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STRONGER INTERNATIONAL SAFEGUARDS AS A CONDITION OF SUPPLY TO NUCLEAR ENERGY PROGRAMS: COMING TO CONSENSUS IN THE NUCLEAR SUPPLIERS GROUP

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Nations that are party to the Treaty on the Non-Proliferation of Nuclear Weapons but are not allowed nuclear weapons under the treaty ("non-nuclear-weapon states") must have international safeguards applied to civil nuclear energy facilities if they pursue such programs. The International Atomic Energy Agency (IAEA) applies these safeguards and conducts inspections on nuclear energy programs, and determined in the 1990s that it needed additional capabilities to verify states were not engaging in secret (i.e., undeclared) nuclear activities. Subsequently, the IAEA developed a set of stronger safeguards measures, known as the Model Additional Protocol ("Additional Protocol"), which was approved in 1997. Today, most nations have an Additional Protocol in force, but a few dozen do not.

The nations that do not may pose a concern if they pursue nuclear energy as a means of addressing energy and environmental challenges, such as decarbonization to meet climate goals. The greater reporting requirements and inspection measures in the Additional Protocol give the international community assurance that a nation's declarations about its civil nuclear program are both correct and complete. The enhanced inspections in turn provide greater deterrence against states pursuing illicit nuclear activities.

The Nuclear Suppliers Group (NSG)—which comprises 48 governments, including those representing the major reactor vendor countries—maintains guidelines governing the export of nuclear materials, equipment, and technology. The NSG has been considering modifying those guidelines for many years to support more universal adoption of the Additional Protocol. But adoption has been hard to come by, in part because of potential disruptions to existing supply relationships given that not all countries participating in the NSG have Additional Protocols in force and some client states of countries participating in the NSG also do not have these upgraded inspections in place. There may be room for consensus building among NSG states, however, since most support requiring an Additional Protocol as a condition of supply to further the nonproliferation regime. The remaining governments may agree if measures are proffered to address challenges that have blocked acceptance to date.

This commentary discusses a history of related policy developments in the NSG, examines some of the group's roadblocks to consensus, and suggests options for making progress on adding stronger international safeguards as a condition of supply to nuclear energy programs.

Safeguards as a Condition of Supply in the NSG

The IAEA is charged with independently verifying that nuclear facilities are not misused and nuclear material is not diverted from peaceful uses. IAEA safeguards are technical measures (e.g., seals, cameras, and detectors) that the agency employs to verify that states are living up to their international commitments not to shift civil nuclear programs toward weapons development.[1]

The NSG is a "group of nuclear supplier countries that seeks to contribute to the non-proliferation of nuclear weapons through the implementation of…guidelines for nuclear exports."[2] In 1978, the NSG first published a list of nuclear materials and equipment with a set of guidelines that governments participating in the NSG would apply to their export. One condition of supply was that participating governments would not export nuclear materials and equipment to a non-nuclear-weapon state (NNWS) unless the material or associated facility was under IAEA safeguards. The export of items on this NSG-maintained list would thus trigger the need for safeguards—hence it is sometimes referred to as the "trigger list."

In 1992, the NSG went a step further and required recipient NNWS to have IAEA safeguards placed on all their nuclear facilities and materials—not just the destination site for an individual export—to qualify for exports of trigger list nuclear materials and equipment. In other words, a recipient nation would have to have in place what is known as a comprehensive safeguards agreement (CSA) with the IAEA. The policy shift put trade barriers in place, for example, with countries that had not joined the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and, in the absence of the requirements of the treaty, had in some cases placed only a limited number of their nuclear facilities under international safeguards.

