

United Nations conference to negotiate a legally binding instrument to prohibit nuclear weapons, leading towards their total elimination

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A Path to Universality through Cooperative, Transparent, Verifiable and Irreversible Disarmament

Submitted by Princeton University¹

1. The 22 May 2017 Draft Convention on the Prohibition of Nuclear Weapons (A/CONF.229/2017/CRP.1) aims to prohibit nuclear weapons with a view to their total elimination. Recognizing that achieving nuclear disarmament will need the consent and participation of states that have nuclear weapons, Article 13 of the draft obliges parties to “*encourage States not party to this Convention to ratify, accept, approve or accede to this Convention, with the goal of attracting the adherence of all States to this Convention.*”

2. This working paper offers suggestions on Articles 3, 4, and 5 of the President’s initial draft of the convention (Draft 0) with regard to on-ramps for enabling weapon states to join the Convention, the verification of nuclear disarmament, and enduring safeguards against possible proliferation and reconstitution of nuclear weapon programs.² It also proposes that measures for more effective verification could be made explicit in Articles 7, 8, and 9, which deal with national implementation, international cooperation and meetings of States Parties respectively.

1. Challenges of “do-it-yourself disarmament” and “end-state verification”

3. Article 4 of Draft 0 allows for a state to eliminate its nuclear arsenal on its own terms (“do-it-yourself disarmament”) and then seek to join the treaty through the verification of its non-weapon status (i.e., “end-state verification”) by the International Atomic Energy Agency (IAEA). This draws on South Africa’s experience of nuclear weapons dismantlement in the early 1990s and the subsequent verification of this by the IAEA, and has been termed the “South Africa-Plus” model. While this do-it-yourself disarmament and end-state verification approach may seem appealing, applied to the existing nuclear weapon states it would turn verification into a long, drawn-out exercise in forensic investigation and may leave potentially large uncertainties that may eventually prove to be enduring and irreducible.

4. There are important differences between South Africa and the states currently having nuclear weapon programs. South Africa had one of the smallest nuclear weapon programs in history, using a fraction of the 1000 kg of highly enriched uranium (HEU) that it produced in a single enrichment plant to manufacture seven gun-type nuclear weapons.³ Nonetheless, after South Africa disarmed, it took 19 years (1991–2010) for the IAEA to account for all the HEU and close the case. In contrast, United States’ HEU production reached almost 100,000 kg per year around 1960, i.e., more than 1000 times South Africa’s average rate of production of less than 100 kg per year. The United States also produced plutonium for weapons; in 1964,

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² This paper draws on analysis from Zia Mian, Tamara Patton and Alexander Glaser, “Addressing Verification in the Nuclear Ban Treaty,” *Arms Control Today*, June 2017.

³ David Albright and Andrea Stricker, *Revisiting South Africa's Nuclear Weapons Program: Its History, Dismantlement, and Lessons for Today*, CreateSpace Independent Publishing Platform, September 2016.

production peaked at 6400 kg of plutonium, enough for about 2000 weapons in a single year.⁴ The United States also had a much more complex production complex, which began much further in the past and operated over a much longer period.⁵ The smaller French and British weapon programs have the added complication of overlapping civilian and military fissile material production.

5. It also is important that South Africa did not conduct any nuclear tests. The current weapon states between them have conducted over 2000 nuclear test explosions; the United States has done more than 1000 of these. The United States used more than 3000 kg of plutonium in its nuclear tests.⁶ This plutonium, along with the HEU used in tests and as fuel in nuclear powered submarines and ships and in research reactors, is lost forever.

6. Given the severe difficulties inherent in verifying the elimination of a state's nuclear weapon program, a better approach than the "South Africa-Plus" model would be to encourage nuclear-weapon states to engage with the international community in anticipation of a cooperative and transparent disarmament process and to establish a mutually agreeable disarmament and verification protocol, as proposed in Article 5 of Draft 0. This would not eliminate uncertainties, but it could establish structures for cooperation and transparency at an early stage that could help significantly reduce uncertainties, depending on the rigor and scope of the verification process.

2. The scope for "cooperative disarmament" and "process verification"

7. Based on the considerations outlined above, a preferable course of action would be for ban treaty states and the IAEA to be able to engage as early as possible in any planned elimination of nuclear weapon programs ("cooperative disarmament") and to participate in the verification process in all its aspects to the extent possible ("process verification"). While the Convention should remain inclusive and allow for nuclear weapon-possessing states to join the Convention via a "South Africa-Plus model", the Convention should more clearly frame cooperative disarmament and process verification as the *preferred* pathway for joining.

8. Article 5 of Draft 0 does not seek to set up detailed measures to eliminate nuclear weapons, but simply specifies that any nuclear weapon state (or group of such states) seeking to join the treaty must do so through an arrangement agreed with the conference of parties to the treaty, to be codified possibly as a protocol to the Convention. This pathway allows the issue of joining to be addressed on a case-by-case basis for the nine states possessing nuclear weapons.

