistic missile (SLBM), and the type 096 will be armed with the JL-3 SLBM, which is also under development.[24] The JL-3 is estimated to have a range of 9,000 kilometers, an extension from the 7,000-kilometer range of the JL-2.[25]

Deploying China's submarines would necessitate that warheads are mated with missiles while on board the ship and could have implications for command and control. It is possible that China may pre-delegate nuclear launch authority under certain circumstances.[26]

Beijing has declared that its weapons are de-targeted. A 2008 defense white paper on China's nuclear forces states that, "[i]n peacetime the nuclear missile weapons of the Second Artillery Force are not aimed at any country."[27] That phrase was not included in the 2015 defense white paper, which did, however, reiterate that China's nuclear strategy is "self-defensive" in nature.[28]

There have been some indications from Chinese officials that Beijing may be revising its nuclear doctrine. Some Chinese military publications argue that China should move to an increased alert level, such as a launch-on-warning posture to be able to launch a retaliatory strike quickly if it detects an incoming nuclear strike.[29]

China has a mixed record on supporting resolutions on reducing nuclear alert levels at the UN General Assembly. In 2016 and 2018, China voted in favor of a UN General Assembly First Committee resolution calling for decreasing the operational readiness of nuclear weapons (the resolution was not offered in 2017).

An expert examines radionuclide station RN20 in Beijing, China. RN20 was one of four IMS stations certified in China in 2017. (Photo: Comprehensive Test Ban Treaty Organisation)

However, China abstained on separate resolutions in the UN General Assembly First Committee in 2016 and 2017 calling for "immediate steps to reduce the risks of unintentional and accidental use of nuclear weapons, including through de-alerting and de-targeting nuclear weapons."[30]

2016 grade: B-
2013 grade: A
2010 grade: A

4. Nuclear Force Reductions: F

Although China expresses support for nuclear disarmament, including in a 2018 statement at the UN General Assembly First Committee, Beijing has steadily expanded its nuclear arsenal in recent years, rising to an estimated 280 warheads, an increase of 20 warheads from the estimated 260 as of the 2016 version of this report. China's delivery systems include an estimated 120-130 land-based ballistic missiles and 48 sea-based ballistic missiles and bombers, many of which are being upgraded.[31]

China continues to modernize its nuclear forces. In addition to its nuclear-capable submarines (detailed in the prior section), since the last report, China has fielded a new version of a nuclear medium-range ballistic missile and a new dual-capable intermediate-range ballistic missile. Beijing is also developing a road-mobile ICBM, the DF-41, and a dual-capable bomber. According to the 2018 U.S. Defense Department report to Congress on China's military, China may be considering developing a low-yield nuclear weapon. A "defense industry publication has discussed the development of a new low-yield nuclear weapon," the report notes, although it does not judge if such a weapon is actually under development.[32]

China abstained from voting on the motion to take forward negotiations on the Treaty on the Prohibition of Nuclear Weapons (TPNW) in the UN General Assembly. All other nuclear-weapon states voted against the motion.

2016 grade: F
2013 grade: D
2010 grade: F

5. Negative Security Assurances: B+

China is the only recognized nuclear-weapon state to have declared a no-first-use policy, which it has reaffirmed as recently as October 2018 in a statement to the First Committee of the UN General Assembly. China also has consistently supported negotiating a legally binding instrument preventing the first use of nuclear weapons, earning it a plus grade. However, some People's Liberation Army officers have written

about the need for China to clarify the conditions under which its no-first-use policy may not apply, leading the U.S. Defense Department to conclude in 2018 that there is some ambiguity about the policy.

Chinese experts contend that the country may be considering moving to a launch-on-warning posture, which could also undermine its no-first-use pledge. Although Chinese military publications state the purpose of the increased alert posture would be to prepare China to quickly launch a retaliatory strike to a nuclear attack, it would be difficult for China to definitively determine the nature of the attack before warheads had detonated, leaving open the possibility that China could launch nuclear warheads in response to a conventional attack.[33]

China issued unilateral negative security assurance (NSA) pledges in 1978 and 1995. These pledges are non-binding. China consistently reiterates its no-first-use policy in its defense white papers. The most recent, in 2015, stated that "China will unconditionally not use or threaten to use nuclear weapons against non-nuclear-weapon states or in nuclear-weapon-free zones, and will never enter into a nuclear arms race with any other country."[34] China voted in favor of a UN General Assembly First Committee resolution in 2018 calling for negotiating legally binding negative security assurances.

2016 grade: B+
2013 grade: B+
2010 grade: B+

6. Nuclear-Weapon-Free Zones: B

China signed the Central Asian nuclear-weapon-free zone (NWFZ) treaty protocol, along with all five of the nuclear-weapon states, in May 2014 and deposited its ratification in August 2015. China signed and ratified negative security assurance protocols to the Latin American (1974), South Pacific (1988), and African (1997) NWFZ treaties. Beijing also signed onto a joint declaration, in collaboration with the four other nuclear-weapon states, which recognized Mongolia's status as a NWFZ in 2012.

Beijing announced in 2015 at the UN General Assembly First Committee that it had resolved its outstanding concerns on the protocol for the Southeast Asian NWFZ treaty protocol and is ready to sign but has yet to do so.[35]

China has expressed regular support for the establishment of a NWFZ and a WMD-free zone in the Middle East, including by voting for the UN General Assembly First Committee resolutions supporting the zone in 2018. China also voted in favor of a UN General Assembly First Committee resolution calling for a fourth conference of nuclear-weapon-free zones to be held in 2020.

2016 grade: B+
2013 grade: B
2010 grade: B

7. IAEA Safeguards: N/A

China concluded a voluntary safeguards agreement with the IAEA in 1988 and an additional protocol in 2002.

8. Nuclear Weapons-Related Export Controls: F

China professes to support export controls, but Chinese entities continue to support nuclear and missile programs in states like North Korea, raising concerns about the effectiveness of Beijing's implementation of these measures.

China joined the Nuclear Suppliers Group (NSG) in 2004, and its national export controls include provisions related to export licensing, control lists, end-user controls, and import controls. At the IAEA General Conference in 2015, China said it carries out "stringent reviews" on its export controls and adjusts its trigger lists according to technical progress. Beijing updated its Nuclear Export Control List in January 2016 and started to implement its updated list in March 2016.[36]

China continues to supply nuclear reactors to Pakistan, despite the objections from some NSG member states that the sales contravene the group's guidelines. Pakistan is not a state-party to the NPT or under full-scope safeguards, so Islamabad is not eligible to receive nuclear reactors and related technology without an NSG exception. China contends that the supply of reactors is permitted since China's original contract for units at the Chasma site was grandfathered in when China joined the NSG. However, China has entered into contracts for additional units at the site, arguing that they too are covered by the grandfathered contract. Several NSG states object to China's interpretation. In November 2017, the China National Nuclear Corporation signed a cooperation agreement with the Pakistan Atomic Energy Commission for the construction of a third nuclear reactor in Pakistan.

In September 2018, China released its draft Atomic Energy Law, intending to fill regulatory gaps and promote the development of China's nuclear industry, including a section on nuclear export requirements which encourages Chinese entities to participate in the global market.[37,38] The law could help strengthen the country's dual-use export controls, but that remains to be seen.

China applied to join the Missile Technology Control Regime (MTCR) in 2004, but its application was blocked. Beijing claims to follow the export

control regime's guidelines, although China has not adopted the full annex, which includes a common list of controlled items. Prior to the MTCR application, China committed in 2000 not to assist, "in any way, any country, in the development" of nuclear-capable ballistic missiles.[39]

Despite that pledge, the U.S. State Department has consistently found that Chinese companies continue to flout export controls. Most recently the State Department stated that "Chinese entities continued to supply missile programs of proliferation concern" in a 2018 report.[40]

China has not submitted a national report to the 1540 Committee since 2007, but it has submitted national implementation reports on nuclear weapon-related UN Security Council sanctions on North Korea, including on Resolution 2397 in March 2018. However, the UN panel of experts assessing compliance with North Korea sanctions has cited evidence over the past several years calling into question Beijing's full compliance with the UN measures.

2016 grade: F
2013 grade: F
2010 grade: C-

9. Nuclear Security Commitments: A

Beijing ratified the Convention on the Physical Protection of Nuclear Materials (CPPNM) in 1989 and its 2005 amendment in September 2009. China has a regulatory framework in place consistent with the IAEA Code of Conduct, which includes material accounting, material security, and licensing, and established a national radioactive source database. China also participated in all four nuclear security summits.

China committed in 2016 to meet the intent of the IAEA's nuclear security guidelines in its regulatory framework. Beijing also operates a nuclear security "Center of Excellence," which provides critical training for personnel working at nuclear security facilities and collaborates with other centers in the region. In September 2017, the IAEA completed an International Physical Protection Advisory Service (IPPAS) mission to China.

China is also working with the IAEA and the United States on a project to convert Chinese-origin miniature source neutron reactors, which contain one kilogram of weapons-grade HEU, that it sold to Ghana, Iran, Nigeria, Pakistan and Syria. China also operates two of the reactors domestically. Experts from the United States, the IAEA, China, and Ghana completed the conversion of Ghana's nuclear reactor, the first of the reactors outside China to be converted, in July 2017. Conversion of Nigeria's reactor to run on LEU was also completed and, in November 2018, Nigeria returned the HEU to China.

2016 grade: A-
2013 grade: A
2010 grade: B+

10. Criminalization and Illicit Trafficking Commitments: A

China participates in the Incident and Trafficking Database (ITDB) and the Global Initiative to Combat Nuclear Terrorism (GICNT). China ratified the Nuclear Terrorism Convention in November 2010. Beijing implements the Yangshan Port Pilot Program in Shanghai as a part of the larger Megaports Initiative in cooperation with the U.S. National Nuclear Security Administration (NNSA), which uses radiation inspection equipment to minimize incidences of illicit trafficking. China announced in March 2016 it is working toward radiation inspection of all inbound and outbound cargo from the Yangshan and Dongjiang Ports.[41]

2016 grade: A
2013 grade: A
2010 grade: B+

NUCLEAR-WEAPON STATES

France

Overall Grade

B

France was the last of the five nuclear-weapon states to join the NPT, depositing its ratification in August 1992. While France has shut down its fissile material production facilities and closed its nuclear test site, Paris has not taken steps to decrease the size of its nuclear arsenal since the country declared in 2008 that it would reduce to less than 300 warheads. In its 2017 Defence and National Security Strategic Review, France indicated an increased role for its nuclear weapons, which stated that "given that the nuclear factor is set to play an increasing role in France's strategic environment, maintaining over the long-term our nuclear deterrent, the keystone of the Nation's defence strategy, is essential now more than ever."[42] France also utilizes nuclear reactors for energy generation and is an active supplier of nuclear technology for peaceful programs.

1. Banning Nuclear Testing: A

An Annex 2 state, France ratified the CTBT in 1998, two years after declaring a testing moratorium. France consistently votes in favor of an annual UN General Assembly First Committee resolution urging all states to ratify the treaty or to accelerate efforts to do so and voted in favor of UN Security Council Resolution 2310, which calls for early entry into force of the CTBT, in September 2016.

France first tested nuclear weapons at two sites in the Algerian desert from 1960 to 1967 before moving its test site to French Polynesia, a group of islands in the South Pacific. That site was operational from 1966–1996. In total, France tested 210 nuclear devices. France closed down and "irreversibly dismantled" its test sites, the only nuclear-weapon state to have taken these steps, according to the CTBTO.

France is facing a legal complaint over its past nuclear tests in the International Criminal Court. The former president of French Polynesia filed the complaint in October 2018, arguing that France's nuclear testing constituted crimes against humanity. It is unclear if the court will hear the case.

2016 grade: A
2013 grade: A
2010 grade: A

2. Ending Fissile Material Production for Weapons: A

France halted production of separated plutonium for military purposes in 1992. Four years later, in February 1996, France formally declared a definitive halt to all fissile material production for nuclear weapons. Following that announcement, France halted HEU production in June 1996.

In 2008 France took a further step by announcing that the country would irreversibly dismantle its fissile material production facilities. France later allowed representatives from the CD and other experts to visit its shuttered uranium enrichment facility at Pierrelatte and its reprocessing plant at Marcoule.[43]

As of December 2016, France has an estimated six metric tons of weapons-grade plutonium and 26 metric tons of HEU in its military stockpile.[44] France also holds stockpiles of fissile materials for its civil

program, about 65 metric tons of plutonium and 4.8 metric tons of HEU and continues to enrich uranium and separate plutonium for reactor fuels.

France has consistently supported efforts to negotiate an FMCT and maintains that negotiations on such a treaty should not be linked to other issues. France actively participated in the high-level FMCT expert preparatory group created in 2016 to generate recommendations on a path forward for negotiating a treaty.

During the UN General Assembly First Committee in 2018, France called attention to the work done by the expert group and said negotiations should take into account the progress made by that body.[45] France voted in support of the 2018 UN General Assembly First Committee resolution calling for an FMCT, calling such a treaty "an essential and irreplaceable step" toward a world without nuclear weapons, and voted for similar resolutions every year covered in this report.

2016 grade: A
2013 grade: A
2010 grade: A

3. Reducing Nuclear Weapons Alert Levels: B-

France announced the de-targeting of its nuclear forces in 1997. Prior to that announcement, France took steps in 1992 and 1996 to extend the time it takes to launch nuclear weapons. With these steps in place, French nuclear weapons are no longer on "permanent high alert" and are believed to need several days of preparation to be launched.[46]

The French president has the sole authority to launch nuclear weapons. France maintains that it has employed "technical means" and "effective procedures" to prevent the use of nuclear weapons without the proper presidential authorization.[47] In 2007, a report on governance of nuclear weapons in France suggested that the chief of the presidential military staff and the chief of the defense staff have a role in validating any decision to launch a nuclear attack.[48]

Despite these steps, France consistently has voted against a resolution offered in the UN General Assembly First Committee to decrease the operational readiness of nuclear weapons systems, earning it a minus grade. France also voted against a 2018 UN General Assembly First Committee resolution on reducing nuclear dangers.

While France did not offer an explanation of vote, the 2017 defence review emphasized the importance of maintaining "strategy autonomy" given the fluctuating threat environment.[49]

2016 grade: B-
2013 grade: B
2010 grade: B

4. Nuclear Force Reductions: D

France possesses 300 nuclear weapons which are deployed on 54 airborne missiles and four ballistic missile submarines that can each carry 16 SLBMs.[50] France did deploy nuclear warheads on ground-launched missiles but has dismantled these systems, moving from a triad, which includes air, sea, and land-based options for delivering nuclear weapons, to a dyad, which includes two of the three delivery options. At its height at the end of the Cold War, France's nuclear arsenal was comprised of about 550 warheads.

The 300-warhead limit was set by President Nicolas Sarkozy in March 2008, when he announced that the country would pursue a one-third reduction in total warheads.[51] Sarkozy's remarks indicated that the warheads would be dismantled, but no formal verification of the reductions took place. France has not taken any steps to further reduce its nuclear arsenal since that reduction was completed, arguing that it supports "consensus-based action" on nuclear disarmament that does not negatively impact international stability and is conducted in "appropriate fora."[52] France also said in its 2017 defence review that maintaining the deterrent "over the long term is essential."

France is currently upgrading its nuclear delivery systems. As of December 2017, France had fitted its nuclear submarines to carry the M51.1 SLBM, and by 2020, France is scheduled to equip submarines with the longer-range M51.2 SLBM. France is engaged in design work for a new class of submarine, which it intends to have operational by 2035.

France will begin a program to replace its nuclear-capable bombers in 2022.[53] The French Ministry of Defense has started research on an upgraded air-launched cruise missile which would be stealthier and more maneuverable.[54]

France opposed the negotiations of the TPNW, adopted at a UN negotiating session in July 2017, arguing that the treaty risks weakening the NPT. In its 2017 defense review, the government concluded that the "nuclear factor is coming back in force" and "disarmament cannot be decreed but ought to be built on gradually." France advocates for a "realistic process of arms control and confidence building to contribute to strategic stability and shared security."

2016 grade: D
2013 grade: D+
2010 grade: C+

5. Negative Security Assurances: C

France issued unilateral NSAs in 1978 and 1995, pledging not to use nuclear weapons against

French President Emmanuel Macron speaks at the Armistice Day Centennial Commemoration luncheon, Sunday, Nov. 11, 2018, at the Elysee Palace in Paris. (Official White House Photo by Shealah Craighead)

non-nuclear-weapon states that belong to the NPT unless it is facing an invasion or sustained attack against its territories, armed forces, or states with which it has a security agreement and the attack is in alliance with a nuclear-weapon state.[55]

Despite issuing unilateral NSAs, France consistently abstains from the annual UN General Assembly First Committee resolution calling for negotiations to reach an effective international agreement to "assure the non-nuclear weapon States against the use or threat of use of nuclear weapons."

France maintains that its nuclear weapons are "strictly defensive" and designed to protect France against "any state-led aggression" that threatens its vital interests.[56] France has never precisely defined "vital interests" and says it defines threats and response options on a case-by-case basis.

The French nuclear strategy of "dissuasion," or deterrence, appears to be fairly expansive, allowing for the possibility of responding to threats of attacks of a non-nuclear nature. There are indications that since the 2016 version of this report was published, France has increased its reliance on its nuclear weapons. The government concluded in a 2017 Defence and National Security Strategic Review that its nuclear deterrent has an increased role in the country's defense strategy. The review concluded that "given that the nuclear factor is set to play an increasing role in France's strategic environment, maintaining over the long-term our nuclear deterrent, the keystone of the Nation's defence strategy, is essential now more than ever."

In the 2017 review, France concluded that it must maintain its nuclear deterrent to address four challenges: protecting national territory, retaining the ability to respond to a crisis that would impact national territory and possibly one with major humanitarian dimensions, preserving dominance over nonstate adversaries, and fulfilling French responsibilities in the event of military confrontation with other states. To address these four challenges the state must retain a "full spectrum and balanced force model."

2016 grade: C
2013 grade: C
2010 grade: C

6. Nuclear-Weapon-Free Zones: B

France has ratified protocols for NWFZs in Latin America (1991), Africa (1996), the South Pacific (1996) and Central Asia (2014). France reaffirmed its commitment to respect the zones again in 2015.[57] In collaboration with the four other nuclear-weapon states, France recognized Mongolia's status as a NWFZ in 2012.[58]

French Foreign Minister Jean-Yves Le Drian chairs a meeting of the G7 during France's presidency of the G7 and the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction.
(Photo: French Ministry for Europe and Foreign Affairs, April 6, 2019.)

France has not yet signed the protocol to the Southeast Asian NWFZ, and at the UN General Assembly First Committee in 2018, France's representative said Paris hopes to "resume constructive dialogue with all States concerned on the Protocol to the Bangkok Treaty," which established the NWFZ.

At the UN General Assembly First Committee in 2018, France abstained on a resolution calling on the UN secretary-general to convene a conference on establishing a MEWMDFZ by the end of 2019. France does express rhetorical support for the establishment of such a zone and did vote in favor of an annual UN General Assembly First Committee resolution calling for a NWFZ in the Middle East in 2018, which it has consistently supported.

France also abstained from a UN General Assembly First Committee resolution calling for a fourth conference of NWFZs to be held in 2020. France joined the United States and the United Kingdom in abstaining from the resolution over what the three states described as contradictory language in one of the perambulatory paragraphs.[59]

2016 grade: B+
2013 grade: B
2010 grade: B

7. IAEA Safeguards: N/A

France concluded a voluntary safeguards agreement with the IAEA in 1981 and an additional protocol in 2004.

8. Nuclear Weapons-Related Export Controls: A

France is an NSG member and serves as the "point of contact" for the MTCR, meaning Paris organizes inter-sessional meetings of the body and receives communications from states on implementation of the MTCR's guidelines. Paris maintains an extensive national export control system consistent with the guidelines of both export control regimes and requirements of UN Security Council Resolution 1540, including licensing provisions; measures related to deemed exports, end-user, transshipment, and re-export controls, and a catchall clause.[60] France adheres to the EU's Council Regulation No. 428/2009, which requires member states to incorporate into law the recommendations and guidelines from export control groups, including the NSG and MTCR. France also adheres to the EU's Dual Use Export Control Annex, which was updated in October 2018 to reflect changes made to NSG and MTCR lists in 2017.[61]

France submitted its national implementation report of Resolution 1540 to the United Nations

most recently in August 2015. It has submitted all five reports on implementation of nonproliferation resolutions against North Korea to the sanctions committee, required by UN Security Council resolutions passed in 2016 and 2017.