When it made the change in 1992, the NSG provided two exceptions to the CSA requirement: for cases involving operational safety and for existing commercial supply relationships (i.e., a grandfather clause).[3] The safety exception[4] was cited in the late 1990s by Russia, for example, which used the "essential for the safe operation of existing facilities" clause as a justification for its exports of low-enriched uranium fuel to India for the Tarapur reactors in 2001.[5]

The grandfather clause makes an exception to the CSA requirement for agreements or contracts made prior to April 3, 1992.[6] If a country began adhering to the trigger list guidelines after that date (e.g., joined the NSG at a later time), the grandfather clause applies to agreements previous to the start of adherence. For example, when China joined the NSG in 2004, it reportedly declared the supply of two power reactors to the Chashma site in Pakistan as "grandfathered"; in 2010, China announced the supply of two additional reactors to Pakistan, maintaining that they were also grandfathered.[7] Like India, Pakistan is not party to the NPT, does not have a CSA in place, and does not have all its nuclear facilities under IAEA safeguards. Use of the safety and grandfather clauses in those instances was controversial and subject to criticism that it undermined the CSA requirement.[8]

In 2008, the participating governments in the NSG agreed to what was, in effect, a third exception to the CSA requirement: nuclear exports to sites under IAEA safeguards in India.[9]

Stronger Safeguards Measures: The Additional Protocol

Subsequent to the IAEA's experiences with Iraq (a clandestine nuclear weapons program) and North Korea (undeclared plutonium separation activities) in the early 1990s, the agency embarked on an effort to develop stronger safeguards. It sought measures in particular to enhance its ability to detect undeclared nuclear material and activities in states with CSAs.[10] In 1997, the IAEA Board of Governors approved a set of safeguards measures collectively known as the "Model Additional Protocol." Since then, the enhanced safeguards provisions in what is commonly called the Additional Protocol have helped the IAEA to verify the "completeness" of countries' declarations regarding their nuclear programs—meaning that there are no secret nuclear activities beyond what a country has declared to the agency.[11]

However, as of June 1, 2021, 57 UN member states do not have an Additional Protocol in force:[12]

> Algeria, Argentina, Bahamas, Barbados, Belarus, Belize, Bhutan, Bolivia, Brazil, Brunei Darussalam, Cabo Verde, Democratic People's Republic of Korea, Dominica, Egypt, Equatorial Guinea, Grenada, Guinea, Guinea-Bissau, Guyana, Iran, Israel, Kiribati, Lao People's Democratic Republic, Lebanon, Malaysia, Maldives, Micronesia, Myanmar, Nauru, Nepal, Oman, Pakistan, Papua New Guinea, Qatar, Saint Lucia, Saint Vincent and the Grenadines, Samoa, San Marino, São Tomé and Príncipe, Saudi Arabia, Sierra Leone, Solomon Islands, Somalia, South Sudan, Sri Lanka, Sudan, Suriname, Syrian Arab Republic, Timor-Leste, Tonga, Trinidad and Tobago, Tunisia, Tuvalu, Venezuela, Yemen, Zambia, Zimbabwe.

Among them, Argentina, Belarus, Brazil, Iran, and Pakistan have power reactors planned, under construction, or in operation, according to the IAEA.[13] Fourteen of the 57 nations, including Algeria, Belarus, Bolivia, and Iran, have signed an Additional Protocol but have not yet brought it into force. The remaining countries have neither signed an Additional Protocol nor have one in force. This includes Egypt, which has had discussions with Russia over the supply of reactors;[14] Pakistan, which is buying reactors from China;[15] and the Kingdom of Saudi Arabia, which has announced that it will pursue a nuclear power program.[16]

After the Model Additional Protocol was approved in 1997, the NSG could have strengthened the conditions of supply in its trigger list guidelines by requiring countries to agree to these enhanced safeguards measures in order to qualify for imports of nuclear materials, equipment, and technology. As many have observed, this type of revision to the guidelines would help to support wider adherence to the Additional Protocol and thereby bolster the nonproliferation regime.[17]

At the 2000 plenary meeting of the NSG, the public statement from the group encouraged states to conclude an Additional Protocol with the IAEA,[18] but the group did not require it as a condition of supply of trigger list materials. In the public statement coming out of the 2005 plenary, the NSG acknowledged that adding the Additional Protocol as a condition of supply was a point of discussion within the group,[19] but again, there was no consensus to require it. The topic arose again in the following year's plenary, when the NSG adopted an "approach to…discussions"[20] about the Additional Protocol as a condition of supply. That approach and any associated discussions did not lead to—and still have not led to—a consensus within the

group on the topic. As of August 2021—fifteen years later—the Additional Protocol is not a general condition of supply in the trigger list guidelines for the export of nuclear material, equipment, and related technology.

