ODUMUNC 2026 Issue Brief
The International Atomic Energy Agency

Strengthening IAEA Safeguards to Prevent Clandestine Nuclear Weaponization

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Introduction

Since its creation in 1957, the International Atomic Energy Agency (IAEA) has been tasked with promoting the peaceful uses of nuclear energy while serving as the global watchdog to prevent the diversion of nuclear materials for destructive purposes. No issue is trickier for the IAEA than a country or non-state actor working secretly to develop nuclear weapons.

North Korea used a secret program to develop a complete nuclear arsenal. Iraq tried to develop nuclear weapons under the rule of Saddam Hussein. Iran has developed the capability, but probably doesn't currently have actual nuclear warheads. South Africa had a secret program it abandoned. Syria tried to start one, but was stopped by an Israeli attack.

The IAEA safeguard system, designed during the Cold War, remains the cornerstone of the global non-proliferation regime under the Nuclear Non-Proliferation Treaty (NPT)[1]. Yet the challenges the Agency faces today are far more complex. Safeguards on nuclear materials and technology have faced growing challenges and exposed the agency's limitations in a globalized world where access to nuclear information, expertise and materials has become easier than ever.

Both developed and developing countries now possess and are attempting to pursue nuclear technology; with many seeking nuclear energy to meet domestic energy demands. This growing interest has created significant challenges for an IAEA already constrained by geopolitical conflict, compliance concerns, and financial limitations. As a result, the Agency struggles to meet the demands of an increasingly complex international environment.

Clandestine nuclear activities, nuclear development not publicly disclosed to the UN or affiliated bodies, continue to threaten international peace and security. Cases such

[1] https://www.iaea.org/bulletin/the-npt-and-iaea-safeguards?, https://www.iaea.org/topics/non-proliferation-treaty

as Iran's nuclear program, North Korea's withdrawal from the NPT, and fragile security assurances of the U.S. "nuclear umbrella" highlight both the critical importance of nuclear safeguards and the limits of the current system, underscoring the urgent need for reform to strengthen their effectiveness.

With decreasing UN oversight, member states are taking it upon themselves to prevent the proliferation of nuclear weapons. Iran in particular has experienced a difficult relationship with international nuclear inspections. Through delayed inspections and evolving treaties, Iran has continued to develop nuclear energies technology with concerns that it might begin weaponization. It is currently estimated that Iran possess, "almost 10,000 kilograms of enriched uranium, of which more than 400 kilograms were of the crucial 60-percent variety. For the building of an atomic bomb, this would still have to be enriched to 90 percent."[2]

The risk that Iran has used this stockpile to build a weapon increased between 13-24 June 2025, known now as the "Twelve Day War," as Iran launched conventional missiles at Israel in retaliation over a nuclear facility bombing. If Iran did possess a nuclear weapon, or could rush the creation of one, it was likely that it would during this war. To preempt this possibility, the U.S. in "Operation Midnight Hammer" launched a massive attack on Iranian nuclear facilities.[3] The war soon ended with Iran's nuclear ambitions being set back.

The UN and the IAEA are noticeably absent from this conflict. The U.S. and Israel worked bilaterally against one other state. This war represents a failure of the UN and the larger international order to control the chain of events that led to it.

Since South Africa's gave up its nuclear weapons program in 1993, clandestine nuclear development has persisted in members states such as Iran and North Korea with terrorist groups entering into the illegal trade of nuclear materials. The IAEA must become more proactive in member states nuclear projects so that civilian nuclear energy is used safely and to prevent the trade of nuclear materials.

[2] https://www.statista.com/chart/23528/irans-stockpile-of--low-enriched-uranium/

[3] https://breakingdefense.com/2025/06/operation-midnight-hammer-how-the-us-conducted-surprise-strikes-on-iran/

Background

The scientists of the Manhattan Project called for some form of international organization to control nuclear weapons even before the weapon was first used.[4] They argued that nuclear weapons usage would become common if left to individual state leadership as more states joined the "nuclear club" When the Korean War brought two nuclear powers into conflict, parties on all sides realized the potential danger and agreed to limit the war to conventional arms.