2016 grade: A
2013 grade: A
2010 grade: A

9. Nuclear Security Commitments: A

Paris joined the CPPNM in 1991 and ratified its 2005 amendment in February 2013. France also has a variety of national controls and regulations in place with regard to nuclear security including the establishment of a nuclear regulatory authority, material accounting measures, physical protection regulations, and licensing for materials, facilities, and entities.

France participates in the Global Partnership and will chair the initiative in 2019. Paris says that as chair it will prioritize operations to secure radioactive sources and bilateral training activities.

France participated in all four nuclear security summits. During the 2016 Nuclear Security Summit, France announced that it received a second International Physical Protection Advisory Service (IPPAS) mission, which is an IAEA-led peer review of a state's nuclear security practices and recommendations for improvements, and updated its design basis threat. In 2017, France created a joint specialized command for its nuclear security forces (COSSEN).

In 2014, France signed on to the IAEA Strengthening Nuclear Security Implementation (SNSI) initiative introduced at that year's Nuclear Security Summit, which commits Paris to meet the intent of IAEA recommendations in the agency's nuclear security series.

2016 grade: A
2013 grade: A
2010 grade: B+

10. Criminalization and Illicit Trafficking Commitments: A

France participates in the ITDB, and the GICNT. Paris ratified ICSANT in September 2013.

France also participates in PSI, including the Operational Experts Group (OEG) which sets priorities for the initiative. France hosted PSI's high-level political meeting and OEG meeting in 2018. In 2013, France, along with Germany, suggested a PSI Mediterranean Initiative to focus on specific regional challenges. As part of the initiative, France hosted a table top exercise in 2015 to "put in practice concrete methods and tools and emphasized the challenge of addressing proliferation threats on very tight deadlines."[62] France also participated in the most recent exercise in the series, held in Sicily in September 2018.

2016 grade: A
2013 grade: B+
2010 grade: B+

Russia

Overall Grade

C+

In the aftermath of the Cold War, Russia inherited the majority of the Soviet Union's nuclear weapons—about 40,000 warheads. The Soviet Union was the second country, after the United States, to test a nuclear device, and these two countries played a critical role in drafting the NPT. Beginning in 1969, before the NPT entered into force, the United States and the Soviet Union (and now Russia), have engaged in a series of negotiations to limit deployed nuclear weapons delivery systems and warheads. However, Russia is currently developing and deploying new nuclear-capable delivery systems, one of which violates the INF Treaty between the United States and Russia prohibiting ground-launched ballistic and cruise missiles with ranges between 500–5,500 kilometers. Russia and the United States worked together to secure nuclear material and facilities of the former Soviet Union, but these cooperative efforts largely ceased in 2013. The two states have continued to cooperate on multilateral initiatives to address the threat of nuclear terrorism and remove fissile materials from third party countries on a more limited basis. Russia is also a major supplier of nuclear technology and nuclear materials for peaceful programs.

1. Banning Nuclear Testing: A

Russia, an Annex 2 state, ratified the CTBT in 2000 and continues to reiterate support for the treaty and its entry into force. Russian Foreign Minister Sergey Lavrov said in October 2018 that entry into force of the CTBT is "one of the priorities of Russia's foreign policy" and committed to support efforts to achieve entry into force of the treaty.[63]

Russia supports the regular UN General Assembly First Committee resolution supporting the CTBT and, at the 2018 First Committee called upon all states not yet party to the treaty to join "as soon as possible" and warned against "shortsighted policy" by certain states that could lead to a situation where the CTBT "simply ceases to exist."[64] Russia voted in favor of UN Security Council Resolution 2310, which calls for early entry into force of the CTBT, in September 2016.

Russia conducted a total of 715 nuclear tests from 1949–1990. In 2012, Russia, the United States, and Kazakhstan announced completion of a 17-year project to seal test tunnels at the Soviet Union's main test site, Semipalatinsk, to prevent the theft of plutonium left in the test tunnels. Semipaltinsk, located in Kazakhstan, is the only nuclear test site now open to the public. The second of the Soviet Union's primary nuclear test sites is located on the island Novaya Zemlya in the Arctic Ocean.

2016 grade: A
2013 grade: A
2010 grade: A

2. Ending Fissile Material Production for Weapons: A

Russia declared that it ceased production of fissile material for nuclear weapons in 1994, but the country continues to produce HEU to fuel its naval propulsion program. Russia's HEU stockpile is estimated at 679

U.S. President Ronald Reagan and Soviet General Mikhail Gorbachev signing the INF Treaty in the East Room at the White House in 1987. (Photo: Getty Images)

metric tons, of which about 650 metric tons are designated for military purposes (which includes naval reactors). The stockpile of weapons-grade plutonium for military purposes is estimated at 128 metric tons, with an additional 57 metric tons of civilian material.[65] But there is considerable uncertainty surrounding the Russian estimates, given the lack of transparency by Moscow about its stockpiles.

Moscow supports an FMCT, and consistently votes in favor of UN General Assembly First Committee resolutions calling for the commencement of negotiations on an FMCT. Russia supports negotiations for the treaty based on the Shannon Mandate, and has spoken against moving the negotiations on the FMCT out of the Conference on Disarmament. Russia also participated in the high-level expert preparatory group that convened in 2017–2018 under UN General Assembly Resolution 71/259 and supported the consensus final report adopted by that body. The report recommended that negotiations on an FMCT begin "without delay" in the CD.

Russia has taken some steps over the past decade to reduce its stockpiles of fissile material, although there are no current, active agreements in place. Russia suspended in October 2016 an agreement reached by the United States and Russia in 2010 that would have required both Moscow and Washington to dispose of 34 metric tons of surplus weapons-grade plutonium. In the press release announcing the suspension, Russian President Vladimir Putin said the United States was unable to fulfill its commitments under the disposition agreement.[66]

In 2013, Russia fulfilled a 1993 agreement to allow the United States to down-blend 500 tons of HEU from Russian nuclear warheads.[67]

2016 grade: A
2013 grade: A
2010 grade: A

3. Reducing Nuclear Weapons Alert Levels: C-

Russia is believed to maintain slightly more than half of its deployed nuclear warheads on SLBMs and ICBMs on prompt alert status, meaning that the weapons are ready to launch in less than 15 minutes.[68] Statements from Russian officials, including one in December 2016 from Commander General Sergei Karabayev and one in early 2009 from Colonel General Nikiolai Solovstov claim that 95–99 percent of Russia's missiles are combat ready, or on prompt alert, but experts generally assess that those statistics are inflated and the number is closer to 50 percent.[69]

Russia traditionally abstains from an annual resolution at the UN General Assembly First Committee calling for states possessing nuclear weapons to take steps to de-alert and de-target nuclear weapons, earning it a minus grade. Russia also voted against a 2018 UN General Assembly First Committee resolution on reducing nuclear dangers.

It is unclear if the Russian president has the sole authority to launch nuclear weapons. The president, the defense minister, and chief of the general staff, all possess "nuclear footballs" or briefcases with communications systems to order a strike. Scholars, however, assess that the Russian command-and-control system (like its Soviet predecessor) is designed to prevent one person from launching a first-strike nuclear attack, and therefore likely requires more than one person to order a launch.[70]

2016 grade: C-
2013 grade: C-
2010 grade: C

4. Nuclear Force Reductions: D

Russia's total inventory of nuclear weapons is 6,850 warheads, including an estimated 4,350 warheads available for deployment and 2,500 warheads awaiting dismantlement. [71] About 2,000 warheads available for deployment are tactical nuclear warheads.[72]

Russia met its obligations under the New Strategic Arms Reduction Treaty (New START) to reduce deployed strategic nuclear warheads to less than 1,550 and deployed launchers to less than 700 by February 2018 and continues to remain below those limits. As of March 2019, Russia has 524 deployed strategic delivery systems (SLBMs, ICBMs, and bombers) and 1,461 deployed strategic nuclear warheads under New START counting rules.[73] Under New START counting rules, each strategic nuclear bomber counts as one nuclear warhead, even though bombers can carry up to 16-20 nuclear warheads. Verification procedures in the treaty confirm these numbers.

After resisting calls in 2013 from former U.S. President Barack Obama for each side to negotiate further reductions in deployed nuclear warheads by one-third below the New START levels, Russian President Vladimir Putin has offered in 2018 to begin talks to extend New START, which is currently set to expire in 2021, for an additional five years.[74] But Russia has raised concerns about the procedures the United States has used to remove SLBM launchers and B-52 bombers from accountability under the agreement.[75] The Trump administration, however, has yet to take a position on New START extension.

While Russia is meeting the limits of New START, the United States has formally accused Moscow of violating the Intermediate-Range Nuclear Forces (INF) Treaty. The U.S. government, along with NATO member states, argue that the Russian 9M729 ground-launched cruise missile has a range that exceeds the 500 kilometer limit set by the INF Treaty, and the United States intelligence community says that Russia has deployed "multiple" battalions of the missile beginning in 2017. Under the updated methodology, which in past reports did not take into account treaty violations, this drops Russia's grade to a D.

The United States first made the allegation in 2014, and since then, the annual State Department report on compliance with arms control agreements has referenced the Russian violation.[76] In 2018, the United States released additional information regarding the violation, including the designation of the specific system in violation of the treaty, the 9M729.[77] Russia denies the allegation and argues that the 9M729 has a range below the limit set by the INF Treaty, but has resisted calls to allow an inspection of the missile. After the United States announced in February 2019 that it would immediately suspend its obligations under and withdraw from the INF Treaty, Russia said it too would suspend its obligations under the treaty and begin development of new ground-launched intermediate-range missile systems.

In addition to the 9M729, Russia is developing new road-mobile and rail-mobile ICBMs, as well as a new silo-based ICBM. The silo-based ICBM, called the Sarmat, was tested in 2017 and can carry 15 warheads. The Sarmat is also capable of carrying a hyper-glide vehicle, the Avangard, that Russia says is maneuverable and can evade U.S. missile defenses. The hyper-glide vehicle was tested on the Sarmat in December 2018, although it appears that the Avangard will now be carried by the SS-19 ICBM.[78] Russian President Vladimir Putin said the test was a success and the system will be deployed in due course.[79]

Russia is also building eight new SSBNs, the Borei class, to replace its existing submarines. Moscow may increase that number to 12. In addition to its sea-based SSBNs, Russia may be pursuing a nuclear-powered, nuclear-tipped torpedo. Putin mentioned the system in a 2018 speech.[80] Russia is also developing two new strategic bombers: one is an upgraded version of its existing Tu-160 Blackjacks, the other is a next-generation bomber known as the PAK-DA. Russia is also developing an air-launched ballistic missile, the Kinzhal, which it tested in July 2018.

Moscow has resisted calls to take steps to reduce its nonstrategic weapons, and there are indications that Russia has instead increased its reliance on these systems as part of its overall defense strategy.[81] In particular, Moscow has often linked the issue of nonstrategic weapons reduction to the U.S. deployment of ballistic missiles defenses in Europe.[82]

In July 2018, during a meeting between Putin and Trump, Russia offered to restart strategic stability talks.[83] It is unclear if those negotiations would explicitly include nonstrategic nuclear weapons, as the United States has yet to take Russia up on its offer to engage in dialogue.

Russian President Vladimir Putin delivers an annual address March 1, 2018 to the Russian Federal Assembly at Moscow's Manezh Central Exhibition Hall where he outlined Russia's development of new strategic systems, including two hypersonic weapons. (Photo: YURI KADOBNOV/AFP/Getty Images)

Russia opposes the TPNW, voted against the start of negotiations and did not participate in the negotiations in 2017. At the 2018 UN General Assembly First Committee, Russia stated that the TPNW is an "untimely and inefficient instrument" that undermines the NPT.[84]

2016 grade: B-
2013 grade: B+
2010 grade: B-

5. Negative Security Assurances: C-

Russia issued unilateral pledges not to attack non-nuclear-weapon states with nuclear weapons in 1978 and 1995. Moscow stated in 1995 that those pledges would not apply in cases in which Russia was attacked by a non-nuclear-weapon state in association with a state that possesses nuclear weapons.[85] In that same statement, Russian officials appear to have asserted that Moscow may use nuclear weapons against an ally of a nuclear-armed state even if it has not been attacked, earning it a minus.

Subsequent statements from Russian officials further complicate Russia's negative security assurances. In December 2014, in the Russian Military Doctrine Paper, Russia opened the door to using nuclear weapons in response to a conventional attack "when the very existence of the state is under threat."[86] However, Putin stated in October 2018 that Russia would only use nuclear weapons in response to an incoming missile attack.[87]

There is considerable controversy over whether or not Russia abides by an "escalate to de-escalate policy," meaning that Russia would use nuclear weapons first in a conflict in order to coerce an adversary into ceasing its attack. The 2018 U.S. Nuclear Posture Review (NPR) credits "escalate to de-escalate" as Russia's policy, although a number of experts disagree that "escalate to de-escalate" accurately reflects Russia's policy as did Russian

Ambassador to the United States Anatoly Antonov in remarks to the 2019 Carnegie International Nuclear Policy Conference.[88]

The extent to which Russia is willing to abide by its negative security assurances also remains in question. The Russian military's 2014 intervention and occupation of Crimea violates the 1994 Budapest Memorandum to respect the territorial sovereignty of Ukraine after Kiev agreed to denuclearize in 1994 and join the NPT as a non-nuclear-weapon state. This action sets a precedent that Moscow is willing to disregard its assurances in the face of other calculations. Russia's nuclear modernization plans also point toward a more aggressive, offensive nuclear posture that includes regional warfighting capabilities, not just deterrence.

Russia consistently abstains from the annual UN General Assembly First Committee resolution calling for negotiations to reach an effective international agreement to "assure the non-nuclear weapon States against the use or threat of use of nuclear weapons."

2016 grade: C-
2013 grade: C
2010 grade: C

6. Nuclear-Weapon-Free Zones: B

Russia ratified the protocols for four of the five nuclear-weapon-free zones: Latin America (1979), the South Pacific (1988), Africa (2011), and Central Asia (2015). Russia also joined a declaration, in collaboration with the other nuclear-weapon states, recognizing Mongolia as a NWFZ in 2012.[89] In October 2018, Russia said that it is open to consultations on the protocol to the Bangkok Treaty establishing a NWFZ in Southeast Asia and called the failure to reach agreement on the protocol a "lost opportunity."[90]

As one of the three states that sponsored the MEWMDFZ 1995 Resolution, Russia has put forward proposals to advance the zone after the 2015 NPT Review Conference failed to reach a consensus and the mandate for the 2010 process ended, including a working paper at the 2017 NPT Preparatory Committee meeting. Russia's proposals, however, do not appear to have led to further steps to advance the zone.

At the UN General Assembly First Committee in 2018, Russia expressed support for the Arab League's resolution calling for the UN secretary-general to convene a conference moving toward a zone in 2019 and every year thereafter until the zone is realized. Russia said that with adoption of the resolution, "the 1995 Resolution on the Middle East will be brought to practical implementation."[91]

Russia abstained from a 2018 UN General Assembly First Committee resolution calling for a fourth conference on NWFZs to be held in 2020. During the timeframe of the last report, Russia had ratified the protocol for the Central Asian NWFZ, earning it a plus grade, but Russia did not ratify any additional protocols during the timeframe of this report.

2016 grade: B+
2013 grade: B
2010 grade: C

7. IAEA Safeguards: N/A

Moscow's voluntary safeguards agreement entered into force in June 1985, and its additional protocol did so in October 2007.

8. Nuclear Weapons-Related Export Controls: C

Russia is a member of the NSG and MTCR. It has a number of national export control measures in place to prevent the spread of nuclear and missile technologies, including export control legislation, licensing provisions, deemed exports restrictions, end-user controls, a catch-all clause, and controls over re-export and transshipment.[92]

Russia submitted a national report on implementation to the 1540 Committee most recently in 2014, stating the preparation of the report is "yet another step towards the full implementation of the resolution at the national and international levels."[93] Moscow last reported to the committee in 2007.

Russia has submitted five reports corresponding with the resolutions passed by the UN Security Council sanctioning North Korea since 2016. Reports from the UN Panel of Experts, a group charged with assessing implementation of UN sanctions on North Korea, raised concerns about Russia's implementation of the measures, including in 2018.[94] This accounts for the drop in Russia's grade.

2016 grade: A
2013 grade: C
2010 grade: C

9. Nuclear Security Commitments: B-

Russia ratified the CPPNM in 1983 and its 2005 amendment in 2008 and adheres to the IAEA's guidelines for securing radioactive sources, the Code of Conduct on the Safety and Security of Radioactive Sources. Russia was a participant in the Global Partnership until it was expelled from the G8 (now the G7) in March 2014.

Russia has implemented a number of physical protection measures to account for and secure nuclear materials. The United States and Russia engaged in a bilateral assistance program, the Cooperative

Threat Reduction program, which began in 1992 and included objectives for securing Russian nuclear materials and warheads. That program ended in 2014 and Russia has not sought to renew it. In late 2016, Putin suspended the Plutonium Management and Disposition Agreement that the United States and Russia signed in 2010 to eliminate 34 tons of weapons-grade plutonium each, earning it a minus grade. Independent assessments judge that Russia's nuclear security would benefit from renewed cooperation with the United States.[95]

In 2015, U.S. President Obama terminated existing executive orders against Russia, which were originally enacted because of the "risk of nuclear proliferation created by the accumulation of a large volume of weapons-usable fissile material resulting from the reduction of nuclear weapons" in Russia.[96] Questions remain, however, about the security of Russian radiological materials, after operations in countries including Moldova and Georgia uncovered attempts to sell radioactive sources believed to have originated in Russia on the black market.[97]

Despite the breakdown in U.S-Russian bilateral cooperation on nuclear security projects in Russia, Moscow does cooperate with the United States on disposition of Russian-origin nuclear materials in third-party countries and conversion of Russian-supplied reactors to run on LEU. Most recently, Russia took back 61 kilograms of spent fuel from Poland's Maria research reactor in 2016 and HEU from Kazakhstan in 2017. Russia has taken some steps to reduce its use of fissile materials in civil applications. Russia participated in the 2010, 2012, and 2014 Nuclear Security Summits and, as part of that process, committed to convert HEU-research reactors to run on LEU fuels. Russia did not participate in the 2016 Nuclear Security Summit, citing a lack of value in additional summits beyond the initial four-year commitment.

Russia has not signed on to the Strengthening Nuclear Security Implementation (SNSI) initiative introduced at the 2014 summit (now open to all IAEA member states), which would have committed Moscow to implement the IAEA recommendations for nuclear security in the agency's nuclear security series documents.

2016 grade: B-
2013 grade: A-
2010 grade: A-

10. Criminalization and Illicit Trafficking Commitments: A-

Russia participates in the ITDB and ratified the Nuclear Terrorism Convention in 2006. It is a partner in the PSI, including the Operational Experts Group (OEG).

Since several high-profile incidents involving HEU trafficked out of Russia were reported, the country has installed radiation detectors at all border points. Despite these steps, there are legitimate allegations of illicit trafficking of radioactive materials across Russian borders, earning it a minus grade.[98] Russia worked in collaboration with the United States to create the GICNT in July 2006 and continues to serve as co-chair of that body.

2016 grade: A
2013 grade: A
2010 grade: A

United Kingdom

Overall Grade

B

The United Kingdom's nuclear arsenal is currently comprised of 215 nuclear warheads which it can deploy on its four Vanguard-class nuclear submarines.[99] It was the third state to test a nuclear weapon and played a significant role in the U.S. Manhattan Project. Unlike the other nuclear-weapon states, the British government continues to engage in an internal debate about the salience of its nuclear arsenal, including replacing its submarine fleet. In addition to taking steps over the years to reduce its nuclear arsenal, the United Kingdom is a leader in promoting nuclear disarmament verification research. London's decision to leave the European Union has had consequences for its nuclear program, including requiring the United Kingdom to withdraw from Euratom, which conducted safeguards on the county's civil nuclear program. As a result, the United Kingdom has renegotiated a safeguards agreement with the IAEA and renegotiated its civil nuclear cooperation arrangements.