The NSG works by consensus, so the governments of all 48 countries participating in the group would have to agree with any change made. One factor hindering consensus on adding the Additional Protocol as a condition of supply for trigger list items is that not all the participating governments themselves have signed an Additional Protocol with the IAEA, let alone have one in force. Brazil and Argentina, for example, are two participating governments in the NSG that have nuclear energy programs (two and three power reactors, respectively), and neither country has signed an Additional Protocol with the IAEA. Belarus is another with an existing nuclear energy program (one power reactor in operation, a second under construction) that has signed an Additional Protocol but has not yet brought it into force. Thus, an immediate change to require the Additional Protocol without exceptions for existing nuclear energy programs would have the effect of preventing those three countries (until they adopted the protocol) from importing nuclear materials, equipment, and technology from supplier countries to support their operating reactors—a likely unworkable outcome given that in the past it has taken some countries years to bring Additional Protocols into force from the start of negotiations with the IAEA.

But the fact that not all NSG-participating governments have Additional Protocols in force is not the only challenge to reaching consensus. Some NSG-participating governments are currently supplying reactors to nations that do not have Additional Protocols in place (e.g., China's supply to Pakistan), and NSG condition of supply changes could have impacts on those business relationships. In addition, members of the Non-Aligned Movement (NAM)[21] have voiced their opposition to the Additional Protocol as a condition of supply, arguing it contravenes Article IV of the NPT[22], which contains the "inalienable" right of parties to the treaty to develop and use nuclear energy and also contains a statement that parties to the treaty will undertake to facilitate the "fullest possible" exchange of nuclear equipment, materials, and information. Some participating governments (e.g., South Africa and Belarus) in the NSG are members of the NAM.

A Limited Inclusion of the Additional Protocol…with Alternatives

The NSG did finally achieve consensus related to the Additional Protocol—albeit in a very limited context and with a specific exemption—in 2011. The group concluded a years-long effort to delineate conditions of supply related to enrichment and reprocessing exports, and as part of that effort, it was forced to grapple with a familiar challenge: some NSG members did not have Additional Protocols in force.

When the NSG first published its guidelines in 1978, Paragraphs 6 and 7 of the trigger list guidelines contained controls on the export of enrichment and reprocessing technology (which stoke particular nonproliferation concerns given their ability to produce separated fissile material suitable for use in a nuclear explosive). These were restrictions on nuclear trade that did not exist in the previous multilateral nuclear export control regime—known as the NPT Exporters Committee (sometimes called the "Zangger Committee," after its first chair,

Claude Zangger). While Paragraph 6 of the 1978 NSG trigger list contained clear safeguards requirements regarding the export of enrichment and reprocessing technologies, Paragraph 7 was vaguer and merely called on participating governments to "exercise restraint" in the transfer of sensitive facilities, technology, and weapons-usable materials without defining what "restraint" meant for the purposes of practical implementation.

Decades later, the NSG decided to revisit Paragraphs 6 and 7 to define criteria (as opposed to calling for "restraint") that would have to be met for enrichment and reprocessing trade. One driver of the initiative was information concerning the A. Q. Khan network that came into public view in the early 2000s, including the illicit transfer of enrichment technology to North Korea, Iran, and Libya.[23]

Changes to Paragraphs 6 and 7 in 2011 included a variety of new requirements related to enrichment and reprocessing exports: recipients must have membership in the NPT, adhere to NSG guidelines, agree to safeguards in perpetuity for the facility in question, commit to IAEA safety standards, as well as other criteria. Paragraph 6(c) included a new requirement that recipients have a comprehensive safeguards agreement in force as well as either an Additional Protocol or—pending this—that they are implementing a safeguards agreement in cooperation with the IAEA, including a regional accounting and control arrangement approved by the IAEA Board of Governors.[24]

Only two such regional arrangements at the time met this latter criteria: the IAEA-Euratom agreement and another one involving the IAEA, Brazil, and Argentina. All the NNWS nations that are part of the IAEA-Euratom agreement have an Additional Protocol in force. Brazil and Argentina do not, but they do have a regional accounting and control arrangement that was approved by the IAEA Board of Governors. On account of that arrangement, Brazil and Argentina are able to meet the criteria in Paragraph 6. (A short background on that agreement is provided in Box 1.)

The Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials

Argentina and Brazil are both party to the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (sometimes referred to as the "Treaty of Tlatelolco"). The treaty was open for signature in 1967—a year before the NPT—and entered into force in 1969, almost a year before the NPT entered into force. It was the first regional agreement that prohibited participating countries from production, acquisition, or use of nuclear weapons in their own territories. Brazil and Argentina both signed the Treaty of Tlatelolco in 1967, with Brazilian ratification the next year; Argentina did not ratify it until 1994. Argentina acceded to the NPT in 1995 and Brazil in 1998.

In the 1980s, the two countries had opened their nuclear programs to greater transparency—with each other and the world—in an effort to demonstrate that their programs were peaceful.[25] In 1990, Brazil and Argentina signed the Argentine-Brazilian Declaration on Common Nuclear Policy of Foz do Iguaçu, wherein the governments

committed themselves to peaceful uses of nuclear energy. In 1991, the presidents of the two countries signed the Agreement Between the Federative Republic of Brazil and the Argentine Republic on the Exclusively Peaceful Use of Nuclear Energy, or Bilateral Agreement, which created the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (commonly referred to as ABACC). Subsequently, ABACC would carry out on-site inspections of nuclear facilities in the two countries and maintain an inventory of nuclear material in each country. At the end of 1991, the IAEA, ABACC, Argentina, and Brazil agreed to the Quadripartite Comprehensive Safeguards Agreement, wherein the IAEA would apply safeguards on all nuclear facilities in the two nations.[26]

The scale of the effort involved with this inspection regime is substantial. ABACC has noted that "in 2019, there were 52 Argentinean and 49 Brazilian ABACC inspectors… [and] ABACC performed 105 inspections at nuclear installations in both countries"[27] that year. These ABACC inspection resources are applied toward enrichment, power reactor, research reactor, conversion, and fuel fabrication facilities (as well as others), with Brazilian uranium enrichment plants and Argentine power reactors requiring the most resources of any facility category in terms of inspector days for each respective country.[28] The inspections and evaluation of data gathered have provided a level of confidence to Brazil and Argentina and the rest of the world that the two countries are complying with the terms of the Bilateral Agreement.

It is possible that variations on the language in Paragraph 6 of the NSG guidelines might provide viable options for how the group could reach consensus regarding the Additional Protocol as a more general condition of supply for trigger list items and related technology. Discussion of such options is included in the next section, along with other approaches that are not premised on the Paragraph 6 language.

Policy Formulations and Implications

Adding the Additional Protocol as a condition of supply could naturally take place in the "safeguards" section[29] of the trigger list guidelines, namely Paragraphs 4 and 5. Paragraph 4(a) is where the requirement of a CSA for supply of trigger list items to NNWS resides, and an amendment could be made there or just after it, such as

> Suppliers should transfer trigger list items or related technology to a non-nuclear-weapon State only when the recipient has brought into force an Additional Protocol based on the Model Additional Protocol.

This construction states a very clean, straightforward requirement but would raise the same challenges to group consensus that have seemingly prevented its adoption. The NSG, therefore, could consider several alternate approaches to this type of formulation to gain consensus.

Add Language Similar to That in the 2011 Changes

One approach could be to simply use the exact, or close to the same, language from Paragraph 6:

> Suppliers should transfer trigger list items or related technology to a non-nuclear-weapon State only when the recipient has brought into force an Additional Protocol based on the Model Additional Protocol or, pending this, is implementing appropriate safeguards agreements in cooperation with the IAEA, including a regional accounting and control arrangement for nuclear materials, as approved by the IAEA Board of Governors.