IAEA inspectors checking nuclear fuel rods at a civilian reactor during a Safeguards Comprehensive Training Exercise at Dukovany Nuclear Power Plant in the Czech Republic on 11 June 2015

In 1953, U.S. President Eisenhower's "Atoms for Peace" address to the UN General Assembly laid the groundwork for the International Atomic Energy Agency (IAEA). Created in 1957, the IAEA was tasked with promoting peaceful nuclear technology while applying safeguards to prevent misuse, giving it authority over nuclear materials, equipment and facilities.[5]

Early safeguards were limited-bilateral or regional in scope, tied to supply agreements like Euratom (1956), and lacking universality. These arrangements failed to prevent weapons development outside IAEA oversight.

By the late 1960s, momentum shifted toward comprehensive safeguards. The Treaty of Tlateloco(1967) became the first agreement to ban nuclear weapons in a populated region [6], paving the way for additional nuclear-weapon-free zones in the South Pacific (1985), Southeast Asia (1995), Africa (1996), and Central Asia (2006)[7].

The Nuclear Non-Proliferation Treaty (NPT), which entered into force in 1970, sought to prevent the spread of nuclear weapons, promote peaceful nuclear cooperation, and advance disarmament among nuclear powers (UN NPT Conference 2020). The IAEA became the NPT's verification arm, responsible for monitoring compliance, and safeguards..

To implement this system, the Comprehensive Safeguards Agreement (CSA) was created requiring non-nuclear-weapon states to declare all nuclear materials and submit to inspections, audits, and surveillance. But the CSA effectiveness was limited to declared information, leaving

[4] https://www.osti.gov/opennet/manhattan-project-history/Events/1945-present/public_reaction.htm
[5] https://www-pub.iaea.org/MTCD/Publications/PDF/IAEA_SG_INF_3_web.pdf
[6] https://inis.iaea.org/records/6f8ah-qkk04
[7] https://www.iaea.org/topics/safeguards-and-verification

space for clandestine programs. India's 1974 nuclear test exposed these limits, followed by Iraq's secret weapons program uncovered after the 1991 Gulf War. These cases, along with North Korea, Libya, and Iran pushed the IAEA to adopt the Additional Protocol(1997)[8].

The Additional Protocol expanded verification by requiring states to declare the full scope of their nuclear fuel cycle activities– mining to waste storage–as well as equipment production, imports and exports, research and development, future plans, etc. It strengthened surveillance, introduced more frequent and short-announced inspections, and leveraged new technologies and databases[9]. These measures provided greater transparency, helping reveal undeclared activities in Egypt, South Korea, and Iran–though Iran has resisted full compliance[10].

South Korea's Wolsong Nuclear Power Plant in North Gyeongsang province

Safeguard challenges

The IAEA faces an array of complex and persistent challenges in maintaining effective safeguards. These challenges included legal, technological, financial, and geopolitical constraints that limit the agency's ability to verify compliance and prevent clandestine nuclear activities.

Securing Legal Authority: The IAEA's ability to draw conclusions about the peaceful nature of a state's nuclear program depends entirely on the legal agreements in place and the willingness of states to honor them. Without universal authority, the agency's reach remains uneven[11].

State Compliance and the Additional Protocol: The Comprehensive Safeguards Agreement (CSA) remains limited to declared information. The Additional Protocol (AP) expands inspector access to data, sites, and reports, enabling more stricter verification. Yet adoption is inconsistent: as of 2025, 191 states have safeguard agreements in place, but only 143 have put the AP into force[12]. This gap leaves major vulnerabilities in the safeguards system.

[8] https://www.armscontrol.org/act/2007-11/looking-back-additional-protocol
[9] https://www.armscontrol.org/act/2007-11/looking-back-additional-protocol
[10] https://www.armscontrol.org/act/2007-11/looking-back-additional-protocol

[11] https://www.iaea.org/newscenter/statements/major-challenges-currently-facing-international-nuclear-non-proliferation-regime
[12] https://www.iaea.org/newscenter/statements/iaea-director-generals-introductory-statement-to-the-board-of-governors-3-march-2025

Technological Advances: Verification challenges are evolving rapidly. Proliferators seek new technologies and exploit information-sharing networks, requiring the IAEA to continually update detection tools. At the same time, the agency struggles with limited laboratory capacity and equipment, undermining its ability to independently verify results and provide unbiased conclusions.[13]

Financial Constraints: Demand for nuclear energy is rising, yet the IAEA's budget for inspections comes from its regular, fixed budget. This neutrality safeguard creates funding shortfalls that limit inspectors and reduce the agency's capacity to respond to growing verification needs, particularly in developing states[14].