1. Banning Nuclear Testing: A

The United Kingdom, an Annex 2 state, signed the CTBT in 1996 and was one of the first nuclear-weapon states to ratify the treaty in 1998. The United Kingdom has consistently supported international efforts to bring the CTBT into force, including voting for the most recent UN General Assembly resolution supporting the treaty in 2018. The United Kingdom also voted in favor of UN Security Council Resolution 2310, which calls for early entry into force of the CTBT, in September 2016.

The United Kingdom conducted 45 nuclear weapons tests from 1952 to 1991.

2016 grade: A
2013 grade: A
2010 grade: A

2. Ending Fissile Material Production for Weapons: A

The United Kingdom declared that it stopped production of HEU for weapons in 1962 and ceased production of plutonium for weapons in 1995. London is estimated to have a stockpile of 19.8 metric tons of HEU for military purposes (including naval fuel) and 3.2 metric tons of plutonium for weapons.[100] The United Kingdom has 110.3 metric tons of reactor-grade plutonium in its civilian stockpile.

The United Kingdom has consistently expressed support for negotiations on an FMCT based on the Shannon Mandate including by voting for resolutions in the UN General Assembly First Committee calling for negotiations of an FMCT, most recently in 2018. The United Kingdom participated in the high-level FMCT expert preparatory group, which met from 2017-2018 and produced a final report on taking forward FMCT negotiations.

2016 grade: A
2013 grade: A
2010 grade: A

3. Reducing Nuclear Weapons Alert Levels: B-

The United Kingdom keeps its nuclear weapons de-targeted and on a low alert level. In its 1998 Strategic

UK Prime Minister Theresa May delivers a speech in Grimsby, March 8, 2019. (Photo: Office of the Prime Minister)

Defense Review, the United Kingdom states that its submarine-based missiles "will not be targeted and it will normally be at several days 'notice to fire.'"[101] The Prime Minister has the sole authority to launch nuclear weapons but he or she cannot do so without due cause.

The United Kingdom consistently rejects additional multilateral calls for reducing nuclear weapons alert levels. In 2018, the United Kingdom voted against a UN General Assembly First Committee resolution which "calls for further practical steps to be taken to decrease the operational readiness of nuclear weapons systems, with a view to ensuring that all nuclear weapons are removed from high alert status," earning it a minus grade.[102] The United Kingdom also votes against an annual UN General Assembly First Committee resolution, most recently in 2018, on reducing nuclear dangers which calls for steps including de-alerting and de-targeting nuclear forces.

When the United Kingdom decided to downgrade its alert status of its nuclear forces during the 1990s, it also limited its nuclear delivery systems to the Trident submarine-launched ballistic missile (SLBM) in 1998. The British government's standard practice is to have one submarine on deterrent patrol at any given time.

2016 grade: B
2013 grade: B
2010 grade: B

4. Nuclear Force Reductions: D+

As of January 2018, the UK nuclear arsenal was comprised of 215 nuclear warheads, about 120 of which are available for deployment.[103] Unlike during the timeframe of the last report, the United Kingdom is not known to have taken steps to reduce its nuclear arsenal during the timeframe of this report, earning it a D level grade. By the mid-2020s, the United Kingdom intends to reduce its total nuclear stockpile from 215 warheads down to 180, which it announced in 2010 and reiterated in a 2015 national security strategy document, earning it a plus.[104]

In its March 2018 report on implementing the 2015 national security strategy document, that UK stated "the UK's independent nuclear deterrent will remain essential to our security today, and for as

long as the global security situation demands."[105] The United Kingdom is engaged in upgrading its nuclear delivery systems. It plans to replace the current Vanguard-class nuclear-capable submarines with four new Dreadnought-class nuclear submarines. The replacement plan was approved by the House of Commons in a 2016 vote. Each Dreadnought-class submarine will be equipped with launch tubes for 12 Trident II SLBMs, a reduction from the 16 SLBM launch tubes in the Vanguard-class SSBNs. The United Kingdom cooperates with the U.S. program to modernize and extend the service life of the Trident II (D5) missile into the early 2060s. The United Kingdom is still developing replacement options for the Holbrook warhead for Trident II missiles, and until a decision is reached, the British Atomic Weapons Establishment is starting to extend the life and improve the current warhead.

The United Kingdom has been active in engaging in nuclear disarmament verification research, including through the International Partnership for Nuclear Disarmament Verification (IPNDV) since 2015 and with Norway in bilateral and quadrilateral initiatives since 2007. The United Kingdom participated in the group of governmental experts on nuclear disarmament verification convened in 2018 and 2019.

The United Kingdom did not participate in the negotiations on the 2017 TPNW and has condemned the treaty since its adoption, including at the UN General Assembly First Committee in 2018, stating that the treaty "ignores the security context and does nothing to increase trust or transparency between nuclear weapons possessor states."[106]

2016 grade: C+
2013 grade: C+
2010 grade: D+

5. Negative Security Assurances: C

The United Kingdom issued unilateral negative security assurances in 1978 and 1995, and reaffirmed its commitment not to use or threaten to use nuclear weapons against non-nuclear-weapon states in its 2015 Strategic Defense and Security Review document, although it does retain some reservations.

In an April 1995 letter to the United Nations, the United Kingdom said it will not use, or threaten to use, nuclear weapons against non-nuclear-weapon states party to the NPT, except when a state is acting "in association or alliance with a nuclear-weapon state" that attacks the United Kingdom, its territories or allies, or any state in breach of its commitments under the NPT.[107] The United Kingdom seems to allow the possibility of responding to a chemical or biological attack from a non-nuclear-weapon state with nuclear weapons in its 2015 Review. While the 2015 document claims there is no current threat to the country from weapons of mass destruction, it states that it reserves the right to "review this assurance if the future threat, development, or proliferation of these weapons make it necessary."

In 2018, the United Kingdom abstained from a UN General Assembly First Committee resolution encouraging the Conference on Disarmament to negotiate agreements to assure non-nuclear-weapon states against the use or threat of use of nuclear weapons.

2016 grade: C
2013 grade: C
2010 grade: C

6. Nuclear-Weapon-Free Zones: B

In January 2015, the United Kingdom ratified the protocol for the Central Asian NWFZ, becoming the second nuclear-weapon state to complete ratification, and earning it a plus grade in the 2016 version of this report. The United Kingdom ratified the relevant protocols for the Latin American NWFZ (1969), for the South Pacific NWFZ (1997), and for the African NWFZ (2001). The United Kingdom recognized Mongolia's status as a NWFZ in 2012. The nuclear-weapon states announced in 2013 that they had reached an agreement with ASEAN on a revised protocol to the Southeast Asia NWFZ, but the United Kingdom has taken no action on the protocol for that zone.

The United Kingdom was tasked at the 2010 NPT Review Conference (along with the United States and Russia) to convene a conference establishing a zone free of weapons of mass destruction in the Middle East by 2012 and has traditionally supported creating such a zone. The conference did not take place and the mandate established by the 2010 Review Conference document expired in 2015.

In 2018 at the UN General Assembly First Committee, the United Kingdom abstained from the resolution on creating a NWFZ in the Middle East that in past years has been adopted without a vote, and from a resolution suggesting that the UN secretary-general convene a conference no later than 2019 on a WMDFZ in the Middle East. London has opposed setting deadlines for progress on the zone, likely prompting its abstention from the 2018 MEWMDFZ resolution. The United Kingdom also abstained from a 2018 UN General Assembly First Committee resolution on convening a fourth conference in 2020 on NWFZs.

2016 grade: B+
2013 grade: B
2010 grade: B

7. IAEA Safeguards: N/A

London reached a voluntary safeguards agreement with the IAEA in 1972 and concluded an additional protocol to strengthen its IAEA safeguards in 2004.

On June 7, 2018, the United Kingdom passed the Nuclear Safeguards Bill to enable the United Kingdom to establish nuclear safeguards on its civilian nuclear program following its withdrawal from the European Atomic Energy Community (Euratom) in March 2019 as part of the country's exit from the European Union. Euratom had applied the country's safeguards in connection with the IAEA. The United Kingdom signed a new safeguards agreement with the IAEA in 2018 to replace its Euratom agreement.

2016 grade: N/A
2013 grade: N/A
2010 grade: N/A

8. Nuclear Weapons-Related Export Controls: A

The United Kingdom has been a member of the NSG since its creation in 1975 and of the MTCR since 1987. In January 2019, United Kingdom updated its export control lists to reflect updates to the EU dual-use export control list. The EU export control list takes into account changes to the NSG and MTCR trigger lists made in 2018.

The United Kingdom, along with other G7 members, has expressed the need for the NSG to adopt stricter guidelines involving the transfer of enrichment and reprocessing technology and, along with the G7, has agreed to abide by draft criteria-based guidelines for such transfers.

The United Kingdom last submitted a national report on its implementation of UN Security Council Resolution 1540 in December 2013. The United Kingdom has submitted national reports on its implementation of sanctions on North Korea, including on UN Security Council Resolution 2397 in March 2018.

2016 grade: A
2013 grade: A
2010 grade: A

9. Nuclear Security Commitments: A

In addition to ratifying the CPPNM in 1992 and its 2005 amendment in 2010, the United Kingdom has endorsed the IAEA Code of Conduct on the Safety and Security of Radioactive Sources and signed onto a joint statement at the 2014 Nuclear Security Summit which committed participating states to "meet the intent" of the IAEA's nuclear security recommendations and "subscribe to the fundamental principles" of the nuclear security guidelines. The United Kingdom participated in all four nuclear security summits.

The United Kingdom has taken a number of steps domestically to secure nuclear materials, including an IAEA follow-up IPPAS mission to review the United Kingdom's implementation of recommendations from a prior mission in 2011. The United Kingdom has an extensive regulatory system for nuclear security, overseen by the Office for Nuclear Security, including accounting, physical protection, and licensing regulations. The 2018 annual report of the Office for Nuclear Regulation described implementation of a new Risk Management Framework.[108] London has also developed a Nuclear Security Vulnerability Assessment in order to support the country's civilian nuclear industry by providing a qualitative assessment of each nuclear facility's security measures.[109] The vulnerability assessment evaluates security at nuclear sites, facilities, transports, ports, and other "Critical National Infrastructure."

The United Kingdom established its own Global Threat Reduction Program to fund nonproliferation and security projects in other countries and participates in the Global Partnership.

2016 grade: A
2013 grade: A
2010 grade: A

10. Criminalization and Illicit Trafficking Commitments: A

The United Kingdom participates in the ITDB and ratified the Nuclear Terrorism Convention in 2009. London participates in the GICNT and chairs its Nuclear Detection Working Group. The United Kingdom is also an active member in PSI, including the Operational Experts Group (OEG), and hosted an OEG meeting in 2016.

2016 grade: A
2013 grade: A
2010 grade: A

United States

Overall Grade

C+

The United States has the second-largest nuclear arsenal behind Russia at 6,550 nuclear warheads.[110] It was the first country to test a nuclear weapon and the only country to have ever dropped nuclear weapons on two cities—Hiroshima and Nagasaki—in August 1945. The United States has promoted nonproliferation policies and encouraged international and domestic nuclear security practices. However, the Trump administration has retracted its support from many established nuclear nonproliferation and arms control agreements and initiatives, including withdrawing from the 2015 nuclear deal with Iran, known as the Joint Comprehensive Plan of Action (JCPOA), and the INF Treaty. The Trump administration also expanded options under which the United States would consider using nuclear weapons in its 2018 Nuclear Posture Review (NPR) and is investing in new, low-yield nuclear warheads. The United States has continued to advance nuclear security worldwide and strengthen international efforts to combat nuclear terrorism.

1. Banning Nuclear Testing: C-

The United States halted nuclear testing in 1992 after carrying out a total of 1,030 nuclear test explosions. Washington led global efforts to negotiate and conclude the CTBT at the CD in 1996 and was the first nation to sign the treaty. As an Annex 2 state, U.S. ratification is necessary for entry into force. The U.S. Senate failed to achieve the necessary two-thirds majority for the United States to complete CTBT ratification in 1999 and has not taken it up again since.

The Trump administration walked back U.S. support for the CTBT relative to the Obama administration, which expressed support for ratifying the treaty. In its 2018 Nuclear Posture Review, the United States stated that it would not seek ratification of the CTBT and as a result, its grade dropped from the 2016 version of this report.[111] In addition, the United States stated in the FY2018 Stockpile Stewardship Management Plan that it would shorten the readiness timeline for a simple nuclear test, while admitting that there is no current requirement for the United States to conduct a nuclear test, earning it a minus grade.[112]

The United States voted for the resolution urging states to ratify the CTBT at the UN General Assembly First Committee in 2016 but abstained in 2017 and 2018. The United States voted in favor of UN Security Council Resolution 2310, which calls for early entry into force of the CTBT in September 2016.

2016 grade: B+
2013 grade: B
2010 grade: B

2. Ending Fissile Material Production for Weapons: A

The United States declared a halt to the production of fissile materials for nuclear weapons in 1992 and is estimated to have 574.5 metric tons of HEU, including in irradiated naval fuel, and 87.8 metric tons of separated weapons-grade plutonium remaining in its military stockpile as of February 2018.[113] The United States also possesses about seven metric tons of civilian plutonium.

Air Force General John Hyten, U.S. Strategic Command commander, addresses the 5th Bomb Wing airmen at Minot Air Force Base, N.D., June 6, 2017. "The ICBMs that we have here are the most ready element [of the nuclear triad], the bombers that we have here are the most flexible, the submarine element is the most survivable, and when you put those three together, you come up with a deterrent capability that our adversaries fear and they need to fear those capabilities," he told the Bismarck Tribune during the visit. "I hope to never have to employ them but they have to be ready all the time." (Photo: J.T. Armstrong/U.S. Air Force)

The United States has consistently supported efforts to negotiate an FMCT in line with the Shannon Mandate. In April 2018, then-Acting Assistant Secretary of State for Arms Control, Verification and Compliance Anita Friedt reiterated that the United States would support pursuing an FMCT, a claim which was repeated by Christopher Ford, assistant secretary of state for international security and nonproliferation, at the 2018 NPT Preparatory Committee. However, Ford also stated that "[t]he hard reality is that FMCT negotiations will not begin until the remaining key states are prepared to cap their stocks of fissile materials for nuclear weapons."[114]

The United States has voted in favor of resolutions at the UN General Assembly First Committee in support of an FMCT including in 2018 and participated in the UN high-level FMCT expert preparatory group from 2017 to 2018.

2016 grade: A
2013 grade: A
2010 grade: A

3. Reducing Nuclear Weapons Alert Levels: C-

The United States maintains about half of its nuclear forces at a high alert level. Experts assess that an estimated 852 U.S. warheads are on prompt alert, or are ready to be launched within 15 minutes.[115] Nearly 98 percent of U.S. ICBMs (392 missiles) are capable of launching within five minutes of the U.S. president issuing the launch codes.[116] Four or five of U.S. nuclear submarines are believed to be on "hard alert," capable of reaching their targets within 15 minutes of presidential authorization, and another four or five boats could be brought up to this alert status within hours or days.[117] U.S. nuclear bombers are not on alert. In October 2017, the U.S. Air Force was reportedly preparing to put nuclear-armed bombers back on alert, for the first time since 1991, if given the order to do so.[118]

The 2018 Nuclear Posture Review states that "the United States will maintain a portion of its nuclear forces on alert day to day and retain the option of launching those forces promptly. This posture maximizes decision time and preserves the range of U.S. response options." It explicitly rejects de-alerting its ICBM force.

In 2016 and 2018, the United States voted against the UN General Assembly First Committee resolution entitled "Decreasing the Operational Readiness of Nuclear Weapons Systems," which called for "further practical steps to be taken to decrease the operational readiness of nuclear weapons systems, with a view to ensuring that all nuclear weapons are removed from high alert status." The United States also consistently votes against a UN General Assembly First Committee resolution on reducing nuclear dangers. These votes earned it a minus grade.

Washington did de-target its nuclear forces in 1994 and re-stated in the 2018 NPR that it would continue

its policy of targeting its strategic forces at open oceans, instead of adversaries' territories.

The U.S. President has the sole authority to launch nuclear weapons.

2016 grade: C
2013 grade: C
2010 grade: C

4. Nuclear Force Reductions: D

As of February 2018, the United States possessed an estimated total of 6,550 nuclear warheads.[119] Of that 6,550 total, about 4,000 nuclear weapons are part of the "active" stockpile and 2,550 warheads are retired but still intact.[120] Within the 4,000 warheads in the active stockpile are about 1,650 strategic deployed warheads, 150 tactical deployed warheads and roughly 2,200 warheads in storage, some of which are awaiting retirement.[121] The United States reduced its nuclear arsenal by dismantling about 400 warheads during the timeframe of this report, down from roughly 6,970 warheads as of the last version of this report.

The United States met the February 2018 deadline imposed by New START to limit its strategic nuclear arsenal to 1,550 accountable deployed strategic warheads, 700 deployed strategic delivery systems, and 800 deployed and non-deployed launchers for strategic delivery systems.[122] As of March 2019, the United States deployed 1,365 strategic nuclear warheads on 656 deployed strategic delivery systems, according to the New START counting rules.[123] Under New START counting rules, each strategic nuclear bomber counts as one nuclear warhead, even though bombers can carry up to 16-20 nuclear warheads. The treaty will expire in February 2021 unless both countries decide to extend it. Since May 2017, the Trump administration has been conducting an interagency review regarding whether or not it will seek an agreement with Russia to extend the treaty. The administration has said that it is in no hurry to make a decision. Russian President Vladimir Putin has proposed to begin negotiations on its extension on several occasions.[124]

The Trump administration outlined a new approach to arms control and disarmament in a U.S. working paper, "Creating the Conditions for Nuclear Disarmament," presented at the 2018 NPT Preparatory Committee for the 2020 Review Conference, which contends that a number of changes in international security are required for total nuclear disarmament. [125] The State Department plans to convene a set of working groups to implement the new approach.[126]

On February 2, 2019, the United States formally announced it intends to withdraw from the INF Treaty if Russia does not immediately and verifiably return to compliance with the agreement.[127] Per the terms of the treaty, the U.S. withdrawal will become effective six months later (August 2, 2019). The Trump administration justified the decision to withdraw by arguing that Russia is in material breach of the INF Treaty's provisions and that it refuses to take the necessary steps to return to compliance.[128] In 2018 Congress approved $48 million for the Defense Department to begin developing a conventional, ground-launched, intermediate-range nuclear cruise missile that would violate the treaty if tested, produced, or deployed.[129] Under the updated methodology, withdrawal from a treaty causes the U.S. grade to drop to a D.

The United States is engaged in a decades-long plan to upgrade and replace its nuclear delivery systems. The Air Force plans to build a new intercontinental ballistic missile and refurbish all silos and related infrastructure under the Ground Based Strategic Deterrent program. The Navy has begun building 12 new Columbia-class ballistic missile submarines and plans to build a new submarine-launched ballistic missile for fielding in the early 2040s. To modernize the strategic nuclear-capable bomber force, the Air Force is building a new bomber, the B-21, which can be used for nuclear and conventional missions, and replacing the ALCM with a new nuclear-capable cruise missile, the long-range standoff (LRSO) weapon. The B-21 is expected to be introduced in the mid-2020s and the LRSO is expected to be produced starting in the late 2020s. The United States is also planning to replace U.S. nuclear warheads and their supporting infrastructure. This includes an upgraded B61 gravity bomb warhead, the B61-12, which would consolidate the current different B61 bomb versions into one. The upgraded B61-12 will also be equipped with a new tail-kit guidance assembly in order to make it more precise and to provide an option for a lower yield than previous B61 variants.

In addition to replacing existing strategic delivery systems and their associated warheads and supporting infrastructure, in the 2018 Nuclear Posture Review (NPR), the United States stated that it would develop additional nuclear weapons systems, including a new low-yield submarine-launched ballistic missile warhead and submarine-launched cruise missile system. The reviews states that the Pentagon will also undertake research on "advanced nuclear delivery system technology and prototyping capabilities," including "on the rapid development of nuclear delivery systems, alternative basing modes, and capabilities for defeating advanced air and missile defenses." This could include research and development on mobile ICBMs and hypersonic missiles for nuclear weapons delivery.[130] The NPR also

calls for the United States to increase its production of plutonium pits, the core of some nuclear weapons, to a rate of no fewer than 80 pits per year by 2030.

Trump has suggested increasing the size of the U.S. nuclear arsenal. In December 2016, then President-elect Trump tweeted that the United States "must greatly strengthen and expand its nuclear capability."[131]

The United States, along with other nuclear-weapon states, boycotted the negotiation of the TPNW in 2017 and has urged its allies not to sign the treaty since its adoption. The U.S. criticism of the treaty continued into statements at the UN General Assembly First Committee in 2017 and 2018.