This approach would, in effect, require an Additional Protocol as a condition of supply for export of nuclear materials, equipment, and technology to every non-nuclear-weapon state in the world except Brazil, Argentina, and the pertinent members of Euratom (all of whom already have Additional Protocols in force). It would likely lead to some of the same criticism applied to the 2011 changes to Paragraph 6, including an implied false equivalency between the Additional Protocol and ABACC[30] or a potential open door for countries to create their own regional agreements similar to ABACC to meet the criteria.[31] The latter challenge could seemingly be addressed with simple modifications to the language above.

Another challenge to adoption of this formulation could come from possible impacts to existing nuclear commerce, such as China's supply of material, equipment, and technology to Pakistan's program or Russia's supply to Belarus's program. Neither Pakistan nor Belarus has a regional arrangement in place matching the Paragraph 6 criteria, and neither has an Additional Protocol in force.

Add a Grandfather Clause

After a requirement for the Additional Protocol, an exception could be added for agreements or contracts that predate the new policy. The applied date could be specified in a variety of ways, including the following: the date of the adoption for the new Additional Protocol policy in the NSG, the date of the IAEA Board of Governors' approval of the Model Additional Protocol, or the same date construction as the grandfather clause in 4(c), which is either April 3, 1992, or the date that a country began adhering to the trigger list guidelines.

A grandfather clause would permit some or all existing cooperation, including China's supply of reactors to Pakistan, and thus, might avoid opposition from NSG-participating governments for that reason. However, potential drawbacks include whether the NSG could successfully reach an understanding as to what relationships will be grandfathered to prevent future misunderstandings and whether the clause would end up serving as a potential opening for misuse and controversy in the future.

Add the Additional Protocol after the CSA Requirement

One variant on a grandfather clause could be to add the Additional Protocol after the CSA requirement in Paragraph 4(a):

> Suppliers should transfer trigger list items or related technology to a non-nuclear

> weapon State only when the receiving State has brought into force an agreement with the IAEA requiring the application of safeguards on all source and special fissionable material in its current and future peaceful activities, *as well as an agreement based on the IAEA Model Additional Protocol*. [changes in italics]

This construction would include the existing grandfather and operational safety clauses with the new Additional Protocol requirement, with likely the same drawbacks as in the previous formulation. Given subsequent references to the CSA in Paragraph 4(a), some of the bullets and sub-bullets that follow Paragraph 4(a) would have to be modified to account for this change.

Allow Time for Countries to Bring Additional Protocols into Force

An additional measure the NSG could contemplate to gain internal consensus is to specify an amount of time for countries to bring an Additional Protocol into force with the IAEA before trade is impacted. Setting the date to January 1, 2025, (or 2027) would, for example, allow NSG members as well as other nations to bring an Additional Protocol into force before a new requirement was active. This could enable agreement if the remaining nations have ample time to bring an Additional Protocol into force with the IAEA—a process that, at times, has taken on the order of years from start to finish—without disrupting their current supply arrangements.

While the NSG could also simply wait until all participating governments have brought Additional Protocols into force to enact a policy change that would take effect immediately, setting a time period in advance for bringing Additional Protocols into force could allow for an earlier policy announcement by the NSG, which might then be of use in other nearer-term bilateral and multilateral discussions.

Conclusion

Nuclear energy use may grow in the coming decades as nations explore means of decarbonization to avoid the worst impacts of climate change.[32] Finally making progress on stronger international inspections as a condition of supply for nuclear materials, equipment, and technology within the NSG would help to strengthen the nonproliferation regime. Drawbacks to the various formulations discussed in this commentary should be weighed against the possibility of no movement in the NSG on the issue for another 15 (or more) years, given the challenges to finding consensus that the group has contended with for decades. In that context, waiting for a perfect amendment to the NSG trigger list guidelines could damage overall nonproliferation interests.