Security Crises and Non-Compliance: Geopolitical conflicts and defiant states create some of the most pressing safeguard challenges today. Countries with new or secreta nuclear programs in recent years include:

(i) Iran: After halting implementation of key commitments under the JCPOA, Iran has expanded its stockpile of enriched uranium to 60%-- the highest level for any non-nuclear-weapon state. It has also suspended AP verification, failed to address undeclared uranium particles, and provided inconsistent reporting, intensifying regional tensions, including June 2025 Iran-Israel conflict [15] .

(ii) North Korea: The Democratic People's Republic of North Korea expelled IAEA Inspectors in 2009 and has since expanded its nuclear arsenal through undeclared tests, leaving the agency blind to its program. [16]

(iii). Syria: the secret nuclear reactor at In Deir el-Zour, built with North Korean assistance, was destroyed by Israel in 2007, but access issues have persisted. In 2024, the IAEA again faced restricted inspections of undeclared sites[17].

Fear of U.S. withdrawal : Some states– such as Poland, Lithuania, South Korea and Taiwan–worry that U.S. security guarantees might be withdrawn or weakened under a more isolationist posture. Saudi Arabia, United Arab Emirates also could host clandestine nuclear programs.[18] This uncertainty pushes them to explore alternative defenses, potentially including clandestine nuclear options, to deter threats from neighbors like Russia or North

[13] https://www.iaea.org/newscenter/statements/major-challenges-currently-facing-international-nuclear-non-proliferation-regime

[14] https://www.iaea.org/newscenter/statements/challenges-in-nuclear-verification

[15] https://www.iaea.org/newscenter/statements/iaea-director-generals-introductory-statement-to-the-board-of-governors-3-march-2025

[16] https://www.iaea.org/newscenter/statements/meeting-safeguards-challenges ,https://www.nknews.org/2025/02/iaea-chief-calls-for-engagement-with-north-korea-amid-nuclear-arsenal-concerns/

[17] https://www.armscontrol.org/act/2025-07/news/iaea-gains-access-former-syrian-nuclear-sites

[18] https://www.geopoliticalmonitor.com/the-strategic-case-for-us-security-guarantees-in-europe/, https://carnegieendowment.org/posts/2023/02/south-koreas-nuclear-flirtations-highlight-the-growing-risks-of-allied-proliferation? https://www.cato.org/commentary/why-south-korea-wants-nuclear-weapons-now-more-ever

Korea.[19] The erosion of faith in the U.S. protection thus creates a strategic environment more favorable to secret nuclear development.

An IAEA inspector during a safeguards inspection at a nuclear fuel processing facility in the Netherlands.

The United Nations on IAEA Safeguards

The International Atomic Energy Agency is an independent organization within the United Nations, partnering with over a dozen UN organizations[20]. The IAEA acts as a technical expert for the UN to determine whether countries are using nuclear technology and materials for peaceful purposes and not to weaponize them.

The United Nations, through its main organs, operates within this partnership, as a political authority[21]. Through the IAEA's inspections and verification processes, once a country is determined by the IAEA to be non-compliant (such as Iran or North Korea), this information is reported to the UN who then debates and decides the response– i.e. either to impose sanctions (as in Resolutions 1737, 1747, and 1929 on Iran), negotiate agreements or issue warnings.[22] The Council's decisions are legally binding under UN Charter VII but require a consensus among the permanent members, often limiting the speed or strength of action due to political divisions or vetoes. [23]

The UN General Assembly (UNGA) plays a more deliberative and norm-setting role, by discussing global disarmament and non-proliferation trends, adopts resolutions promoting universal adherence to the NPT, and urges the strengthening of the IAEA safeguards.[24] The UNGA is the most representative global body for addressing disarmament and international security, and its resolutions have contributed to many key international developments like the endorsement of the NPT (1968), and Comprehensive Nuclear-Test-Ban Treaty (CTBT, 1996) to name a few.[25]