The United States has engaged in research on nuclear disarmament verification, including through leading the International Partnership on Nuclear Disarmament Verification (IPNDV) and by participating in the group of governmental experts on nuclear disarmament verification convened in 2018 and 2019.

2016 grade: B+
2013 grade: B
2010 grade: B-

5. Negative Security Assurances: C-

The United States issued assurances not to use nuclear weapons against non-nuclear-weapon state NPT members in 1978 and 1995 except in the case of an attack "in association or alliance with a nuclear weapon state." In 1997 the United States issued a Presidential Decision Directive reaffirming these pledges. However, Trump's statements undermine confidence in the U.S. stated declaratory policy and his administration broadened the circumstances in which the United States would consider using nuclear weapons to respond to a non-nuclear attack. [132]

The 2018 NPR explicitly rejects a no-first-use policy, stating that "such a policy is not justified today." The 2018 NPR does state that the first use of nuclear weapons will only be considered under "extreme circumstances," but it expands these circumstances beyond the Obama administration's NPR to include "significant non-nuclear strategic attacks" against "U.S., allied or partner civilian population or infrastructure, and attacks on U.S. or allied nuclear forces, their command and control, or warning and attack assessment capabilities." Although the policy does not explicitly define "significant non-nuclear strategic attacks," Undersecretary of Defense for Policy John Rood clarified at the press conference following the report's release that this could include chemical and biological attacks, large-scale conventional aggression, and cyberattacks.[133] The scenarios provided for in the 2018 NPR report are much broader than the "narrow range of contingencies" laid out in the 2010 report, earning the United States a minus grade.

Whereas the 2010 report called for enhanced non-nuclear capability to maintain deterrence, the 2018 document states that "non-nuclear capabilities can complement but not replace U.S. nuclear capabilities" for the purpose of deterrence.

The United States consistently abstains on a UN General Assembly First Committee resolution on concluding international instruments to assure non-nuclear-weapon states against the use of nuclear weapons.

2016 grade: C
2013 grade: C
2010 grade: B

6. Nuclear-Weapon-Free Zones: C

The United States has ratified the relevant protocol to the Latin American NWFZ (1981), but has only signed the protocols for the treaties of the African (1996), South Pacific (1996) and Central Asian (2014) zones. On September 17, 2012, Washington released a joint declaration, in collaboration with the four other nuclear-weapon states, which recognizes Mongolia's status as a NWFZ. Washington announced in 2013 that it had reached an agreement with ASEAN on a revised protocol to the Southeast Asian NWFZ and that a signing of the treaty should take place soon. The United States has not signed the protocol at the time of publication.

Unlike the Obama administration, the Trump administration has not said that it will seek ratification of the three zone treaties before the Senate.

At the 2018 UN General Assembly First Committee, the United States voted against a resolution for the UN secretary-general to convene a conference in 2019, and every year thereafter, on taking forward a WMDFZ in the Middle East. The United States also broke a decades-long consensus on the annual UN General Assembly First Committee resolution in support of a NWFZ in the Middle East by, along with Israel, voting against the resolution, which is usually adopted by consensus without a vote.

The United States debuted a new approach on the issue at the 2018 NPT Preparatory Committee for the 2020 Review Conference, stating in a working paper that "the NPT review cycle cannot be the primary mechanism for progress" on a zone free of WMD in the Middle East but that regional states should work to establish the conditions needed to make progress on the initiative.[134] The United States abstained from a 2018 UN General Assembly First Committee resolution on convening a conference on NWFZs in 2020.

2016 grade: C+
2013 grade: C
2010 grade: C

7. IAEA Safeguards: N/A

The United States has had a voluntary safeguards agreement in place with the IAEA since December 1980 and an additional protocol since January 2009.

2016 grade: N/A
2013 grade: N/A
2010 grade: N/A

8. Nuclear Weapons-Related Export Controls: A

The United States was a founding member of the NSG and MTCR. The United States updated its domestic export administration regulations to comply with the changes adopted at the 2016 and 2017 MTCR plenaries. It also supports G7 commitments not to transfer reprocessing and enrichment technologies to non-NPT states.

The United States has an extensive export control assistance program aiding the development of nuclear weapons-related export controls in other states, including the Export Control and Related Border Security program, a Department of State-led interagency program aimed at export control assistance in about 60 countries.

The United States last submitted a report to the 1540 Committee in March 2016, including reporting on its activities to revise safety and export control regulations and its assistance to other states in implementing Resolution 1540.[135] The United States has consistently submitted national reports on its implementation of UN Security Council sanctions on North Korea, including on Resolution 2397 in March 2018.

2016 grade: A
2013 grade: A
2010 grade: A

9. Nuclear Security Commitments: A

Washington joined the CPPNM in 1982 and its 2005 amendment in July 2015. The United States has agreed to implement nuclear security procedures consistent with the IAEA Code of Conduct and at the 2014 Nuclear Security Summit announced it would incorporate the IAEA's nuclear security guidelines into its regulatory framework. The United States participated in all four nuclear security summits.

The United States implements extensive national nuclear security regulations overseen by the Nuclear Regulatory Commission and the National Nuclear Security Administration (NNSA). Regulations cover accounting and security for the use, storage, and production of nuclear material, physical protection for facilities and material, and licensing for entities and facilities. For example, the Office of Materials Management and Minimization, formerly the Global Threat Reduction Initiative, continues to support reactor conversions, fuel returns, and LEU fuel development. The United States participates in the Global Partnership.

2016 grade: A
2013 grade: B+
2010 grade: B+

10. Criminalization and Illicit Trafficking Commitments: A

The United States signed the Nuclear Terrorism Convention in September 2005 and ratified it in September 2015. The United States participates in the ITDB and has initiated or joined a number of multilateral efforts to prevent or counter illicit trafficking in nuclear materials, including the GICNT, which the United States co-chairs along with Russia. The United States also played an instrumental role in creating PSI and participates in the Operational Experts Group (OEG) and in the annual Asia-Pacific exercise rotation.

In December 2018, the Trump administration released a National Strategy for Countering Weapons of Mass Destruction Terrorism, outlining the U.S. plan to counter nonstate WMD threats, pressure WMD-capable terrorist groups and enhance security for dangerous materials internationally. Washington also works with a number of countries to strengthen screening for radioactive materials at ports and border crossing through its Second Line of Defense and Megaports Initiatives.

2016 grade: A
2013 grade: B+
2010 grade: B+

NON-NPT STATES

India

Overall Grade

C

India participated in negotiations on the NPT at the Eighteen Member Disarmament Committee, but chose not to support the treaty, arguing that it did not provide adequate access to civil nuclear technology. India went on to develop a nuclear arsenal outside the NPT, carrying out its first nuclear test in 1974. India described the 1974 test as a "peaceful nuclear explosion," but later admitted it was part of New Delhi's pursuit of nuclear weapons. Fourteen years later, in May 1998, India conducted five nuclear tests in quick succession and then formally declared itself a nuclear-armed state. India currently is estimated to possess 130–140 nuclear warheads and has been steadily expanding its nuclear arsenal.[136] Despite long-standing calls from New Delhi for global nuclear disarmament, India rejects the current nonproliferation regime as inherently discriminatory and has been resistant to join multilateral disarmament efforts under the NPT, arguing that nuclear weapons are "an integral part" of its national security "and will remain so pending the global elimination of all nuclear weapons."[137] India proclaims to abide by a no-first-use doctrine but some experts have questioned its sincerity. In 2008, the NSG agreed to exempt India from rules restricting commercial nuclear cooperation to non-NPT members, allowing India to take advantage of a key NPT incentive despite remaining outside the treaty.

1. Banning Nuclear Testing: D+

In 1954, Indian Prime Minister Jawaharalal Nehru called for a "standstill agreement" to halt further nuclear testing "pending progress towards some solution, full or partial, in respect to the prohibition and elimination of these weapons of mass destruction."[138] But during negotiations on the CTBT at the CD in 1996, India sought to block adoption of the text, arguing that the treaty "is not conceived as a measure towards universal nuclear disarmament and it is not in India's national security interest."[139]

Following India's nuclear tests in May 1998, the UN Security Council passed Resolution 1172 in June 1998, which urged both India and Pakistan to join the CTBT "without delay and without conditions." India did announce a nuclear testing moratorium in September 1998 and continues to abide by it but has yet to sign the CTBT. As an Annex 2 state, India's ratification is necessary for entry into force of the treaty.

Furthermore, India traditionally abstains from a UN General Assembly First Committee resolution calling for the CTBT's entry into force, including the most recent in December 2018.

If India resumed testing, it would likely jeopardize nuclear cooperation with other countries. Following the 2008 NSG agreement to exempt India from restrictions on nuclear trade with non-NPT states, many countries issued statements indicating that

such trade would halt if India were to conduct a nuclear test. U.S. law requires that nuclear trade with India cease in the event of a test.[140] Most recently, the nuclear cooperation agreement concluded between India and Japan in November 2016 included the option for Tokyo to nullify the agreement if India conducts a nuclear test.[141]

2016 grade: D+
2013 grade: D+
2010 grade: D+

2. Ending Fissile Material Production for Weapons: F

New Delhi has expressed support for negotiating an FMCT that is verifiable and nondiscriminatory, but it has rejected a voluntary moratorium on fissile material production for weapons.

India voted in favor of the UN General Assembly resolution calling for an FMCT in 2018, participated in the 2017–2018 high-level expert preparatory group on the FMCT and welcomed the findings of that group. At the UN First Committee in 2018, New Delhi expressed the hope that the recommendations "would propel the CD to commence negotiations on an FMCT."[142]

While India does not disclose the size of its fissile material stockpiles, evidence indicates that the country continues to produce fissile materials for military purposes. India's stockpile of fissile material is estimated to include 0.6 metric tons of weapons-grade plutonium.[143] Of India's two plutonium production reactors, only one, the Dhruva, is currently operating. Another reactor is under construction. India also possesses about six tons of separated reactor-grade plutonium that is considered part of the military stockpile and about 0.4 metric tons under IAEA safeguards.

Additionally, India has about 4.5 metric tons of HEU enriched to about 30 percent uranium-235 for naval reactor fuel. India is expanding its enrichment facility used to produce the HEU for military purposes and building a new facility to enrich uranium for civil purposes.[144]

2016 grade: F
2013 grade: F
2010 grade: F

3. Reducing Nuclear Weapons Alert Levels: B+

Initially, India was believed to store its nuclear warheads de-mated from its land-based ballistic missiles. Separate storage reduced the level of readiness and risk of accidental or unauthorized use. However, India's nuclear-capable ballistic missiles now include canister-based and submarine-launched systems. In both the submarine and canister-based configurations, warheads are likely stored mated with the missile, casting doubt that the prior "de-mated" status still applies and earning it a lower grade than the previous report.

Control over India's nuclear weapons rests with the country's Strategic Forces Command, and authority to launch a nuclear strike in India rests in the National Command Authority, which was established in 2003. This body is comprised of an Executive Council and a Political Council. The Political Council, chaired by the prime minister, has the authority to order a nuclear strike. It is unclear if the decision to launch requires consensus agreement from the Political Council, but, according to the 2017 Joint Doctrine for the Armed Forces, "the ultimate decision to authorize the use of nuclear weapons rests solely with the prime minister."[145]

India sponsors an annual UN General Assembly First Committee resolution, including in 2018, entitled "Reducing Nuclear Danger," earning it a plus. India also voted in favor of a UN General Assembly First Committee resolution introduced in 2018 on decreasing the operational readiness of nuclear weapons.

2016 grade: A-
2013 grade: A
2010 grade: A

4. Nuclear Force Reductions: F

India continues to expand the size of its nuclear arsenal and diversify its nuclear delivery capabilities. As of 2018, India possesses an estimated 130-140 warheads, an increase from the 110-120 estimated in the 2016 version of this report. It is unclear if India is pursuing a particular target for the size of its arsenal, as the country has consistently maintained that India's nuclear deterrent would be "commensurate with the size and geostrategic position of India."[146]

In addition to the expanding arsenal, India is developing new nuclear-capable delivery systems. Most notably, in November 2018, Prime Minister Narendra Modi announced that the country's first domestically built nuclear submarine (SSBN) conducted its first "deterrent patrol," completing the state's triad. The submarine, the INS Arihant, began sea-trials in 2016. It can be armed with 12 K-15 ballistic missiles that have a range of about 750 kilometers. The Arihant-class submarines will also be able to carry the K-4 SLBM, which is currently under development and has an estimated range of 3,500 kilometers. India plans to build a fleet of four to six SSBNs, which will improve the country's second-strike

Indian Prime Minister Narendra Modi chairs the meeting of the Cabinet Committee on Security at Lok Kalyan Marg in New Delhi on February 15, 2019. (Photo: Office of the Prime Minister)

capability by providing a more survivable leg of the country's triad.

In addition to advancing its sea-based capabilities, India is also developing longer-range ballistic missiles. In 2018, India deployed its Agni-V, which if tested at full range would likely be an ICBM. India, however, has tested the system at ranges just shy of the 5,500-kilometer range designation for an ICBM. India may be pursuing a missile, the Agni-VI, with an even greater range. According to the U.S. National Air and Space Intelligence Center, the Agni-VI has an estimated range of about 6,000 kilometers.[147]

There is ambiguity as to whether India's cruise missile, the Nirbhay, will have a nuclear mission. The Nirbhay has an estimated range of 700 kilometers.

India consistently reiterates its support for nuclear disarmament, despite the country's expanding nuclear arsenal and decision to remain outside of the NPT. India voted against the start of negotiations of the TPNW and voted against the resolution in support of the TPNW at the 2018 UN General Assembly First Committee.

2016 grade: F
2013 grade: F
2010 grade: F

5. Negative Security Assurances: C+

India's 1999 draft nuclear doctrine states that India "will not be the first to initiate a nuclear strike, but will respond with punitive retaliation should deterrence fail." It also states that India "will not resort to the use or threat of use of nuclear weapons against States which do not possess nuclear weapons or are not aligned with nuclear weapon powers." An official doctrine was later released in January 2003 which reiterated the no-first-use commitment, but suggested that India reserved the right to use nuclear weapons first in the event of a chemical or biological weapons attack.[148] Indian Prime Minister Narendra Modi reiterated the country's commitment to its no-first-use policy in October 2018.[149]

However, statements from former high-ranking Indian officials and experts call the country's commitment to no-first-use into question. India's former National Security Advisor Shivshankar Menon said in 2016 there are "potential gray areas" where India might use nuclear weapons first against a state that possesses nuclear weapons. Menon said "circumstances are conceivable in which India might find it useful to strike first."[150] Those circumstances could include certainty that a nuclear attack was imminent.

This statement is widely interpreted to mean that India is willing to engage in a preemptive first strike using nuclear weapons, despite its established no-first-use doctrine, resulting in a lower grade from the 2016 version of this report.

India does maintain a policy of the nonuse of nuclear weapons against non-nuclear-weapon states and has proposed negotiations of a "universal and legally-binding agreement on non-use of nuclear weapons against non-nuclear weapon states."[151]

India consistently votes in favor of the annual UN General Assembly First Committee resolution calling for negotiations to reach an effective international

An undated photo shows India testing a submarine-launched ballistic missile system. The missile was launched from a location in the Bay of Bengal, from a depth of 50 meters. The nuclear-capable system was developed to be deployed on INS Arihant. (Photo: Pallava Bagla/Corbis via Getty Images)

agreement to "assure the non-nuclear weapon States against the use or threat of use of nuclear weapons," earning it a plus grade.

2016 grade: B+
2013 grade: B+
2010 grade: B+

6. Nuclear-Weapon-Free Zones: C

India has voted in support of UN General Assembly First Committee resolutions calling for the establishment of NWFZs in other regions, including the UN General Assembly First Committee resolution in 2018 calling for a conference to be held on NWFZs in 2020.

In 2018, India voted in favor of an annual UN General Assembly First Committee resolution on establishing a NWFZ in the Middle East and abstained from the resolution calling for the UN secretary-general to convene a conference in 2019 to take forward a WMDFZ in the Middle East.

2016 grade: C
2013 grade: C-
2010 grade: C-

7. IAEA Safeguards: C+

The IAEA's Board of Governors approved an India-specific limited INFCIRC/66-type safeguards agreement in 2008. The initial agreement covered 14 reactors, but has subsequently expanded. In September 2018, India announced that it was putting another four reactors under IAEA safeguards, bringing the total of Indian nuclear facilities subject to safeguards to 26, and earning it a plus grade.[152]

The IAEA approved an additional protocol for India in March 2009, which New Delhi ratified in 2014. Although India's additional protocol is based on the 1997 Model Additional Protocol, it does not include a number of reporting requirements otherwise contained in the model protocol, nor does it cover all nuclear facilities or include complimentary access to undeclared sites. India agreed to report only nuclear-related exports, excluding reporting on nuclear-related imports, uranium mining, and research and development related to the nuclear fuel cycle.[153]

Despite the difficulties in differentiating between India's civil and military programs based on the limited extend of the safeguards agreement and additional protocol, a number of states, including Australia, agreed to sell uranium to India for its civil program.

2016 grade: C+
2013 grade: C
2010 grade: C+

8. Nuclear Weapons-Related Export Controls: A

India's national export controls include provisions related to export licensing, import controls, dual-use controls, brokering controls, transshipment and transport controls, and end-user controls.[154]

India's bid to join the MTCR was finally successful in June 2016. India committed to adhere to the NSG's guidelines in 2005, but its efforts to join that body have been unsuccessful as the NSG debates the membership criteria for non-NPT states. India was granted an NSG waiver in 2008, but its push for full membership requires consensus and the NSG has not yet reached agreement on the criteria for membership for non-NPT states.

India has recently pushed for a "merit-based approach" to defining the criteria for membership, which plays to India's nonproliferation record and would make it more difficult for Pakistan to join, as opposed to a criteria-based approach that defines standards for non-NPT members to meet in order to become members, which a number of NSG members prefer.

In June 2017, India notified the UN committee established to oversee implementation of UN Security Council Resolution 1540 that the country has taken "significant steps to further strengthen its legislative and regulatory framework for exercising control so as to eliminate risk relation to sensitive materials and technologies falling into the hands of proliferations, terrorists, and non-State actors." The steps included updating its export control list in April 2017 to take into account changes to the control lists of the MTCR, NSG, Wassenaar Arrangement, and Australia Group.

India also noted in the 1540 committee update that it participated in international conferences on best practices for export controls, including the Asian Export Control Seminar in February 2017 and responded to a request for assistance submitted by Cabo Verde. India submits national implementation reports for Resolution 1540, most recently in May 2013. India has submitted all five of the required reports on North Korea sanctions required by UN resolutions passed since 2016.

2016 grade: A
2013 grade: A-
2010 grade: A-

9. Nuclear Security Commitments: B

India acceded to the CPPNM in 2002 and the 2005 amendment in 2007. India is implementing the IAEA Code of Conduct. In April 2016, India joined the Strengthening Nuclear Security Implementation (SNSI) initiative introduced at the 2014 Nuclear Security Summit, which commits New Delhi to adhere to the nuclear security recommendations laid out by the IAEA in its nuclear security series. India participated in all four nuclear security summits.

India has also undertaken a number of national nuclear security measures consistent with the requirements of Resolution 1540. These steps include the establishment of an independent nuclear regulatory authority, accounting measures for nuclear material, and a licensing procedure for nuclear facilities and materials.

India pledged at the 2010 Nuclear Security Summit to open a nuclear security Center of Excellence. At the 2016 summit, India reported that the center had been operating for more than five years and conducted more than 30 international and regional programs on a range of nuclear security topics.

India is not a member of the Global Partnership. India's grade decreased from the past report, in part due to the revised criteria for assessing nuclear security and India's lack of participation in multilateral nuclear security initiatives, earning it a B grade.

2016 grade: A
2013 grade: A
2010 grade: A

10. Criminalization and Illicit Trafficking Commitments: A

India participates in the ITDB, joined the Nuclear Terrorism Convention in 2006, and is a partner nation in the GICNT. In February 2017, India hosted a meeting of the GICNT's Implementation and Assessment Group, to review the initiative's accomplishments from 2015-2017 and discuss objectives for 2017-2019. This was the first GICNT meeting held in South Asia. India announced in 2016 that it set up a counter nuclear smuggling team.