While it is possible that some of the historical barriers to reaching consensus within the NSG on the Additional Protocol as a condition of supply may change—for instance, some or all of the NSG participating governments without Additional Protocols in force could reverse course in the near term—it is also possible that the status quo will continue to reign. The NSG might, therefore, consider a variety of approaches to try and support progress on wider adoption of the Additional Protocol, especially given the possibility of new nuclear energy programs in newcomer countries that have not yet agreed to these stronger inspections.

Notes

1. International Atomic Energy Agency (IAEA), "IAEA Safeguards Overview: Comprehensive Safeguards Agreements and Additional Protocols," https://www.iaea.org/publications/factsheets/iaea-safeguards-overview.
2. Nuclear Suppliers Group, "NSG Part 1 and Part 2 Control Lists Updated," https://www.nuclearsuppliersgroup.org/en/news/185-nsg-control-lists-updated.
3. The requirement of a CSA for supply of trigger list items to an NNWS is contained in Paragraph 4(a) of the trigger list guidelines.
4. Paragraph 4(b) reads: "Transfers covered by paragraph 4(a) to a non-nuclear-weapon State without such a safeguards agreement should be authorised only in exceptional cases when they are deemed essential for the safe operation of existing facilities and if safeguards are applied to those facilities. Suppliers should inform and, if appropriate, consult in the event that they intend to authorise or to deny such transfers."
5. Fred McGoldrick, "The Road Ahead for Export Controls: Challenges for the Nuclear Suppliers Group," *Arms Control Today*, (January/February 2011): https://www.armscontrol.org/act/2011-01/road-ahead-export-controls-challenges-nuclear-suppliers-group.
6. Paragraph 4(c) reads: "The policy referred to in paragraph 4(a) and 4(b) does not apply to agreements or contracts drawn up on or prior to April 3, 1992. In case of countries that have adhered or will adhere to INFCIRC/254/Rev. 1/Part 1 later than April 3, 1992, the policy only applies to agreements (to be) drawn up after their date of adherence."
7. Daniel Horner, "China, Pakistan Set Reactor Deal," *Arms Control Today*, (June 2010): https://www.armscontrol.org/act/2010-06/china-pakistan-set-reactor-deal.
8. Fred McGoldrick, "The Road Ahead for Export Controls."
9. IAEA, "INFCIRC/734," September 19, 2008, https://www.iaea.org/sites/default/files/publications/documents/infcircs/2008/infcirc734c.pdf.
10. IAEA, "Additional Protocol," https://www.iaea.org/topics/additional-protocol.
11. IAEA, "Strengthening Measures," https://www.iaea.org/topics/additional-protocol/strengthening-measures.
12. IAEA, "Status List: Conclusion of Additional Protocols," as of June 1, 2021, https://www.iaea.org/sites/default/files/20/01/sg-ap-status.pdf.
13. IAEA, *Nuclear Power Reactors in the World*, 2020, https://www-pub.iaea.org/MTCD/Publications/PDF/RDS-2-40_web.pdf.
14. World Nuclear News, "Rosatom Keeps to Overseas Schedule Despite Pandemic," August 26, 2020, https://world-nuclear-news.org/Articles/Rosatom-keeps-to-overseas-schedule-

despite-pandemi.

15. World Nuclear News, "Pakistan's Chasma 4 Officially Accepted," September 28, 2020, https://world-nuclear-news.org/Articles/Pakistans-Chashma-4-officially-accepted.

16. Congressional Research Service, "Prospects for Enhanced U.S.-Saudi Nuclear Energy Cooperation," updated February 12, 2020, https://fas.org/sgp/crs/mideast/IF10799.pdf.

17. George Perkovich et al., *Universal Compliance: A Strategy for Nuclear Security* (Washington, DC: Carnegie Endowment for International Peace, June 2007), 41, https://carnegieendowment.org/files/univ_comp_rpt07_final1.pdf; Laura Rockwood, Noah Mayhew, Artem Lazarev, and Mara Pfneisl, "IAEA Safeguards: Staying Ahead of the Game," report number 2019:14, (January 2018): 13–15, https://vcdnp.org/wp-content/uploads/2019/09/201914-iaea-safeguards-staying-ahead-of-the-game.pdf.