The UN Secretary-General serves as a mediator and advocate for disarmament and verification[26]. The Secretary-General calls attention to threats to global peace that arise

[19] https://www.cidob.org/en/publications/what-us-military-disengagement-means-european-security, https://theloop.ecpr.eu/polands-push-for-nato-nuclear-sharing-is-response-russian-aggression
[20] https://www.iaea.org/about/partnerships/united-nations-system
[21] https://www.un.org/en/global-issues/atomic-energy
[22] https://www.armscontrol.org/factsheets/un-security-council-resolutions-iran#res1737
[23] https://www.un.org/en/global-issues/atomic-energy
[24] https://www.nti.org/education-center/treaties-and-regimes/united-nations-general-assembly/
[25] Ibid.
[26] https://peacemaker.un.org/en/mandate/secretary-general-mediation

from nuclear proliferation, and helps support multilateral treaties such as the Comprehensive Nuclear-Test-Ban Treaty. [27] However, the role of the Secretary-General is limited as they cannot enforce compliance nor override any state's sovereignty. Much of the weight of enforcement falls upon the UN Security Council.

The UN Security Council eventually decides on how to respond politically to any reports brought forth by the IAEA, adopting resolutions and imposing sanctions/demands upon non-compliant states. However, it is also limited in its decision making abilities due to the clashing political interests by the permanent 5 members and shortage of enforcement options. [28]

Landmark resolutions

The United Nations has adopted numerous resolutions aimed at strengthening IAEA safeguards and preventing the clandestine weaponization of nuclear materials.

UNSC Resolution in non-proliferation 1540 (2004) , was unanimously voted by all members and required all states to adopt and enforce laws preventing proliferation of weapons of mass destruction (chemical, biological, nuclear) , including domestic trade channels to prevent non-state actors from secretly acquiring these materials.[29]

This resolution is legally binding as it falls in accordance with chapter VII of the UN Charter and helps countries reinforce existing treaties such as the NPT to mandate a level of safeguard protocols within their borders and thereby strengthening security assurances from illegal nuclear proliferation.[30]

UN Security Council Resolutions on North Korea (1718 [2006]- 2375 [2017]), where over a decade, the members of the UNSC adopted nine resolutions responding to North Korea's nuclear tests and withdrawal from the NPT, which posed a growing threat to international security.[31] Resolution 1718 (2006) imposed heavy sanctions and banned all trade in materials related to nuclear or ballistic missile programs, while latter resolutions like the 1874 (2009) encouraged North Korea to join the Comprehensive Nuclear Test Ban Treaty (CTBT) and cooperate with the IAEA, however expanded sanctions followed with their continued non-compliance (UNSC Resolutions 2087-2375)[32].

UN Security Council Resolution on Iran 1969 (2006)- 2231 (2015), marked the direct action on Iran's clandestine nuclear weapons program, with the UNSC demanding suspension of uranium enrichment and complete compliance with

[27] Ibid.

[28] https://www.armscontrol.org/act/2010-01/safeguards-noncompliance-challenge-iaea-and-un-security-council#:~:text=Finding%20a%20state%20in%20noncompliance,grounds%20for%20noncompliance.%5B13%5D

[29] https://www.un.org/en/sc/1540/about-1540-committee/general-information.shtml

[30] Ibid

[31] https://www.armscontrol.org/factsheets/un-security-council-resolutions-north-korea

[32] Ibid

the IAEA verification processes.[33] Similar to North Korea, latter resolutions (1737-1929) focused on expanded and growing sanctions, restrictions, and international pressure on Iran due to thier continued non-compliance toward IAEA Protocols of transparency.[34] Resolution 2231 (2015) later promoted the Joint Comprehensive Plan of Action (JCPOA) between Iran and the P5+1 (Germany), by formally integrating IAEA verification into UN's legal framework and also utilized IAEA verification and monitoring on Iran's nuclear program. [35]

Finally, the NPT presents a puzzling case for IAEA. Article 2 of the treaty states:

> Each non-nuclear-weapon State Party to the Treaty undertakes not to receive the transfer from any transferor whatsoever of nuclear weapons or other nuclear explosive devices or of control over such weapons or explosive devices directly, or indirectly; not to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices; and not to seek or receive any assistance in the manufacture of nuclear weapons or other nuclear explosive devices.[36]