India is not a member of PSI.

2016 grade: A
2013 grade: A
2010 grade: A

Israel

Overall Grade

C-

Israel is widely believed to possess an undeclared nuclear arsenal of approximately 80 nuclear weapons.[155] One of three states never to sign the NPT, Israel has maintained a policy of nuclear ambiguity since the 1960s, declaring that it will not be "the first country to introduce nuclear weapons into the region."[156] Given that Israel does not admit to possessing nuclear weapons, its policy toward certain arms control and disarmament measures remains vague and it can be difficult to make determinations about Israel's nuclear policy and forces. Israel's position on a wide variety of disarmament measures is that regional security conditions must first improve before it can take certain concrete disarmament steps.

1. Banning Nuclear Testing: B-

Israel signed the CTBT in 1996 but has not yet ratified the treaty. As an Annex 2 state, Israel's ratification is necessary for the treaty's entry into force. Israel is not known to have conducted any official nuclear weapons tests.

While Israel has described the CTBT as an important "confidence-building measure" for preventing proliferation, Israeli officials have raised concerns about IMS coverage in the region and linked ratification to an improvement in the security environment in the Middle East.

CTBTO Executive Secretary Lassina Zerbo, after discussing the CTBT with Israeli Prime Minister Benjamin Netanyahu in June 2016, cited progress on IMS stations in the region as providing additional coverage in the Middle East. Zerbo said he expected Israel to ratify the CTBT in the next five years. Netanyahu later said that Israel's objections are less about the treaty, and more about the "regional context."[157] While Netanyahu's statement does not explicitly commit Israel to ratifying the CTBT, his remarks imply that Israel is working toward overcoming its objections with the intention of completing ratification, earning it a higher grade than the previous report.

Israel's claim that it shall not be the first state to introduce nuclear weapons to the Middle East region is indicative of a de facto moratorium on nuclear testing. Absent another state in the region choosing to test or pursue nuclear weapons, Israel is unlikely to be the first to conduct a nuclear test, as a test would contradict the country's stated position on not introducing nuclear weapons.

Israel consistently votes in favor of the UN General Assembly First Committee resolution in support of the CTBT.

2016 grade: C+
2010 grade: C
2013 grade: C

2. Ending Fissile Material Production for Weapons: F

Israel has expressed support for an FMCT in principle but has raised concerns that it would not be an adequate safeguard against the potential Iranian development of nuclear weapons.[158]

Despite that concern, Israel has not blocked consensus in the CD to move forward on negotiating an FMCT based on the Shannon Mandate. Israel typically abstains from an annual resolution at the UN General Assembly First Committee urging the CD to agree upon a program of work that includes FMCT negotiations.

As of 2014, it is estimated that Israel has about 900 kilograms of weapons-grade plutonium.[159] There is less certainty about Israel's HEU stockpile, which could

Prime Minister Benjamin Netanyahu Meets with Comprehensive Test Ban Treaty Organization Executive Secretary Dr. Lassina Zerbo. (Photo: Kobi Gideon, Comprehensive Test Ban Treaty Organization)

be roughly 300 kilograms. While Israel still operates the Dimona reactor, which was used to produce plutonium, a number of experts believe it is now used solely for tritium production and may be nearing the end of its lifecycle.[160]

2016 grade: F
2013 grade: F
2010 grade: F

3. Reducing Nuclear Weapons Alert Levels: D

Given Israel's nuclear opacity, little is known about its alert levels and command-and-control procedures.

Israel is believed to store its nuclear warheads and its land-based delivery systems separately, or "de-mated." The country is widely believed, however, to have fitted the six Dolphin-class submarines it purchased from Germany with nuclear-tipped cruise missiles, which would need to be stored mated with the missiles, throwing into doubt the "de-mated" status.[161]

Reporting and expert analysis suggests that the prime minister does not have sole launch authority, and any decision to order a nuclear strike also requires approval of the ministry of defense and perhaps the army chief of staff.[162]

Israel typically votes against the annual UN General Assembly First Committee resolution on reducing nuclear dangers, calling for the de-alerting and de-targeting of nuclear warheads, including in 2018. Israel abstained on the 2018 UN General Assembly First Committee resolution on decreasing the operational readiness of nuclear weapons systems.

2016 grade: D
2013 grade: D+
2010 grade: D+

4. Nuclear Force Reductions: D-

Israel is suspected to have an arsenal of about 80 nuclear warheads and enough separated plutonium for an additional 120 weapons.

Israel has land, air, and sea-based nuclear-capable delivery systems. It is difficult to determine if Israel has made any changes to its nuclear force structure since the 2016 report. Israel did receive its sixth Dolphin-class submarine from Germany, likely fitted it to carry nuclear-tipped cruise missiles and entered into another contract with Germany in 2017 for three additional submarines. Its Jericho-2 MRBMs and Jericho-3 IRBMs are assessed to be nuclear capable. Israel also possesses several types of aircraft that are capable of dropping nuclear gravity bombs, including

The Israeli delegation at the International Atomic Energy Agency 60th General Conference Plenary, Vienna, Austria, September 26, 2016. (Photo: Dean Calma / IAEA)

the F-16 and F-15E, even though Israel committed to the United States that it would not use aircraft purchased from the United States for deploying nuclear weapons.

Israel typically votes against UN General Assembly First Committee resolutions calling for disarmament, earning it a minus grade. Israel did not support the negotiation of the TPNW and in 2018 again expressed its "deep reservations" about the treaty, from both a substantive and a procedural viewpoint.[163]

2016 grade: D-
2013 grade: D
2010 grade: D

5. Negative Security Assurances: D-

Given that Israel has not acknowledged possession of nuclear weapons, it has not made any statements regarding its willingness to use nuclear weapons against non-nuclear-weapon states. Israel consistently abstains from the annual UN General Assembly First Committee resolution calling for negotiations to reach an effective international agreement to "assure the non-nuclear weapon States against the use or threat of use of nuclear weapons."

Israel does maintain that it will not be the first state to introduce nuclear weapons to the region, which could be interpreted as a de facto pledge not to use nuclear weapons first. However, Israel Prime Minister Benjamin Netanyahu made a speech in April 2018 standing in front of the Dimona nuclear reactor complex where he said: "those who threated to wipe us out put themselves in a similar danger." His remarks, and the location from which they were made, were interpreted by some as a veiled reference to the country's nuclear arsenal, earning it a minus grade.

2016 grade: D+
2013 grade: D+
2010 grade: D+

6. Nuclear-Weapon-Free Zones: C

Israel supports the creation of a WMDFZ in the Middle East, but prefers movement toward a zone take place as part of larger regional discussions on security issues. The emphasis on regional security discussions have put it at odds with the Arab Group over the path forward on the zone.

Israel voted against a UN General Assembly First Committee resolution on establishing a MEWMDFZ

that requires the UN secretary-general to convene a conference on the zone in 2019, claiming in an explanation of vote that the initiative was aimed at "singling out Israel" instead of "confronting the real… security challenges in the Middle East."[164]

Israel participated in consultations on an agenda for the zone from 2013-2015 and voiced a willingness to continue with the process after the 2015 NPT Review Conference ended up without a consensus document and therefore no new mandate to continue the zone process. Israel's decision to participate in the consultative process came after it was the only country not to have publicly said that it would participate in the conference originally planned for December 2012 but postponed when an agreement could not be reached on the agenda.

In 2018, Israel also voted against an annual UN General Assembly First Committee resolution calling for the establishment of a NWFZ in the Middle East, a resolution that is typically adopted by consensus. Israel has supported NWFZs in other regions of the world but abstained from a 2018 UN General Assembly First Committee resolution calling for a fourth conference on NWFZs to be held in 2020.

2016 grade: C+
2013 grade: D-
2010 grade: C-

7. IAEA Safeguards: C

Select Israeli nuclear facilities are governed under a limited INFCIRC/66-type agreement negotiated with the IAEA in 1975, rather than a full-scope safeguards arrangement. The Dimona nuclear complex is not included in this agreement.

2016 grade: C
2013 grade: C
2010 grade: C

8. Nuclear Weapons-Related Export Controls: A

Israel is not a member of the MTCR or the NSG but has agreed to adhere to the guidelines of both export control regimes voluntarily. The Defense Export Control Agency and the Israeli Ministry of Economy and Industry share export licensing responsibilities and both update regulations periodically to reflect changes in the MTRC and NSG lists and guidelines.

Israel received an MTCR delegation in July 2018 and was briefed on the export control body's recent decisions. The MTCR delegation also held a seminar on the export control regime and received an update from Israeli officials on the country's export controls and proliferation challenges in the region.[165]

Israel has submitted all five of the reports required by UN Security Council resolutions on North Korea since 2016. In its most recent update to the 1540 Committee in 2012, Israel noted a number of national measures to control the spread of nuclear weapons-related and delivery vehicle technologies, including export control legislation, licensing provisions, import controls, and a catchall clause.[166]

2016 grade: A
2013 grade: A
2010 grade: A

9. Nuclear Security Commitments: B

Israel joined the CPPNM in January 2002 and the 2005 CPPNM amendment in March 2012. Israel has endorsed the IAEA Code of Conduct. Israel participated in all four nuclear security summits.

Israel reiterated at the 2016 Nuclear Security Summit that it has a "comprehensive nuclear security system for the protection of nuclear materials in storage and in use in its nuclear research centers," including "advanced physical protection measures, human reliability programs, cyber security and material accounting and control."

Israel signed onto a joint statement at the 2014 Nuclear Security Summit which committed participating states to "meet the intent" of the IAEA's nuclear security recommendations and "subscribe to the fundamental principles" of the nuclear security fundamentals. Israel has not joined multilateral initiatives to strengthen nuclear security, earning it a B grade, under the revised criteria.

2016 grade: A
2013 grade: A
2010 grade: B

10. Criminalization and Illicit Trafficking Commitments: B

Israel participates in the ITDB, GICNT and PSI. Israel has installed radiation monitoring equipment at key ports.

Israel has signed, but not ratified the Nuclear Terrorism Convention. Recent statements from Israeli officials do not reference any move toward ratification of the treaty at this time.

2016 grade: B
2013 grade: B+
2010 grade: B+

Pakistan

Overall Grade

C

Pakistan's concerted effort to pursue nuclear weapons began in the 1970s. Islamabad chose not to join the NPT after regional rival India stated it would not be bound by the treaty. Pakistan first tested nuclear weapons in 1998 and is estimated to have about 140–150 nuclear warheads, an arsenal that been quickly increasing in recent years.[167] As nuclear suppliers began to oppose transfers of sensitive nuclear technologies to the country, Islamabad relied heavily on smuggled uranium-enrichment technology acquired by nuclear official Abdul Qadeer (AQ) Khan. By the 1980s, when Pakistan had acquired sufficient expertise in uranium enrichment, Khan and his smuggling network shared that technology with a number of other countries, including Iran, Libya, and North Korea, likely with some involvement by the Pakistani government or military. Since the AQ Khan network was uncovered, Pakistan has taken steps to institute better export controls and measures to prevent proliferation. Pakistan's recent development of tactical nuclear weapons has raised concerns about the issue of crisis escalation on its border with India.[168]

1. Banning Nuclear Testing: D+

Pakistan, an Annex 2 state, has not signed the CTBT, but continues to abide by a nuclear test moratorium declared in 1998, earning it a plus grade. Pakistan conducted its only nuclear tests earlier that year, shortly after India. In response to the Indian and Pakistani nuclear tests, the UN Security Council passed Resolution 1172 in June 1998, which urged both India and Pakistan to join the CTBT "without delay and without conditions." Pakistan maintains it will not be the first country in the region to resume testing and will ratify the CTBT if India is willing to do the same.[169]

Pakistan has proposed a bilateral nuclear test ban arrangement with India and reiterated its commitment to pursue such a mechanism at the UN General Assembly First Committee in 2018. Pakistan voted in favor of the annual UN General Assembly First Committee resolution on the CTBT in 2018.

2016 grade: D+
2013 grade: D+
2010 grade: D+

2. Ending Fissile Material Production for Weapons: F

Pakistan continues to produce fissile material for nuclear weapons and block attempts to negotiate an FMCT at the CD, out of concern that limitations on its production would essentially freeze the asymmetry between its fissile material stores and that of India, leaving Pakistan at a permanent disadvantage.[170] "A treaty that only bans the future production of fissile material would adversely affect Pakistan's security and freeze the status quo to the permanent strategic advantage of a select few States," Farukh Amil, Pakistan's permanent representative to the UN and other international organizations in Geneva told the CD in February 2018.[171]

Chief of Army Staff General Qamar Javed Bajwa meets with Prime Minister Imran Khan at the Prime Minister's Office Islamabad on April 11, 2019. (Photo: Islamic Republic of Pakistan, Prime Minister's Office)

Islamabad argues that the CD must determine the scope of the treaty, which should include limits on existing stockpiles, before negotiations on an FMCT begin.[172] In addition to procedural concerns, Islamabad argues that "balanced progress" must be made on the CD's other three core issues: complete disarmament, legally binding NSAs, and preventing an arms race in outer space.[173] As a result, Pakistan continues to block consensus on the CD agenda, preventing it from moving forward on negotiating an FMCT.

Pakistan has also criticized the group of governmental experts, formed by the CD as a means of advancing ideas on an FMCT, as "ill-advised." Pakistan chose not to participate in the FMCT experts preparatory group and said Pakistan would not accept "any conclusion or recommendation" from the body.

Pakistan is estimated to possess 280 kilograms of plutonium produced by four reactors at the Khusahab site, a considerable increase from the estimated 190 kilograms when this report was last written.[174] There is less certainty about Pakistan's stockpile of HEU, which is estimated at approximately 3.4 metric tons, because there is ambiguity surrounding the operating history of the centrifuge plant at Kahuta and the existence of a second enrichment facility at Gadwal.[175]

Given that Pakistan continues to operate both the reactors at Khusahab and its uranium enrichment plants, Islamabad's stockpiles of fissile materials will continue to increase, with some experts assessing at a rate of enough material for 14-27 warheads per year.[176]

In 2018, Pakistan was the only state to vote against the UN General Assembly First Committee resolution calling for progress on negotiating an FMCT at the CD.

2016 grade: F
2013 grade: F
2010 grade: F

3. Reducing Nuclear Weapons Alert Levels: B-

Pakistan's nuclear warheads are believed to be non-deployed and stored in a disassembled state, with the fissile core kept separate from the warhead package.[177]

Pakistan is, however, developing new types of nuclear weapon delivery systems, including short-range tactical missiles and sea-based cruise missiles that raise questions as to whether Islamabad is moving to active deterrence, which includes a higher alert level, earning it a minus grade.[178] Deployment of these systems and a change in posture may necessitate changes to Pakistan's decision to de-mate delivery systems and warheads and require a higher alert level.

Pakistan has a three-tiered command-and-control structure overseeing its nuclear weapons

establishment.[179] Islamabad's National Command Authority has the primary responsibility for nuclear weapons development and deployment, including operational planning and control. The National Command Authority is chaired by the prime minister and is comprised of both civilian and military leaders. Authority to launch a nuclear strike requires consensus within the National Command Authority, however, some experts assess that if consensus cannot be achieved, a majority vote would sufficient for ordering an attack.[180]

In 2018, Pakistan voted in favor of a UN General Assembly First Committee resolution on decreasing the operational readiness of nuclear weapons and one calling for de-alerting and de-targeting nuclear weapons.

2016 grade: B
2013 grade: A
2010 grade: A

4. Nuclear Force Reductions: F

Pakistan's nuclear arsenal is estimated at 140-150 warheads, an increase from the estimated 110-130 when this report was last published. Given its current fissile material production facilities, Pakistan's arsenal will continue to grow by an approximate 14–27 nuclear warheads every year. Pakistan maintains that it seeks to avoid an arms race and is expanding its arsenal in line with its policy of "credible minimum deterrence," but the force requirements to meet that remains ambiguous, implying that expansion of the arsenal will continue.[181]

In addition to expanding the size of the arsenal, Pakistan is developing new nuclear-capable delivery systems. Pakistan in particular appears to be emphasizing the development of new cruise missiles, which it views as critical for circumventing India's advancing ballistic missile defense program. Pakistan is pursuing a second-strike capability by developing a sea-launched version of its Babur ground-launched cruise missile. Pakistan tested the Babur-3, which has an estimated range of about 450 kilometers, from a submerged barge in 2017 and 2018. Pakistani officials said the move was prompted by India's decision to develop SLBMs.[182]

Since the prior report was released, Pakistan has developed two air-launched cruise missiles, the Raad and the Raad-2, which are likely paired with its Mirage nuclear-capable aircraft. Pakistan has also extended the range of its ballistic missile arsenal with the development of the Haft-6, which has a range of approximately 2,700 kilometers. The Haft-6 is the longest-range ballistic missile in the Pakistani arsenal to date. Pakistan is believed to be developing a ballistic missile, the Abadeel, which will have multiple reentry vehicles, and two other medium-range ballistic missiles. The range of the most controversial missile in Pakistan's arsenal, the short-range Nasr, was extended slightly from 60 to 70 kilometers since the prior report. The Nasr is designed to carry low-yield tactical nuclear weapons, likely for battlefield use to counter Indian troops.

Pakistan rejected the negotiating of the TPNW, claiming in a 2018 UN General Assembly First Committee statement that it "ignored the fundamental security considerations that underpin nuclear disarmament."[183]

2016 grade: F
2013 grade: F
2010 grade: F

5. Negative Security Assurances: B

Pakistan has made a no-first-use pledge to non-nuclear-weapon states and leads an annual UN General Assembly First Committee resolution calling for "effective international arrangements to assure non-nuclear weapon states against the use or threat of use of nuclear weapons." In 2018, Farukh Amil, Pakistan's permanent representative to the UN and other international organizations in Geneva, told the UN General Assembly First Committee that the issue is "ripe for treaty negotiations in the CD."[184]

Pakistan's position on first use against states that possess nuclear weapons is less clear, particularly with regard to India. Pakistani officials have indicated that the circumstances surrounding its no-first-use policy must remain deliberately imprecise, as demarcating clear redlines could allow provocations by the Indian military just below any established threshold for use.[185] Pakistan's development of short-range ballistic missiles armed with tactical nuclear warheads appear designed to counter Indian conventional attacks, implying that Pakistan would use nuclear weapons first in certain scenarios.

In September 2016, Pakistani Defense Minister Khawaja Asif suggested Islamabad would use nuclear weapons for defensive purposes in armed conflict with India, saying that "we will not hesitate to use" tactical nuclear weapons for our defense to respond to security threats or if "anyone steps on our soil."[186]

2016 grade: B
2013 grade: B
2010 grade: B

6. Nuclear-Weapon-Free Zones: C

Islamabad has generally supported the establishment of NWFZs, having voted in favor of UN General Assembly First Committee resolutions supporting their creation in various regions, including the UN

Pakistani army soldiers travel on a vehicle carrying a Shaheen II ballistic missile during the Pakistan Day parade in Islamabad on March 23, 2019. (Photo: Farooq Naeem/AFP/Getty Images)

General Assembly First Committee resolution in 2018 calling for a conference to be held on NWFZs in 2020.

In 2018, Pakistan voted in favor of an annual UN General Assembly First Committee resolution on creating a NWFZ in the Middle East and a resolution requiring the UN secretary-general to convene a conference in 2019 on advancing a WMDFZ in the Middle East.

2016 grade: C
2013 grade: C-
2010 grade: C-

7. IAEA Safeguards: C+

Pakistan signed its first limited-scope INFCIRC/66 safeguards agreement with the IAEA in 1962. Over the years, additional nuclear facilities in Pakistan have come under safeguards. Most recently, Pakistan reached an agreement with the IAEA in 2017 to apply safeguards to an additional two reactor units at the Karachi site, earning a plus grade.

2016 grade: C
2013 grade: C
2010 grade: C

8. Nuclear Weapons-Related Export Controls: B+

Since the AQ Khan network was uncovered, Pakistan has taken significant steps to build up its own export control system and prevent further illicit transfers of dual-use goods and materials. These steps include export control legislation developed in 2004 covering export, re-exports, and transshipment; national controls lists consistent with those of the NSG and MTCR, and a licensing body responsible for control list implementation and export control law enforcement. Pakistan reported in 2017 that it updated its control lists in November 2016 and issued a new policy guidance on export controls in May 2016 to strengthen its catch-all controls.[187] In May 2016, Pakistan declared in a document circulated by the IAEA that it would adhere to the NSG guidelines.