18. NSG, "Plenary Meeting Paris: Press Statement," June 22–23, 2000, https://www.nuclearsuppliersgroup.org/images/Files/Documents-page/Public_Statements/2000-Press.pdf.

19. NSG, "Plenary Meeting Oslo, Norway: Press Statement," June 23–24, 2005, https://www.nuclearsuppliersgroup.org/images/Files/Documents-page/Public_Statements/2005-06-oslo.pdf.

20. NSG, "Plenary Meeting Brasilia: Press Statement," June 1–2, 2006, https://www.nuclearsuppliersgroup.org/images/Files/Documents-page/Public_Statements/2006-07-Brasilia.pdf. This includes the following language: "In order to strengthen further the Participating Governments' national export controls, the NSG decided to adopt…[a]n approach to continue the Additional Protocol discussions in the Consultative Group."

21. The NAM was formed during the Cold War as a group of countries (now numbering 120) that do not consider themselves formally aligned with or against any major power bloc.

22. See, for example, the NAM statement in 2015 before the NPT Review Conference: https://www.un.org/en/conf/npt/2015/statements/pdf/main2_iran2.pdf; a 2018 list of NAM members can be found here: https://www.nti.org/learn/treaties-and-regimes/non-aligned-movement-nam/.

23. Fred McGoldrick, *Limiting Transfers of Enrichment and Reprocessing Technology: Issues, Constraints, Options* (Cambridge, MA: Belfer Center for Science and International Affairs, Harvard Kennedy School, May 2011), https://www.belfercenter.org/publication/limiting-transfers-enrichment-and-reprocessing-technology-issues-constraints-options.

24. Paragraph 6(c) states: "…for enrichment or reprocessing facilities, equipment or technology…suppliers should authorise transfers, pursuant to this paragraph, only when the recipient has brought into force a Comprehensive Safeguards Agreement, *and an Additional Protocol based on the Model Additional Protocol or, pending this, is implementing appropriate safeguards agreements in cooperation with the IAEA, including a regional accounting and control arrangement for nuclear materials, as approved by the*

IAEA Board of Governors" [emphasis added].

25. Gevaldo Lisboa de Almeida et al., "Accomplishments of the ABACC-DOE Cooperation Program" (Naples, FL: 39th Institute of Nuclear Materials Management Meeting, July 26–30, 1999), https://permalink.lanl.gov/object/tr?what=info:lanl-repo/lareport/LA-UR-99-2634.

26. S. M. Short, M. R. Weimar, J. Phillips, and H. A. Mahy, *Economic and Non-Proliferation Policy Considerations of Uranium Enrichment in Brazil and Argentina* (Springfield, VA: National Technical Information Service, August 2008), https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-17757.pdf.

27. Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials, *2019 Annual Report*, 2019, 45–46. https://www.abacc.org.br/en/wp-content/uploads/sites/2/2020/09/ABACC-Annual-Report-2019.pdf.

28. Ibid., 46.

29. The "Support for Effective IAEA Safeguards" section, Paragraph 14, could also be a plausible location in the trigger list guidelines to add language regarding the Additional Protocol. Amending the guidelines with this aim could clearly be done in several places and in different ways, but for the sake of concrete discussion, this paper proposes specific formulations.

30. Mark Hibbs, "New Global Rules for Sensitive Nuclear Trade," Nuclear Energy Brief, July 28, 2011, https://carnegieendowment.org/2011/07/28/new-global-rules-for-sensitive-nuclear-trade-pub-45203.

31. Jeffrey Lewis, "Additional Protocol and ENR Transfers," *Arms Control Wonk* (blog), May 13, 2011, https://www.armscontrolwonk.com/archive/203962/additional-protocol-and-enr-transfers/.

32. See, for example, the discussion about a "Net-Zero Emissions by 2050 Scenario" in the recent International Energy Agency report "Net Zero by 2050: A Roadmap for the Global Energy Sector," in 2021, https://www.iea.org/reports/net-zero-by-2050. In particular, see page 57: "There is also a large increase in energy supply from nuclear power, which nearly doubles between 2020 and 2050."

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