Article 3 continues with:

> Each non-nuclear-weapon State Party to the Treaty undertakes to accept safeguards, as set forth in an agreement to be negotiated and concluded with the International Atomic Energy Agency in accordance with the Statute of the International Atomic Energy Agency and the Agency's safeguards system, for the exclusive purpose of verification of the fulfilment of its obligations assumed under this Treaty with a view to preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices. Procedures for the safeguards required by this Article shall be followed with respect to source or special fissionable material whether it is being produced, processed or used in any principal nuclear facility or is outside any such facility. The safeguards required by this Article shall be applied on all source or special fissionable material in all peaceful nuclear activities within the territory of such State, under its jurisdiction, or carried out under its control anywhere.

However, Article 4 adds:

> 1. Nothing in this Treaty shall be interpreted as affecting the inalienable right of all the Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with Articles I and II of this Treaty.
>
> 2. All the Parties to the Treaty undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy. Parties to the Treaty in a position to do so shall also co-operate in contributing alone or together with other States or international organizations to the further development of the applications of

[33] https://www.armscontrol.org/factsheets/un-security-council-resolutions-iran#res1737

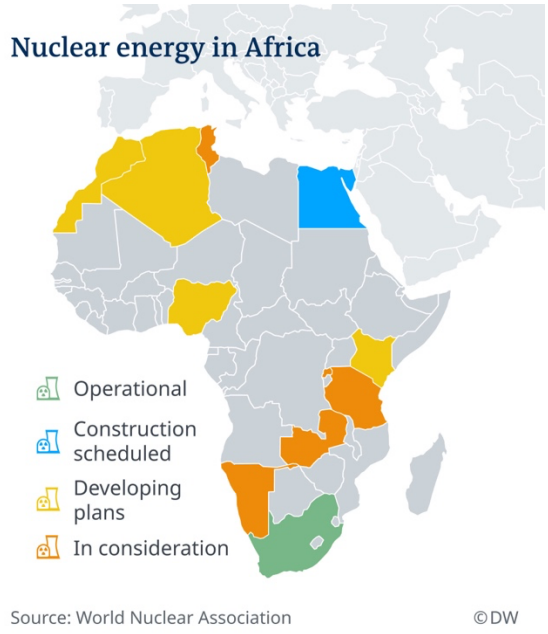
[34] Ibid.

[35] Ibid

[36] https://treaties.unoda.org/t/npt

> nuclear energy for peaceful purposes, especially in the territories of non-nuclear-weapon States Party to the Treaty, with due consideration for the needs of the developing areas of the world.

The issue is found in that nuclear development for military purposes is only possible after it has been processed for peaceful ones. Enriched nuclear material is a byproduct of nuclear power, and once it is created member states have several options to conceal how it manages its nuclear material from the IAEA. The IAEA experiences difficulty balancing the respect for state sovereignty and the management of state's nuclear materials.



Member State Positions

China possesses a large nuclear weapons arsenal with an estimated civilian 1000kg stockpile of highly enriched uranium.[37] China supports measures for nuclear security so long as each Member State remains in full control of everything that happens in their territory.

Democratic People's Republic of Korea (DPRK/North Korea) continues to develop and test its nuclear weapons program. Operating outside of the NPT and IAEA oversight it is difficult to ascertain how much nuclear material the DPRK possesses, but it is estimated to be 300-1700kg from its enrichment reactors.[38] Concerns are rampant that the DPRK is active in the global import and export of nuclear material to an unknown number of state and non-state actors.

India demands that all countries be treated equally. This means exactly the same rules for nuclear and non-nuclear states, for established nuclear powers and emerging nuclear states like India. Above all, India refuses to accept controls or limits that other nuclear states refuse on themselves. This explains is opposition to the 1968 NPT, which allows existing nuclear power to keep their weapons, while denying them to newcomers only.