Pakistan received a delegation from the MTCR in March 2018 to receive an update on the export control body's work and recent decisions, earning it a plus. Pakistan also briefed the MTCR delegation on its updates to its export controls.[188]

Pakistan continues to reiterate its interest in joining the NSG and that it expects a "non-discriminatory expansion" of that body, namely that it is looking for a criteria-based approach for

determining membership of non-NPT states that does not give India preferential treatment. Pakistan is particularly concerned about this after India received an NSG waiver in 2008. Islamabad does, however, continue to purchase nuclear reactors from China, in contravention of NSG guidelines. Pakistan is also suspected of maintaining an illicit procurement network for goods and technologies related to its nuclear and missile programs, although the extent to which the state participates directly in these activities is debatable.[189]

Pakistan has submitted all five reports to the UN Sanctions Committee on resolutions on North Korea since 2016 and announced in 2016 the creation of an enforcement team to ensure effective implementation of UN sanctions. Pakistan also provided an update to the 1540 Committee in May 2017. In the update Pakistan said it held a regional seminar on Resolution 1540 in March 2017.

2016 grade: B-
2013 grade: C-
2010 grade: F

9. Nuclear Security Commitments: B

Pakistan acceded to the CPPNM in 2000, and the 2005 amendment in March 2016. Islamabad has agreed to follow the guidelines of the IAEA Code of Conduct.

In addition, Pakistan has undertaken a number of measures in recent years to enhance the security of its nuclear materials, due in significant part to U.S. assistance across a spectrum of activities. This assistance includes the development of nuclear material accountability and tracking programs, advanced training by U.S. national laboratories, and the development of personnel reliability and accounting measures.[190]

Pakistan participated in all four nuclear security summits. As part of the nuclear security summit process, Pakistan developed, in coordination with the IAEA, the Pakistan Center of Excellence on Nuclear Security. The Center of Excellence offers education and training in nuclear security, as well as support for technical programs. The Center of Excellence works with the broader Nuclear Security Training and Support Center Network.

Pakistan has not signed on to the Strengthening Nuclear Security Implementation initiative introduced at the 2014 Nuclear Security Summit or the subsequent IAEA information circular that opens up the initiative to all IAEA member states, hence its lower grade under the updated criteria.

2016 grade: B+
2013 grade: B
2010 grade: B-

10. Criminalization and Illicit Trafficking Commitments: B

Pakistan participates in the ITDB and the GICNT. It has not signed or ratified the Nuclear Terrorism Convention, nor does the country participate in PSI.

In its 2017 report to the 1540 Committee, Pakistan noted that it has increased detection equipment at key entry and exit points.[191]

2016 grade: B
2013 grade: B
2010 grade: B

Iran

Overall Grade

C-

Iran joined the NPT in 1970, but later pursued an illicit nuclear weapons program in violation of its safeguards agreements. While Iran largely halted its nuclear weapons activities in 2003, Tehran continued to build up its nuclear program and refused to comply with the IAEA's investigations into its past weaponization work. As a result, Iran was subject to heavy sanctions pressure. Iran began negotiations with a group of countries known as the P5+1 over its nuclear program in earnest in 2013 and nuclear weapons concerns largely abated when the Joint Comprehensive Plan of Action (JCPOA) was reached in July 2015. Under the JCPOA, Iran agreed to restrictions on its nuclear program and intensive monitoring and verification in exchange for nuclear-related UN, EU and U.S. sanctions relief. The JCPOA extended the breakout time, or the amount of time it would take for Iran to obtain the material for a nuclear weapon, from two or three months to more than 12 months for the first decade of the agreement. Despite the success of the deal, in May 2018, U.S. President Donald Trump announced his decision to withdraw from the JCPOA and to reimpose all sanctions lifted under the agreement. Iran, however, continues to comply with the deal and the IAEA has reported repeatedly that it is meeting its nuclear-related commitments. However, during the period covered by this report, Iran has continued to transfer ballistic missile and related technologies in violation of UN Security Resolution 2231, likely to advance its ballistic missile program and aid its proxies in the region.

1. Banning Nuclear Testing: B+

Tehran signed the CTBT in 1996 but has yet to ratify it. As an Annex 2 state, Iran's ratification is required for the CTBT's entry into force. Although Iran has generally participated in the CTBT's biennial entry-into-force conferences and expressed support for the treaty, including by voting in favor of an annual resolution in support of the CTBT at the UN General Assembly First Committee, its statements to the conference have not indicated any steps taken by Tehran to ratify the treaty or its intent to do so in the near future.

Rather, Iran has stated that the nuclear-weapon states bear "the main responsibility" for the treaty's entry into force and insisted that Annex 2 states that are non-NPT parties must accede to that treaty in order to make progress on the CTBT.[192]

2016 grade: B+
2013 grade: B-
2010 grade: B-

2. Ending Fissile Material Production for Weapons: N/A

Under the 2015 nuclear deal, Iran can only enrich uranium to reactor-grades (3.67 percent uranium-235) for 15 years and can only store up to the equivalent of 300 kilograms of uranium gas enriched to that level. Iran is also converting its heavy-water reactor at Arak. The initial design was well-suited for the production of approximately two bombs worth of weapons-grade plutonium per year. The redesigned reactor will produce a fraction of what is necessary for one bomb and the spent fuel will be shipped out. Under the JCPOA, Iran committed not to reprocess any plutonium for 15 years and stated its intention to never do so.

The U.S. withdrawal from the JCPOA could threaten these limits on Iran's fissile material stocks, however. Although Iran has committed to remain in the agreement, Iranian leaders stated that Iran could increase its fissile material production, including returning to enrichment to 20 percent uranium-235.[193] Iran halted 20 percent enrichment and disposed of its stockpile of 20 percent enriched material during negotiations on the JCPOA.

Iran has abstained from the annual UN General Assembly First Committee resolution on a FMCT in recent years, explaining in 2018 that such a treaty should encompass the past, present and future fissile material production and should require all nuclear weapon possessors to destroy their stockpiles.[194]

3. Reducing Nuclear Weapons Alert Levels: N/A

4. Nuclear Force Reductions: N/A

Iran voted for the commencement of negotiations on the TPNW, participated in the negotiations and voted in favor of adopting the treaty in July 2017. Iran voted in favor of the 2018 UN General Assembly First Committee resolution welcoming the TPNW. Iran has not signed or ratified the treaty at the time of publication.

5. Negative Security Assurances: N/A

6. Nuclear-Weapon-Free Zones: C+

Iran, under the shah, was the first country to propose the creation of a NWFZ in the Middle East. Since that initial proposal in 1974, a Middle East zone has been a key international nonproliferation goal. Tehran has continued to call for the establishment

Iranian President Hassan Rouhani addresses the general debate of the United Nations General Assembly in September 2015. (Photo: United Nations)

Former U.S. Secretary of State John Kerry and Iranian Foreign Minister Javad Zarif discuss the implementation of the Joint Comprehensive Plan of Action in Vienna May 17, 2016. (Photo: U.S. State Department)

of such a zone and has supported the adoption of the relevant resolutions in the UN General Assembly First Committee, including in 2017 and 2018. In the lead up to the 2015 NPT Review Conference, Iran supported the consultative process with other regional countries to reach consensus on an agenda for a conference to take forward the zone, although negotiations over the JCPOA prevented Tehran from participating fully in that process. At the UN General Assembly First Committee in 2018, Iran also supported the Arab League's proposal to convene a conference at the UN no later than 2019 on a WMDFZ in the Middle East. Iran has also supported resolutions pertaining to NWFZs in other regions. Iran voted in favor of a 2018 UN General Assembly First Committee resolution on convening a conference on NWFZs in 2020, earning it a plus grade.

2016 grade: C
2013 grade: C
2010 grade: C-

7. IAEA Safeguards: A-

Iran's comprehensive safeguards agreement with the IAEA entered into force in 1974. Before the JCPOA, Iran provisionally implemented its additional protocol from 2003–2006. Under the JCPOA, Iran is required to implement its additional protocol and seek ratification of it by 2023. The IAEA consistently assessed during the duration of this report that Iran has been implementing its additional protocol, but since it has not yet ratified the additional protocol, it earns a minus.

In 2002, the IAEA expressed concerns that Iran was violating its safeguards obligations and pursing nuclear activities as part of a weapons development program. In December 2015, the IAEA issued a report assessing Iran's past work related to nuclear weapons development, the so-called possible military dimensions of Iran's nuclear program. The report detailed Iran's organized efforts to pursue a nuclear weapon prior to 2003 and related activities that continued through 2009. The report declared that the agency had no indications of activities related to weaponization since 2009 and no more outstanding concerns. The report came after an intensive five-month process to conclude the IAEA's investigation after Tehran and the agency agreed on a process in July 2015.

2016 grade: A-
2013 grade: F
2010 grade: F

8. Nuclear Weapons-Related Export Controls: F

Prior to reaching the JCPOA, Iran was one of the key targets for controls over the transfer of nuclear and missile-related materials and technology due to widespread concerns over its nuclear and ballistic missile programs. Since the JCPOA took effect, there continue to be concerns that Iran has imported

and exported ballistic missile related materials in violation of UN Security Council Resolution 2231. Resolution 2231 requires Iran to seek Security Council approval prior to importing or exporting items on the NSG Trigger List and Dual Use List and the MTCR guidelines. Resolution 2231's prohibitions replaced international controls in Security Council resolutions adopted between 2006–2010 that required that all states prohibit the transfer of nearly all items on the NSG Trigger List and Dual Use List, as well as items contained in the MTCR Guidelines, to and from Iran.

In a June 2018 report, the UN secretary-general concluded that components of ballistic missiles fired at Saudi Arabia from Yemen were from Iran, and in a report from the preceding year, the UN secretary-general noted a U.S. allegation that an Iranian entity received a shipment of ballistic missile-related materials, including carbon fiber, in October 2016 without prior approval from the UN Security Council.[195,196] Iran also reportedly violated its obligations under the arms embargo established by Resolution 2216 since Iran did not take "necessary measures to prevent the direct or indirect supply, sale, or transfer" of short-range ballistic missiles and other equipment.[197]

Iran has not submitted any reports on its implementation of nuclear weapons-related sanctions on North Korea, pursuant to nine UN Security Council resolutions.

2016 grade: F
2013 grade: F
2010 grade: F

9. Nuclear Security Commitments: D

Iran has not taken action to ratify the amended CPPNM nor has it expressed its intent to adhere to the IAEA Code of Conduct on the Security and Safety or Radiological Sources. According to a 2006 report to the 1540 Committee, the Atomic Energy Organization of Iran (AEOI) established draft regulations based on the CPPNM regarding the physical protection of installations and materials, but there is no indication that Iran has incorporated the CPPNM's requirements into its national laws.[198]

Annex III of the JCPOA encourages cooperation to enhance the safety and security of Iran's nuclear facilities. This includes opening a Nuclear Safety Center, taking steps to prevent sabotage, and conducting workshops and trainings for personnel on nuclear safety and security issues. The EU and Iran have met regularly since the adoption of the JCPOA on the implementation of Annex III. At the third High-Level Seminar on International Nuclear Cooperation in Brussels in November 2018, the EU and Iran discussed past nuclear cooperation projects, including working with Iran's Nuclear Regulatory Authority to ensure it meets international standards, technical exchanges at the EU's Joint Research Center and workshops on civil liability.[199] They also discussed future areas for cooperation, such as seminars on governance frameworks and nuclear law, training on nuclear safety for future activities and garnering support for a Nuclear Safety Center in Iran.

2016 grade: D
2013 grade: D+
2010 grade: D+

10. Criminalization and Illicit Trafficking Commitments: F

Iran participates in the ITDB. It does not participate in multilateral initiatives, including PSI or GICNT. It has neither signed nor ratified the Nuclear Terrorism Convention. Iran last submitted a report on its implementation of Resolution 1540 in 2006.

Iran is widely believed to have illicitly provided ballistic missile-related technology to nonstate actors during the timeframe of this report, including supplying the Houthis in Yemen with arms-related material, including short-range ballistic missile technology, according to a 2018 UN Panel of Experts report.[200]

2016 grade: C
2013 grade: C
2010 grade: C

North Korea

Overall Grade

F

North Korea is estimated to have produced enough fissile material for 20–60 nuclear warheads and developed the means to deliver them using ballistic missiles.[201] Since the last report, North Korea has significantly advanced its nuclear and ballistic missile programs, including testing three ICBMs in 2017 and what was likely a hydrogen bomb in September 2017. North Korea has periodically engaged in negotiations to limit its nuclear weapons program with the United States and other countries after Pyongyang's illicit nuclear activities, conducted in violation of its NPT obligations, were uncovered in the 1990s. While both the 1994 Agreed Framework and the six-party talks (conducted from 2003–2009 with North Korea, China, Japan, South Korea, Russia and the United States), succeeded in halting certain North Korean nuclear activities, these agreements eventually fell apart. Pyongyang's continued defiance of its NPT obligations led to the UN Security Council passing nine major resolutions sanctioning North Korea for its illicit nuclear and missile programs. Despite these sanctions, North Korea remains a key supplier of missile technology to other states, including in South and Southeast Asia and the Middle East. Diplomatic outreach to North Korea by South Korean President Moon Jae-in in early 2018 paved the way for the United States and North Korea to open diplomatic negotiations, beginning with a historic summit between Kim and Trump in June 2018, during which the two leaders agreed to pursue the "complete denuclearization of the Korean Peninsula," and build peace and security. Prior to the summit, North Korea agreed to suspend nuclear and long-range missile testing and destroyed several tunnels at its nuclear test site. It remains to be seen if the negotiations will yield progress toward denuclearization.

1. Banning Nuclear Testing: F+

North Korea, an Annex 2 state, has not signed the CTBT and is the only state in the 21st century to have tested nuclear weapons—six times in total—including two tests during the period of this report in September 2016 and 2017.

In April 2018, North Korea announced a nuclear and long-range missile testing moratorium, earning it a plus, despite having tested nuclear weapons in the timeframe of the report.[202] The next month, North Korea reported that it destroyed its nuclear testing site at Punggye-ri, setting off explosions to destroy the north, west and south portals to tunnels that could have been used to test nuclear weapons.[203] It is unclear if the site was thoroughly destroyed since neither officials nor experts were granted access to verify the destruction of the test site. Kim did offer, following the September 2018 inter-Korean summit, to allow international inspectors to verify the destruction of the site, but at the time of publication, such a visit has yet to take place.

North Korea has regularly voted against the annual UN General Assembly First Committee resolution supporting the CTBT's entry into force, including most recently in 2018.

2016 grade: F
2013 grade: F
2010 grade: F

2. Ending Fissile Material Production for Weapons: F

By the end of 2017, North Korea was estimated to have about 20–40 kilograms of plutonium and 250–500 kilograms of highly enriched uranium.[204] North Korea has the estimated capability to produce the fissile material for 6–7 additional nuclear warheads each year.

North Korea is believed to still be producing fissile material for weapons, according to testimony from U.S. Secretary of State Mike Pompeo to the Senate Foreign Relations Committee on July 25, 2018.[205] In his annual New Years Address in 2019, Kim stated that North Korea had committed in 2018 not to "make" nuclear warheads, but it is unclear exactly what he was referring to.[206]

Satellite imagery suggests that North Korea's 5MWe reactor at Yongbyon continues to operate. North Korea announced its intention to restart its Yongbyon 5MWe reactor for plutonium production in April 2013, after disabling it as a part of the six-party talks in 2007. North Korea declared the site to be "fully operational" by late August 2015.[207] Satellite imagery from April 2016, January 2017, and April 2018 also confirmed increased activity at the reprocessing site.

North Korea also enriches uranium, but its production capacity is unknown. It is unclear if the country is producing HEU for nuclear weapons or using its centrifuge facilities to produce LEU for reactor fuel. In November 2010, North Korea gave permission for three U.S. scientists to visit its Yongbyon nuclear complex. Siegfried Hecker, a former director of Los Alamos National Laboratory, reported that there were 2,000 advanced centrifuges in two cascade halls in the complex, which appeared to be operational.[208] Estimates on the amount of material produced and the uranium-enrichment level vary widely. Satellite imagery indicates that the facility was expanded after 2010 and it may now house about double the original number of centrifuges.

North Korea is also believed to operate covert uranium enrichment sites. In July 2018, researchers at the Center for Nonproliferation Studies were able to locate one of the covert uranium enrichment sites known to the U.S. intelligence community, called Kangson by the U.S. intelligence community.[209] The output at Kangson is believed to be twice that at Yongbyon.

North Korea abstained from a UN General Assembly First Committee resolution calling for the negotiation of a fissile material cutoff treaty in 2018.

2016 grade: F
2013 grade: F
2010 grade: F

3. Reducing Nuclear Weapons Alert Levels: D

It remains unclear in what status Pyongyang's nuclear devices are maintained or what procedures are in place to prevent unauthorized use. North Korean nuclear weapons use can only be ordered by the Supreme Commander of the Korean People's Army according to a 2013 law.[210] This position is held by the chairman of the State Affairs Commission, Kim Jong Un.[211] Kim has also referenced that the "nuclear button is always on my desk," implying that he has control over a launch.[212] It is likely that the country's nuclear-capable ballistic missiles are stored disassembled during peacetime.[213]

In 2016 and 2018, North Korea abstained from a resolution at the UN General Assembly First Committee on decreasing the operational readiness of nuclear weapons. In 2018 and 2016, North Korea voted in favor of a UN General Assembly First Committee resolution on reducing nuclear danger, although it abstained in 2017, earning it an improved grade from the last report.

2016 grade: D-
2013 grade: D
2010 grade: D

North Korean leader Kim Jong Un and U.S. President Donald Trump meet for the first time in Singapore on June 12, 2018. (Photo: Saul Loeb/AFP/Getty Images)

4. Nuclear Force Reductions: F

North Korea is working to expand its nuclear weapons arsenal, which some experts assess includes the fissile material for 20-60 nuclear weapons, although there is a high level of uncertainty.[214] In addition to quantitative expansion, North Korea is developing more sophisticated types of nuclear weapons. Pyongyang claimed that its September 2017 nuclear test, which had an estimated yield of 120–160 kilotons, used a thermonuclear warhead.[215] An August 2018 leaked Defense Intelligence Agency report found that North Korea had produced miniaturized nuclear warheads for ballistic missile delivery, including for ICBMs.

Pyongyang has also rapidly accelerated its nuclear weapons delivery capability since the last publication of this report. In 2017 alone, North Korea conducted 24 ballistic missile tests, including tests of an ICBM, the Hwasong-14, twice in July 2017. North Korea then tested another ICBM, the Hwasong-15, in November 2017. However, experts still question whether North Korea can successfully deliver a nuclear warhead on its ICBMs.[216]

North Korea is also developing a sea-launched ballistic missile, the Pukkuksong-1, which was tested on August 24, 2016 and the Pukkuksong-2, a new medium-range, solid-fuel ballistic missile which North Korea launched in February 2017.

North Korea abstained from the UN General Assembly First Committee resolution calling for negotiating the TPNW and didn't participate in the negotiations. It abstained from the 2018 UN General Assembly First Committee resolution welcoming the treaty's adoption.

2016 grade: F
2013 grade: D
2010 grade: F

5. Negative Security Assurances: F+

In January 2016, after its fourth nuclear test, Pyongyang declared its policy of no-first-use under the condition that "hostile forces" do not encroach on its sovereignty. Kim Jong Un reiterated this policy in May 2016 when he said that North Korea will not use a nuclear weapon unless its sovereignty is "encroached upon by any aggressive hostile forces" with nuclear weapons.[217] This sentiment was again repeated by Kim during his 2018 New Years Address.

The legitimacy of North Korea's no-first-use pledge is dubious. North Korea generally refers to its nuclear-weapon capabilities as a deterrent, but it has threatened to use nuclear weapons against nuclear- and non-nuclear-weapon states, primarily the United States and South Korea. These threats were often made in response to annual U.S.-South Korean joint military exercises.

In September 2017 following a threatening speech from U.S. President Trump at the UN

General Assembly, in an unprecedented statement under his own name, Kim Jong Un threatened "exercising...a corresponding, highest level of hardline countermeasure in history," which North Korean Foreign Minister Ri Yong Ho explained could be a hydrogen bomb test in or over the Pacific Ocean, although he claimed he had "no idea what actions could be taken as it will be ordered by leader Kim Jong Un." Ri also said that Trump's comments make "our rocket's visit to the U.S. mainland inevitable all the more."[218]

Since a new round of diplomatic engagement with North Korea began in 2018, Pyongyang has refrained from issuing such threats, earning it a plus grade.

North Korea abstained from the 2017 UN General Assembly First Committee resolution on concluding an effective international arrangement to assure non-nuclear-weapon states against the use or threat of use of nuclear weapons but it voted in favor of the resolution in 2016 and 2018.

2016 grade: F
2013 grade: F
2010 grade: F

6. Nuclear-Weapon-Free Zones: F

In 1992, Pyongyang and Seoul issued the Joint Declaration on the Denuclearization of the Korean Peninsula, declaring that neither state would test, manufacture, possess, or use nuclear weapons, establishing in essence a NWFZ on the peninsula. The declaration also stated that both countries would use nuclear power solely for peaceful purposes and would not possess nuclear reprocessing and uranium-enrichment facilities. Pyongyang has since maintained or developed reprocessing and enrichment capabilities and nuclear weapons in violation of that agreement. In January 2013, Pyongyang formally announced that it was nullifying the Joint Declaration, and later that year modified its constitution to reflect North Korea's status as a nuclear-armed state. North Korea committed again to "denuclearization of the Korean peninsula," in the June 2018 Singapore Summit declaration, but it is unclear if Pyongyang includes the elimination of enrichment and reprocessing for civil nuclear programs as part of its definition of denuclearization.

North Korea has occasionally supported UN General Assembly First Committee resolutions on various NWFZs in other regions. In 2018, North Korea voted in favor of the UN General Assembly First Committee resolution supporting the establishment of a NWFZ in the Middle East and the resolution on convening a conference to take forward a WMDFZ in the Middle East. North Korea also voted in favor of a 2018 UN General Assembly First Committee resolution on convening a conference on NWFZs in 2020.

2016 grade: F
2013 grade: F
2010 grade: F

7. IAEA Safeguards: F

North Korea ratified the NPT in 1985 but failed to negotiate a comprehensive safeguards agreement with the IAEA in the requisite 18 months. North Korea finally completed its safeguards in 1992 but withdrew from IAEA membership after failing to cooperate with a special inspection. Agency inspectors were briefly allowed to monitor the shutdown of North Korea's key nuclear facilities during two separate denuclearization agreements but were ejected when negotiations collapsed.

The IAEA has not had inspectors on the ground in North Korea since 2009, but the agency continues to monitor developments in North Korea's nuclear program and submits reports to the agency's Board of Governors. In its August 2018 Board of Governors report, the IAEA said the team on North Korea and the Executive Group, both created in August 2017, stand ready to verify North Korea's nuclear program if there is a political agreement to do so.[219] The report also stated that the IAEA has intensified monitoring of the country's nuclear program through satellite imagery.

2016 grade: F
2013 grade: F
2010 grade: F

8. Nuclear Weapons-Related Export Controls: F

North Korea is not a member of the NSG or MTCR and is considered one of the most active proliferators of missile and dual-use technology. While North Korea committed in April 2018 to refrain from proliferating nuclear weapons, it is unclear if Pyongyang is including dual-use technology in its commitment. The U.S. intelligence community assesses that North Korea assisted Syria's construction of a nuclear reactor in 2007 and continues to export ballistic missiles and associated materials to several countries.[220] The UN body that monitors the implementation of sanctions on North Korea, the Panel of Experts, issues annual reports detailing incidents of noncompliance with UN sanctions.

In its March 2018 report, the Panel of Experts noted that it investigated a wide array of North Korea's illicit transfers of dual-use technologies, including ongoing ballistic missile cooperation with Syria and Myanmar, widespread conventional arms deals, and cyber operations to steal military secrets.[221]

This May 14, 2017 picture from the official Korean Central News Agency shows leader Kim Jong Un inspecting a Hwasong-12 ballistic missile before a test launch. The test was intended to verify "the tactical and technological specifications" for a system "capable of carrying a large-size heavy nuclear weapon," according to the state-run news agency. (Photo credit: Stringer/AFP/Getty Images)

North Korean diplomats continue "to play a key role" in the country's prohibited programs, the report notes, in particular in providing "logistical support for arms transfers, military technicians and intelligence operations, acting as fronts for designated entities and individuals and engaging in commercial activities that violate the resolutions and the Vienna Convention on Diplomatic Relations."

North Korea has not submitted a report to the 1540 Committee and is currently facing sanctions from nine major UN Security Council resolutions resulting from its nuclear and missile tests. The UN Security Council passed four of those nine resolutions in the timeframe of this report.

2016 grade: F
2013 grade: F
2010 grade: F

9. Nuclear Security Commitments: D

North Korea is not known to have adopted any nuclear material security measures consistent with the CPPNM and its 2005 amendment. It is not a participant in any international nuclear security initiatives.

2016 grade: D
2013 grade: D
2010 grade: D

10. Criminalization and Illicit Trafficking Commitments: F

North Korea is a key nuclear trafficking concern and is not known to have enacted any measures to address the issue or engaged in any multilateral efforts to prevent illicit trafficking. On the contrary, North Korea employs varied and sophisticated sanctions evasion measures, using illicit and criminal networks.

North Korea continues to provide missile equipment and assistance to Syria and Myanmar, and also conducts widespread conventional arms deals and cyber operations to steal military secrets, according to a UN Panel of Experts report published in March 2018. North Korea assisted Syria in constructing a nuclear reactor, which was ultimately destroyed by an Israeli airstrike in 2007. A September 2017 Panel of Experts report investigated "the widespread presence of nationals" from North Korea in Africa and the Middle East, particularly in Syria, "acting on behalf of or at the direction of designated entities, including their involvement in prohibited activities such as trade in surface to-air missile systems."[222]

In August 2016, Egypt interdicted the Jie Shun, a North Korean vessel en route to the Suez Canal which contained 30,000 rocket-propelled grenades hidden underneath iron ore. The interdiction was the largest seizure of ammunition in the history of sanctions against North Korea and revealed North Korea's concealment techniques to evade sanctions. North Korea also engages in illicit ship-to-ship transfer to evade sanctions.

2016 grade: D
2013 grade: F
2010 grade: D

Syria

Overall Grade

D-

In 2007, Israel bombed what was widely concluded to be a nuclear reactor under construction in Syria, called al-Kibar. The IAEA found Syria to be in non-compliance with its safeguards obligations under the NPT in 2011 and continues to have outstanding concerns about Syria's compliance. Syria also continues to import ballistic missile technology illicitly from North Korea and transfer missile technology to other actors. The civil war that broke out in Syria in 2011, coupled with consistent Syrian non-cooperation, has prevented the IAEA from accessing sites in Syria to investigate further. While additional work on Syria's nuclear program is highly unlikely under current political conditions, Syria's outstanding issues with the IAEA remain concerning.

1. Banning Nuclear Testing: C

Syria has yet to sign or ratify the CTBT. Its ratification is not required for the treaty's entry into force. Syria consistently abstains from the annual UN General Assembly First Committee resolution on the CTBT.

2016 grade: C
2013 grade: C
2010 grade: C

2. Ending Fissile Material Production for Weapons: N/A

Syria is suspected of having worked on a nuclear reactor, the al-Kibar facility, with assistance from North Korea. Intelligence services and experts assess that the al-Kibar facility was intended to produce plutonium for nuclear warheads. However, the site was bombed by Israel in September 2007 prior to the reactor's completion. In March 2018, Israel officially admitted that it had bombed the site.[223] There is no indication that construction resumed at the site. Syria typically abstains from an annual UN General Assembly First Committee resolution on negotiating an FMCT.

2016 grade: N/A
2013 grade: N/A
2010 grade: N/A

3. Reducing Nuclear Weapons Alert Levels: N/A

4. Nuclear Force Reductions: N/A

Syria did not vote on the resolution to begin negotiations on the Treaty on the Prohibition of Nuclear Weapons in the UN General Assembly and did not participate in the negotiations.

5. Negative Security Assurances: N/A

6. Nuclear-Weapon-Free Zones: C-

Syria has declared its support for the establishment of a WMDFZ in the Middle East and consistently supports UN resolutions and NPT actions on establishing such a zone dating back to 1995. However, given the suspicion that Syria considered a covert nuclear weapons program and has used chemical weapons repeatedly since the start of the civil war in violation of international law, its commitment is questionable, earning it a minus grade.

At the 2017 UN General Assembly First Committee, Syria reaffirmed its desire to see a WMDFZ in the Middle East, stating that Syria's 2013 accession to the Chemical Weapons Convention and "destruction" of all chemical weapons "demonstrates its commitment to the establishment of a zone free of all weapons of

mass destruction." Further, Syria expressed "grave" concern over "the obstacles placed by Israel in the way of making the Middle East a zone free of nuclear weapons."[224] There are outstanding concerns about the correctness and completeness of Syria's declared chemical weapons arsenal in light of the repeated use of chemical weapons by the Syrian regime.

In 2018, Syria voted in favor of the annual UN General Assembly First Committee resolution on establishing a NWFZ in the Middle East and on convening a conference to take forward a MEWMDFZ. Syria voted in favor of a 2018 UN General Assembly First Committee resolution on convening a conference on NWFZs in 2020.

2016 grade: C
2013 grade: C
2010 grade: C

7. IAEA Safeguards: F

Syria concluded a comprehensive safeguards agreement with the IAEA in 1992, but was found in noncompliance with its safeguards obligations by the IAEA Board of Governors in June 2011. Since then, Syria has failed to fully cooperate with an ongoing IAEA probe into suspected undeclared nuclear activities.

The IAEA director-general's 2011 report assessed that the building destroyed at al-Kibar was very likely a nuclear reactor that should have been declared by Syria pursuant to its safeguards agreement and modified Code 3.1 of the Subsidiary Arrangements to its safeguards agreement. Modified Code 3.1 dictates that states must submit design information to the IAEA as soon as they decide to build a new nuclear facility.

In August 2017, the IAEA director-general submitted a report to the Board of Governors on Syria's implementation of its safeguards agreement. The IAEA noted that there were no new developments but urged Syria to cooperate fully with the IAEA to resolve outstanding concerns. Syria has yet to respond to these recommendations. The IAEA was not able to find any diversion of nuclear material from peaceful purposes in Syria in 2017 with the access to information that it had.

The U.S. State Department has consistently found Syria to be in non-compliance with the NPT in its annual Arms Control, Verification and Compliance report due to ongoing issues with its safeguards agreement for each year of this report.

2016 grade: F
2013 grade: F
2010 grade: F

8. Nuclear Weapons-Related Export Controls: F

Syria is not a member of the NSG or the MTCR.

In the 2018 declassified Worldwide Threat Assessment, Director of National Intelligence Daniel Coats noted North Korea's history of exporting ballistic missile technology to Syria.[225] Syria was also the recipient of nuclear weapons related materials to build the al-Kibar reactor.

Syria has not submitted any reports on its implementation of nuclear weapons-related sanctions on North Korea, pursuant to nine UN Security Council resolutions. Syria last submitted a report in 2013 on Resolution 1540 implementation.

2016 grade: F
2013 grade: F
2010 grade: F

9. Nuclear Security Commitments: D

Syria has not signed the CPPNM or its 2005 Amendment but it has taken some limited steps to implement nuclear security measures domestically, including agreeing to implement the IAEA Code of Conduct on the Safety and Security of Radioactive Sources.

Syria requested in 2015 that the IAEA assist in converting its research reactor to run on LEU fuel and remove the less than one kilogram of HEU from the reactor. The reactor, located in Damascus, is a miniature source neutron reactor supplied by China. The IAEA deemed that it is too dangerous at this time to consider conversion.

2016 grade: D+
2013 grade: D+
2010 grade: D+

10. Criminalization and Illicit Trafficking Commitments: F

Syria signed the Nuclear Terrorism Convention in September 2005 but has yet to ratify the treaty. It does not participate in any multilateral regimes such as PSI or the GICNT.

Experts widely believe that the Syrian regime has transferred Scud missiles and other armaments across the border with Lebanon to Hezbollah and has received WMD-related materials and technologies in contravention of international law.[226]

2016 grade: F
2013 grade: F
2010 grade: D+

Additional States

Fissile Material

A number of states have taken significant steps to reduce their fissile material stockpiles and work towards an FMCT. Argentina, Indonesia, Poland and Ghana eliminated their HEU stockpiles in 2016 and 2017. Nigeria removed all HEU from its research reactor and returned it to China in December 2018.

FMCT high-level expert preparatory group

A FMCT high-level expert preparatory group, including representatives from 25 states, met for two weeks in 2017 and 2018. It followed on from the meetings of a group of governmental experts, convened in 2014 and 2015, on the same subject. The 2017–2018 group was mandated by a 2016 UN General Assembly resolution. The preparatory group adopted a report with recommendations based on its discussions on a potential treaty's scope, definitions, verification measures, and legal and institutional arrangements.

Japan

Japan is the only state that does not possess nuclear weapons that reprocesses plutonium. As of the end of 2017, Tokyo's stockpile of plutonium was about 47.4 metric tons.[227] The commercial Rokkasho reprocessing plant is planned to be completed in 2021 and will be able to produce 8 metric tons of separated plutonium each year.

In a July 2018 policy paper from Japan's Atomic Energy Commission, Japan stated for the first time that it would reduce the size of its plutonium stockpile.

Treaty on the Prohibition of Nuclear Weapons (TPNW)

In December 2016, the UN General Assembly First Committee voted 113–35 with 13 abstentions to begin negotiations on a treaty banning nuclear weapons. States met in New York for two rounds of negotiations, in March and June–July 2017. On July 7, 2017, 122 states voted in favor of the TPNW and it opened for signature that September. As of 2019, 23 states have ratified the treaty; 50 are necessary for entry into force.

Although the TPNW will not by itself eliminate nuclear weapons without the accession of the nuclear-armed states, the TPNW seeks to advance nuclear disarmament by delegitimizing nuclear weapons and strengthening the legal and political norm against their use. The International Campaign to Abolish Nuclear Weapons was awarded the 2017 Nobel Peace Prize for highlighting the unacceptable humanitarian consequences of nuclear weapons use and for its work to achieve the TPNW.

Nuclear Disarmament Verification

International Partnership for Nuclear Disarmament Verification

The Nuclear Threat Initiative (NTI) and U.S. Department of State established the International Partnership for Nuclear Disarmament Verification, a public-private partnership, in 2014 to address the technical challenges involved in nuclear disarmament verification. More than 25 nuclear- and non-nuclear-weapon states have participated in the initiative, which has held working group meetings, focusing on monitoring and verification, on-site inspection, and technical challenges to verification and plenary sessions.

The first phase of the partnership's work, which took place from 2015–2017, produced a report identifying the 14 steps to nuclear disarmament verification. The next phase of the project will look at verification of nuclear weapons declarations, verification of reductions, and technologies for verification, and plans to share its research with the 2020 NPT Review Conference.

Quad Nuclear Disarmament Verification Structure

Since 2015, Norway, Sweden, the United States and the United Kingdom, have been participating in the Quad Nuclear Disarmament Verification Structure, an arms control simulation initiative building on experience from the United Kingdom-Norway Initiative and previous United Kingdom-United States verification and arms control exercises.

Nuclear-Weapon-Free Zones

Middle East Weapons of Mass Destruction-Free Zone

Proposals for a NWFZ in the Middle East have been issued since the 1970s. Every year since then except for 2018, the UN General Assembly First Committee has adopted a resolution by consensus in support for a NWFZ in the region.

As part of the package of decisions to extend the NPT indefinitely in 1995, the states-parties agreed on the Resolution on the Middle East, which calls for the establishment of a WMD-free zone in the region. During the 2010 NPT Review Conference, states-parties agreed on a consensus final document that included several practical steps toward implementing the 1995 resolution. Key among those steps is a call to convene a regional conference to discuss the matter in 2012. That conference was originally postponed, but a series of five consultations were held between October 2013 and June 2014. Israel, the Arab League and Iran all attended the first consultation and all but Iran continued to attend the meetings. The 2015 NPT review conference failed to produce a final document after the United States, the United Kingdom, and Canada blocked consensus. The failure to produce a consensus ended the mandate of the Finnish facilitator for the zone process, Jaako Laajava.

The Arab League introduced a resolution at the 2018 UN General Assembly First Committee which proposed convening a one-week conference, under the auspices of the UN secretary-general in 2019 to take forward a MEWMDFZ. The resolution was adopted in the First Committee by a vote of 103 to three with 71 countries abstaining.

IAEA Safeguards

Article III of the NPT requires states to adopt comprehensive safeguards with the IAEA irrespective of the presence of nuclear material and facilities. States are encouraged, but not required, to negotiate a more intrusive additional protocol to their safeguards agreements. One hundred and thirty-four states have an additional protocol in place. Cameroon, Cote d'Ivoire, Honduras, Liberia, Senegal, Serbia, and Thailand brought an additional protocol agreement into force during the timeframe of this report. Algeria signed but has not yet ratified its additional protocol agreement.

As of 2019, 11 NPT states-parties (Benin, Cabo Verde, Equatorial Guinea, Eritrea, Guinea, Guinea-Bissau, Federated States of Micronesia, Palestine, São Tome and Principe, Somalia and Timor-Leste) have not brought their comprehensive safeguards agreement into force and 50 states have not yet brought an additional protocol to their safeguards agreement into force.

Nuclear Security Commitments

Since the nuclear security summits from 2012-2016, 11 of the "gift baskets," or multinational commitments made by states during the process, have been adopted as IAEA INFCIRCs which all IAEA members can endorse. However, few additional countries have joined these INFCIRCs at the time of publication.[228] The 11 INFICIRCs are as follows:

- INFCIRC/869 on Strengthening Nuclear Security Implementation
- INFCIRC/899 on the Statement of Principles of the Nuclear Security Contact Group
- INFCIRC/901 on Certified Training for Nuclear Security Management
- INFCIRC/904 on Nuclear and Radiological Terrorism Preparedness and Response
- INFCIRC/905 on Nuclear Detection Architectures
- INFCIRC/908 on Mitigating Insider Threats
- INFCIRC/909 on Transport Security of Nuclear Materials
- INFCIRC/910 on the Security of High-Activity Radioactive Sources
- INFCIRC/912 on Minimizing and Eliminating the Use of Highly Enriched Uranium in Civilian Applications
- INFCIRC/917 on Forensics in Nuclear Security
- INFCIRC/918 on Countering Nuclear Smuggling

Criminalization and Illicit Trafficking

The GICNT has grown from 86 partner states in 2016 to 88 in 2019 and no additional states have endorsed the PSI.

GLOSSARY OF TERMS

1540 Committee: The 1540 Committee was established in 2004 to report on compliance with UN Security Council Resolution 1540, which obligates UN states to refrain from supporting nonstate actors from accessing nuclear, chemical or biological weapons and their means of delivery.

1997 Model Additional Protocol: The 1997 Model Additional Protocol is a voluntary agreement between states and the International Atomic Energy Agency (IAEA) that supplements a Comprehensive Safeguards Agreement. The protocol empowers the IAEA to inspect nuclear facilities throughout the state, even sites outside of a nuclear declaration if the agency has evidence of illicit nuclear activity. The additional protocol also strengthens the effectiveness and improves the efficiency of safeguards. Additional protocols are negotiated individually based on the Model Additional Protocol, known as INFCIRC/540 (Corrected). As of 2019, 134 states have additional protocols in place.

Ballistic Missile: Ballistic missiles follow a predetermined flight path based on the trajectory of the earth. After a rocket engine launches the missile, it travels on an unpowered ballistic trajectory determined by gravity. Ballistic missiles can be armed with conventional or nuclear warheads and launched from fixed silos or mobile platforms. Some ballistic missiles are launched from land and others can also be launched from the sea. Ballistic missiles are classified by range.

- Tactical ballistic missiles: Range of less than 300 km
- Short-range ballistic missile (SRBM): Range between 300 km and 1,000 km
- Medium-range ballistic missile (MRBM): Range between 1,000 km and 3,500 km
- Intermediate-range ballistic missile (IRBM): Range between 3,500 km and 5,500 km
- Intercontinental-ballistic missile (ICBM): Range greater than 5,500 km

Command and Control: A country's nuclear command and control refers to the procedures by which it controls its nuclear forces and authorizes nuclear weapons use. These include "launch authority" which refers to the designated individual(s) or entity/entities granted the authority to order nuclear weapons use.