[37] "Civilian HEU: Who Has What?" Nuclear Threat Initiative. October 2019. https://nonproliferation.org/wp-content/uploads/2021/10/heu_who_has_what.pdf

[38] International Panel on Fissile Materials. "North Korea." 22 May 2025. https://fissilematerials.org/countries/north_korea.html

Iran is heavily invested in nuclear development. It continues to pursue nuclear power to provide energy for its population and other peaceful uses. Even Israel has no problem with peaceful Iranian nuclear energy at its Bushehr plant.[39] The concerns are over Iran's enriched uranium and its military applications. Iran is secretive over its entire nuclear program frequently refusing IAEA inspection access.

Israel is greatly concerned over the proliferation of nuclear materials, particularly to Iran. It is feared that Iran may enrich uranium for its own weapons or distribute it to terrorist organizations. It is not a leading actor in negotiations but has proven its willingness to use its military to eliminate any perceived nuclear threat.

The Non-Aligned Movement (NAM) is the largest group of states, with 120 formal members, including most of the countries of Africa, Asia and Latin America. The NAM seeks the promotion of nuclear development for energy and other technology uses. Over thirty states in recent decades have turned over their stockpiles to UN control where they were given to established nuclear states for safer guarding. Non-aligned states are the most vocal proponents of not only stricter controls on nuclear material but of the total elimination of all nuclear weapons.

NAM Member States generally support measures calling for greater nuclear security in their territory, especially help preventing and intercepting illegal trans-shipping through their territory. But they expect in return to be offered easier access to civilian nuclear technology, especially civilian power generating reactors and infrastructure, including easier financing for reactor and electrical distribution grip development.

Pakistan opposes all proposals that would affect countries unequally, including the Any prohibition on creating new fissile material, say Pakistani diplomats, would disadvantage Pakistan compared to veteran nuclear powers who already have created large stockpiles.

Russian Federation has the largest stockpile of nuclear weapons in the world with 5,460 warheads. Russia has been working with former Soviet Republics to move all their nuclear materials to Russia for safer and more experienced management.

Russia strongly supports measures for nuclear security so long as each Member State remains in full control of everything that happens on their territory. Russia opposes further inspections or international oversight power.

The United States holds the second largest amount of nuclear weapons with 5,177 warheads. Under President Trump, the United States stresses unique national advantage. It continues to support the 1968 Nuclear Non-Proliferation Treaty, because it helps the United States. But it opposes the Comprehensive Nuclear Test Ban Treaty. Along with Israel, the U.S. will engage in military options to enforce global nuclear norms. But with the creation of his new

[39] https://www.jpost.com/middle-east/iran-news/article-857645

Board of Peace, President Trump may be open to other possibilities.

Some proposals for action

The IAEA is under great pressure to strength its safeguards system, but also faces pressure from its Member States, anxious to preserve their national sovereignty. Balancing the priorities of non-proliferation with the demands of national sovereignty is a difficult challenge. Below are some suggestions for action. As sovereign states, the members of the IAEA are free to develop these or others.

Involve the rest of the UN and the international Community more. The IAEA is an organization within the UN. It should garner more support from the GA and SC if the UN hopes to address the raising threats from clandestine development. The IAEA should not only report to the GA and SC but involve them indecision making. The o IAEA could initiative a dialogue with President Trumps new Board of Peace, now considering other international problems to solve, searching for opportunities to cooperate on how to promote nuclear energy, without facilitating nuclear proliferation.

Specialize on specific states. The current IAEA divides its attention through the regional management of member states, such as the AFRA or ARCAL. Recognizing that some states are more prone to nuclear development than others, the IAEA needs specialists to only concentrate on one state at a time since their nuclear programs require more careful attention. The IAEA generally stresses principles for all countries, but it could recommend specific action direct against particular countries of concern, demanding, for example, that they stop military nuclear activity.

Suggest amendments to the NPT. The balance between peaceful development of nuclear energy and weaponization is delicate. Perhaps the treaty needs to be changed so the IAEA can exert greater control over the final states of peaceful development when spent nuclear fuel is produced. The IAEA can only recommend amendments. These would have to be further debated and approved by a Review Conference of the NPT.

Introduce a new treaty. One way to solve the dangers of nuclear development is to create harsher treaties that limit even peaceful development. A treaty that forces a

member state to partner with an existing nuclear state before they can begin development will ensure that accountability falls to a state that already has experience managing nuclear material. Alternatively, the IAEA could create a treaty prohibiting any use of force against an NPT signatory in good standing.

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