Code of Conduct on the Safety and Security of Radioactive Sources: This non-legally binding IAEA Code of Conduct helps national authorities to ensure that radioactive sources are used appropriately in a safe and secure environment. It has received support from more than 130 IAEA member states.

Comprehensive Safeguards Agreement (CSA): A CSA is negotiated between a state and the IAEA. It allows the IAEA to monitor all nuclear facilities and materials that are declared by the state but does not give the agency authority to investigate undeclared sites (see 1997 Model Additional Protocol). The CSA is the NPT standard of verification required by Article III of the treaty. The five NPT nuclear-weapon states have negotiated voluntary safeguards arrangements for select civil nuclear facilities. States that are not party to the NPT can also negotiate safeguards arrangements with the IAEA, known as limited INFCIRC/66-type agreements.

Comprehensive Test Ban Treaty (CTBT): The CTBT is an international treaty that prohibits all nuclear explosions anywhere on Earth - underground, underwater, or in the atmosphere. The CTBT contains provisions for an international monitoring system, comprised of 337 facilities to verify compliance with the treaty, including seismic, hydroacoustic, infrasound, and radionuclide detection stations. The CTBT was negotiated between 1994 and 1996 and opened for signature on September 24, 1996, at the UN General Assembly in New York. 168 states have ratified the CTBT, but it has yet to enter into force. Entry into force requires a set list of 44 states (Annex 2 states) to ratify the treaty and all but eight have completed ratification. The monitoring system is operational, despite the treaty not having entered into force.

Conference on Disarmament (CD): The CD is a multilateral forum for negotiating arms control and disarmament treaties. The CD succeeded the Ten-Nation Committee on Disarmament and the Eighteen-Nation Committee on Disarmament, where the NPT was negotiated. The body was renamed the CD in 1984 and is currently comprised of 65 member states. These states negotiated the CTBT and the Chemical Weapons Convention. The CD addresses weapons of mass destruction as well as conventional weapons.

Convention on the Physical Protection of Nuclear Materials (CPPNM): The CPPNM is the main international legal instrument for nuclear security. It establishes physical protection measures for nuclear material transported internationally and puts in place measures for criminal offenses

related to nuclear material. In 2005, parties to the CPPNM adopted an amendment which would cover the protection of nuclear facilities and material in peaceful domestic use, storage and transport. The amendment entered into force in 2016.

Cooperative Threat Reduction (CTR): Originally sponsored by former Senators Richard Lugar (R-Ind.) and Sam Nunn (D-Ga.), the Cooperative Threat Reduction program initially helped to secure and dismantle weapons of mass destruction and related facilities in former Soviet states. CTR funding has since expanded to help states in other regions.

Cruise missile: A cruise missile is a guided missile that is powered during the entire flight by a propulsion system. By relying on propulsion rather than ballistic trajectories, a cruise missile is maneuverable and can travel at lower altitudes. Cruise missiles carry either conventional or nuclear payloads. Cruise missiles tend to be characterized by the launch platform (sea, air, ground) and by speed (subsonic, supersonic, hypersonic).

De-alerting: De-alerting refers to steps taken by states to reduce the alert level of their nuclear forces, which extends the time it takes to launch a nuclear weapon.

De-mating: De-mating refers to the storage of nuclear warheads separately from their delivery systems. Some delivery systems, such as submarine-launched ballistic missiles and canister-based configurations require the mating of nuclear warheads to delivery vehicles. De-mating is an example of de-alerting because it would extend the time it would take to launch a nuclear weapon.

De-targeting: Nuclear weapons are de-targeted when they are not aimed at another country's territory.

Dual-use item: An item that has both civilian and military applications.

European Atomic Energy Community (Euratom): Euratom was created in 1957 for EU countries to cooperate on nuclear energy development and trade. Euratom also coordinates efforts in nuclear safety, security and safeguards in Europe.

Fissile material: Fissile material contains elements whose nuclei are able to undergo fission, or be split by neutrons. Uranium-233, uranium-235, and plutonium-239 are all fissile materials. Fissile materials undergo fission more easily than other fissionable materials and are more desirable for most reactor types and essential for nuclear explosives. Uranium-235 and plutonium-239 are both used in nuclear weapons.

Fissile material cutoff treaty (FMCT): The FMCT has yet to be negotiated, but the concept is a treaty that would end the production of fissile material for weapons purposes and may or may not address existing stocks of fissile materials. Such a treaty is on the agenda for the Conference on Disarmament, but that body has yet to reach consensus agreement on how to move forward, primarily because of the disagreement over whether or not the treaty should address existing stockpiles.

Global Initiative to Combat Nuclear Terrorism (GICNT): GINCT was created in 2006 to improve the prevention, detection and response to a nuclear terrorist event. The partnership includes 88 countries and five official observers.

Global Partnership Against the Spread of Weapons and Materials of Mass Destruction (Global Partnership): The Global Partnership was created by G8 countries in 2002 to fund and implement projects to prevent the proliferation of weapons of mass destruction. The Global Partnership has expanded beyond the G8 (now the G7), and is composed of 31 member states as of 2018.

Highly enriched uranium (HEU): Uranium that has been processed to increase the proportion of the uranium-235 isotope to more than 20 percent. Weapons-grade uranium generally refers to uranium enriched to at least 90 percent, but material of far lower enrichment levels can be used to create a nuclear explosive device. In addition to nuclear weapons, HEU is used today in naval nuclear reactors. HEU was commonly used in research reactors, but many of these reactors have been shut down or converted to use LEU.

INFCIRC/66-type safeguards agreement: INFCIRC/66-type agreements allow for states to place some but not all of its nuclear facilities under IAEA safeguards. India, Israel and Pakistan have negotiated this type of safeguards agreement.

Incident and Trafficking Database (ITDB): This database is the IAEA's information system on incidents of illicit trafficking and other events with nuclear and other radioactive material outside of regulatory control. 136 states participate in the ITDB.

Intermediate-Range Nuclear Forces (INF) Treaty: The INF Treaty required the United States and the Soviet Union to eliminate and permanently forswear nuclear and conventional ground-launched ballistic and cruise missiles with ranges of 500 to 5,500

kilometers. The 1987 treaty marked the first time the superpowers had agreed to reduce their nuclear arsenals, eliminate an entire category of nuclear weapons, and utilize extensive on-site inspections for verification. As a result of the INF Treaty, the United States and the Soviet Union destroyed a total of 2,692 short-, medium-, and intermediate-range missiles by the treaty's implementation deadline of June 1, 1991.

International Atomic Energy Agency (IAEA): The IAEA is an international organization based in Vienna charged with monitoring and safeguarding nuclear material and facilities to ensure that nuclear programs in non-nuclear-weapon states remain peaceful. The IAEA's safeguards role pre-dated the NPT, but Article III of the treaty required non-nuclear-weapon states to negotiate a safeguards agreement with the agency. The IAEA also helps states pursue peaceful nuclear programs through technical cooperation and provides nuclear safety and security assistance. The IAEA was set up in 1957 within the UN structure after U.S. President Dwight Eisenhower gave his "Atoms for Peace" speech.

International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT): The ICSANT entered into force in 2007 and is designed to criminalize acts of nuclear terrorism and to spur cooperation to prevent, investigate and punish those acts.

International Physical Protection Advisory Service (IPPAS): The IPPAS, created by the IAEA, provides advice on implementing international instruments on protecting nuclear material and related facilities. An IPPAS mission helps states align their current nuclear security infrastructure with IAEA standards.

International Partnership for Nuclear Disarmament Verification (IPNDV): The IPNDV brings together more than 25 countries with and without nuclear weapons to identify challenges associated with nuclear disarmament verification and to develop potential procedures to address those challenges.

Joint Comprehensive Plan of Action: The JCPOA is a 2015 agreement reached by Iran, the P5+1 (China, France, Germany, Russia, the United States, the United Kingdom) and the European Union to place limitations on Iran's nuclear program in exchange for sanctions relief. The United States terminated its participation in the JCPOA on May 8, 2018.

Low-enriched uranium (LEU): LEU is uranium that has been processed to increase the proportion of the uranium-235 isotope between 0.7 and 20 percent. Modern power reactors and research reactors typically run on LEU. LEU is not considered usable for nuclear weapons.

Missile Technology Control Regime (MTCR): The MTCR is a multilateral export control regime that seeks to limit the proliferation of missiles and missile technology. It was created in 1987 by the G7 and currently has 35 members. New members must be admitted by consensus.

Negative Security Assurance (NSA): A negative security assurance is a legally binding or non-legally binding commitment not to use nuclear weapons against non-nuclear-weapon states. Many states attach reservations, or conditions under which they may use nuclear weapons against non-nuclear-weapon states, to their NSAs.

No-First-Use Policy: A no-first-policy is a legally binding or non-legally binding commitment not to use nuclear weapons first in a conflict.

North Atlantic Treaty Organization (NATO): NATO is a political and military alliance founded in 1949, originally to provide collective defense to counter the Soviet Union and promote democratic values. NATO is currently comprised of 29 member states from Europe and North America. NATO's founding treaty includes a collective defense clause and nuclear weapons are a component of the organization's deterrence and defense capabilities. The nuclear deterrent is comprised of U.S. nuclear weapons stationed in several NATO countries. NATO's Nuclear Planning Group is in charge of NATO's nuclear policy and related issues, including arms control and nonproliferation. All NATO members except France participate in the Nuclear Planning Group.

Nuclear Nonproliferation Treaty (NPT): The NPT is the cornerstone of nonproliferation and disarmament efforts. Under the NPT, states possessing nuclear weapons (the five states that tested a nuclear device prior to 1967) committed not to transfer nuclear weapons and related technologies to non-nuclear-weapon states, and non-nuclear-weapon states committed not to pursue nuclear weapons. States also committed to pursue effective measures to end the arms race and negotiate a treaty on disarmament. The NPT also recognizes the right to pursue nuclear programs for peaceful purposes and includes provisions requiring non-nuclear-weapon states to enter into safeguards agreements with the IAEA to ensure that civil nuclear programs remain peaceful. The NPT was finalized in 1968 and entered into force in 1970. There are 191 states-parties to the NPT.

NPT Preparatory Committee (PrepCom): Each NPT review conference is preceded by PrepCom meetings in each of the three years prior to the conference. The PrepComs decide on procedural matters such as the agenda for the review conference and may also issue substantive recommendations.

NPT Review Conference (RevCon): Review conferences of the NPT are held every five years and offer states-parties an opportunity to review and enhance the implementation of the treaty. If the states reach consensus on actions to strengthen the treaty, the RevCon produces a Final Document outlining the agreed-upon conclusions of the meeting.

Non-nuclear-weapon state: A non-nuclear-weapon state, as defined by the NPT, is any state that did not detonate a nuclear explosive device prior to January 1, 1967.

Nuclear-weapon state: A nuclear-weapon state, as defined by NPT Article IX, manufactured and exploded a nuclear weapon prior to January 1, 1967. Those states are China, France, Russia, the United Kingdom, and the United States.

Nuclear-weapon-free zone (NWFZ): A nuclear-weapon-free zone is established by a treaty or convention dictating the total absence of nuclear weapons in the indicated region and establishing an accompanying system of verification.

New Strategic Arms Reduction Treaty (New START): New START is a verifiable arms reduction treaty signed by U.S. President Barack Obama and Russian President Dmitry Medvedev on April 8, 2010, in Prague. Under the treaty, the United States and Russia are limited to 1,550 warheads (warheads on deployed ICBMs and SLBMs count toward this limit and each deployed heavy bomber equipped for nuclear armaments counts as one warhead toward this limit); a combined limit of 800 deployed and nondeployed ICBM launchers, SLBM launchers, and heavy bombers equipped for nuclear armaments; and a separate limit of 700 deployed ICBMs, deployed SLBMs, and deployed heavy bombers equipped for nuclear armaments. The United States and Russia committed to reach the agreed-upon limits by February 2018. The treaty's verification regime includes on-site inspections and exhibitions, data exchanges and notifications related to strategic offensive arms and facilities covered by the treaty, and provisions to facilitate the use of national technical means for treaty monitoring. It also provides for the exchange of telemetry. The treaty's duration is 10 years, unless superseded by a subsequent agreement.

Nuclear Suppliers Group (NSG): The Nuclear Suppliers Group is a multilateral export control regime founded in 1974 that seeks to prevent nuclear weapons by controlling the export of materials, equipment and technology that can be used to manufacture nuclear weapons. States are admitted by consensus. The NSG has 48 members.

Nuclear Security Summits: The four Nuclear Security Summits, held once every two years from 2012 to 2016 were an invitation-only forum of world leaders focused on advancing global nuclear security and minimizing weapons-usable materials in civil programs.

Plutonium Management and Disposition Agreement: The Plutonium Management and Disposition Agreement was signed in 2000 and amended in 2010 and committed Russia and the United States to dispose of 34 metric tons each of surplus weapons-grade plutonium. Russia suspended the agreement in October 2016.

Proliferation Security Initiative (PSI): PSI is a multilateral initiative that aims to stop trafficking of weapons of mass destruction, their delivery systems and related materials to and from states and nonstate actors of proliferation concern. 103 countries have endorsed PSI, agreeing to implement the PSI Statement of Interdiction Principles.

Reprocessing: A chemical process whereby uranium and plutonium may be extracted from used nuclear fuel. Reprocessing is the method used to separate out weapons-grade plutonium.

Shannon Mandate: In 1995, the Conference on Disarmament reached consensus on a mandate for negotiating an FMCT, which is referred to as the Shannon Mandate. The Mandate dictates that an FMCT must be "non-discriminatory, multilateral and internationally and effectively verifiable" and the Mandate does not preclude states from raising concerns about past, present and future stockpiles of fissile materials during negotiations.

Strengthening Nuclear Security Implementation (SNSI): SNSI was originally circulated as a joint statement at the 2014 Nuclear Security Summit but was then turned into an IAEA INFCIRC and opened to all member states for endorsement. SNSI commits states to: subscribe to IAEA nuclear security fundamentals; meet the intent of IAEA recommendations and the Code of Conduct; continuously improve their nuclear security regimes; and ensure that nuclear security management and

personnel are competent. SNSI also provides 14 optional proposed actions for states to strengthen their nuclear security practices.

Tactical nuclear weapons: Tactical nuclear weapons are typically deployed on shorter range delivery systems intended for use on the battlefield.

Treaty on the Prohibition of Nuclear Weapons (TPNW): The TPNW was adopted in July 2017 and bans the development, testing, production, manufacturing, possession, transfer and use or threat of use of nuclear weapons, as well as assistance with any prohibited activities. The treaty also requires its states-parties to provide environment remediation and victim assistance for people and places harmed by nuclear weapons. The TPNW has not yet entered into force.

UN General Assembly First Committee: A subsidiary of the UN General Assembly responsible for drafting resolutions on disarmament issues. The First Committee meets every year in October for four to five weeks after the UN General Assembly General Debate. All UN member states can attend.

Treaty of Bangkok (Southeast Asia Nuclear-Weapon-Free Zone Treaty): A treaty that prohibits the development, manufacture, acquisition, and testing of nuclear weapons anywhere within the region of the 10 full-member parties: Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. It also prohibits the transport of nuclear weapons through the region. Signatories undertake to enact IAEA safeguards and to refrain from dumping at sea, discharging into the atmosphere, or burying on land any radioactive material or waste. Opened for signature in December 1995, the treaty entered into force in March 1997. All 10 states-parties have ratified the treaty.

Treaty of Pelindaba (African Nuclear-Weapon-Free Zone Treaty): A treaty that prohibits the research, development, manufacturing, stockpiling, acquisition, testing, possession, control, and stationing of nuclear explosive devices in the members' territory. The treaty also prohibits the deposit of radioactive waste originating from outside the continent within the region. Under the treaty, signatories are required to put all their nuclear programs under IAEA safeguards. The treaty provides for the establishment of the African Commission on Nuclear Energy, which will supervise treaty implementation and ensure compliance. The treaty was opened for signature in Cairo in April 1996 and entered into force in July 2009. Forty of the continent's 53 states are party to the treaty.

Treaty of Rarotonga (South Pacific Nuclear-Weapon-Free Zone Treaty): A treaty that prohibits the testing, manufacturing, acquiring, and stationing of nuclear explosive devices in any member's territory. The treaty prohibits dumping radioactive wastes into the sea. In addition, the treaty requires all parties to apply IAEA safeguards to all their peaceful nuclear activities. It was opened for signature on August 6, 1985, and entered into force on December 11, 1986. Thirteen states have ratified the treaty.

Treaty of Semipalatinsk (Central Asian Nuclear-Weapon-Free Zone Treaty): In force since March 21, 2009, the treaty is the first such zone in the Northern Hemisphere. It forbids the development, manufacture, stockpiling, acquisition, or possession of any nuclear explosive device within the zone. The treaty is the first to explicitly oblige state parties to implement an additional protocol in addition to the required IAEA safeguards agreement under the NPT. The treaty encompasses an environmental component that addresses concerns unique to the Central Asian region. Five countries (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan) are parties to the treaty.

Treaty of Tlatelolco (Nuclear-Weapon-Free Zone Treaty in Latin America and the Caribbean): A treaty that created a nuclear-weapon-free zone in Latin America and the Caribbean and was the first international agreement aimed at excluding nuclear weapons from an inhabited region of the globe. In addition to prohibiting nuclear testing by all states-parties, member states accept the application of IAEA safeguards for all their nuclear activities to assist in verifying compliance with the treaty. The treaty establishes a regional organization, the Agency for the Prohibition of Nuclear Weapons in Latin America, to help ensure compliance with its provisions. The treaty was opened for signature on February 14, 1967, and entered into force on April 25, 1969. It has since been signed and ratified by all 33 states in Latin America and the Caribbean.

Voluntary Offer Safeguards Agreement: The five recognized nuclear-weapon states under the NPT are not obligated to adopt safeguards agreements, but they have all adopted voluntary offer safeguards agreements, under which the IAEA applies safeguards to civilian facilities to which the state has voluntarily offered to apply safeguards.

NOTES

1. The 1963 Partial Test-Ban Treaty, which forbids testing in the atmosphere, underwater, and in outer space, established the norm of underground nuclear testing. Even countries not party to the treaty that have tested nuclear weapons (China, France, and North Korea) reverted at some point to doing so only underground.

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4. China, Egypt, Iran, Israel, and the United States have signed, but not ratified, the treaty. India, North Korea, and Pakistan have not signed the treaty.

5. UN General Assembly resolution, "Prohibition of the production of fissile materials for nuclear weapons or other nuclear explosive devices," A/RES/48/75L.

6. In December 2008, the UN General Assembly adopted a resolution entitled "Decreasing the Operational Readiness of Nuclear Weapons Systems," which called for further steps to reduce nuclear weapons readiness levels "with a view to ensuring that all nuclear weapons are removed" from high-alert status. The measure was adopted by a vote of 141–3 (France, the United Kingdom, and the United States) with 34 abstentions. UN General Assembly, A/RES/63/41, January 12, 2009.

7. In accordance with Article X of the nuclear Nonproliferation Treaty (NPT), which calls for a conference to decide on the indefinite extension of the treaty 25 years after its entry into force, states-parties held a review and extension conference in 1995. The result was a package of decisions that included the treaty's indefinite extension, a series of principles and objectives guiding the further implementation of the NPT, and a Resolution on the Middle East calling for a weapons of mass destruction-free zone in the region.

8. 2010 NPT Review Conference Final Document (Action 3).

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11. The International Atomic Energy Agency (IAEA) General Conference is an annual meeting of IAEA member states and the agency's "highest policymaking body."

12. Gustavo Zlauvinen, Presentation to the UN General Assembly First Committee, October 17, 2007 (IAEA director-general representative to the United Nations).

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The 2016–2019 update of this report, Assessing Progress on Nuclear Nonproliferation and Disarmament, grades the performance of the recognized nuclear-weapon states (China, France, Russia, the United Kingdom, and the United States) and the states outside of the NPT that have developed nuclear weapons (India, Israel, and Pakistan). The report also assesses states of concern (Iran and Syria) for conducting covert nuclear weapons activities in the past, and North Korea, which developed nuclear weapons in violation of its treaty commitments.

The fourth report finds that states have collectively regressed in nearly every measured criterion. As the NPT nears its fiftieth anniversary in 2020, states must improve their adherence to these standards to address the urgent threat posed by nuclear weapons.

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