9. What is missing is an obligation on any weapon state seeking to join the Convention through Article 5 to accept on a voluntary basis the specific prohibitions of Article 1 and other responsibilities as soon as they are applicable, pending the entry into force of the Convention for that State Party.

10. In principle, any nuclear weapon state wishing to join the ban treaty could offer a commitment to declare its weapons holdings, and accept international monitoring of the process of taking its weapons off deployment, disabling them, and placing them in secure storage pending their verified elimination as part of an agreed, time-bound plan. This plan could include destruction of delivery systems specially designed or certified by the state for nuclear weapons missions. Elimination of even the largest nuclear weapons stockpiles (those

⁴ *Plutonium: The First 50 Years. United States Plutonium Production, Acquisition and Utilization from 1944 through 1994*, DOE/DP-0137, U.S. Department of Energy, Washington, DC, February 1996, www.fissilematerials.org/library/doe96.pdf.

⁵ *Highly Enriched Uranium: Striking a Balance. A Historical Report on the United States Highly Enriched Uranium Production, Acquisition, and Utilization Activities from 1945 through September 30, 1996*, U.S. Department of Energy, Washington, DC, 2006, www.fissilematerials.org/library/doe06f.pdf.

⁶ *Plutonium: The First 50 Years*, *op. cit.*

of the United States and Russia) could be achieved in about 10 years.⁷

11. Article 8 of Draft 0 asks states parties to cooperate with other states parties to “facilitate the implementation of the obligations of this Convention.” Article 8 could include, for instance, explicit encouragement for states to cooperate on supporting and developing and proposing disarmament verification initiatives, as part of their obligation to facilitate implementation. States who wish to act on this opportunity could bring their suggestions to the Meetings of States Parties that are to be set up under Article 9. These Meetings could develop and offer guidance for states that may choose either the Article 4 or Article 5 path, including guidelines not only about what ought to be destroyed in dismantling a weapon program, but also about what ought to be preserved for verification purposes.

12. The Convention also could require states choosing either path to be as transparent as possible. It is noteworthy that South Africa insisted on confidentiality of the information it provided to the IAEA. This made it more difficult for the international community as a whole, and especially the global scientific community, to contribute to resolving challenges faced in the verification process.⁸

13. We also propose that, as in the Chemical Weapons Convention (CWC), Article 9 include provisions for the Meeting of the States Parties to establish a “Scientific Advisory Board” and to “establish temporary working groups of scientific experts to provide recommendations on specific issues.”⁹ This would permit future meetings of States Parties, in consultation with the IAEA and independent civil society experts, to further develop verification guidance by detailing the kinds of transparency and cooperation that would be deemed most effective for assessing compliance. This information would then be available to weapon states when they prepare to make decisions to move to disarmament and to join the ban treaty.

14. For instance, in terms of record keeping, nuclear weapon states should be encouraged to begin now to document warhead assembly, refurbishment, and dismantlement activities and movements of warheads and warhead components through the weapons complex in ways that international inspectors will find credible at a later time. Modern cryptographic techniques, such as blockchaining, could help demonstrate the authenticity of these records in the future. Although these records would not be made public now, they would help establish the provenance of treaty-accountable items and drastically simplify the verification challenges of nuclear disarmament.

15. The best, and perhaps only, way to deal with questions of *completeness* may be to pursue an approach based, at least partly, on nuclear archaeology. Such a process would envision going back to the facilities where the material was originally produced and using nuclear forensic techniques to determine how much material was made at a particular site over its entire life. This concept has been demonstrated for one type of plutonium production reactors with remarkable results -- lifetime production was correctly estimated to within a couple of percent.¹⁰ Further development and demonstration of the tools for nuclear archaeology at an early date is important. It will not reduce the uncertainties to zero, but it could make them significantly smaller.

⁷ “Warhead elimination timelines and the nuclear weapon ban treaty,” IPFM Blog, 2 June 2017, www.fissilematerials.org/blog/2017/06/warhead_elimination_timelines.html.

⁸ Albright and Stricker, *op. cit.*

⁹ Chemical Weapons Convention, Article VIII, B.21h establishes a “Scientific Advisory Board” and the power to “establish temporary working groups of scientific experts to provide recommendations on specific issues” is provided in Article VIII, D.45.

¹⁰ Steve Fetter, “Nuclear Archaeology: Verifying Declarations of Fissile-Material Production,” *Science & Global Security*, 3 (3–4), 1993; Thomas Wood et al., “Establishing Confident Accounting for Russian Weapons Plutonium,” *Nonproliferation Review*, 9 (2), Summer 2002; Thomas Wood et al., “The Future of Nuclear Archaeology: Reducing Legacy Risks of Weapons Fissile Material,” *Science & Global Security*, 22 (1), 2014.

16. Ban-treaty states could take the lead and develop global nuclear archaeology capacities. Fissile material production is not a sensitive issue; countries like Germany, Sweden, Brazil, Argentina, Iran, Canada, and Japan --to name a few-- have nuclear facilities that are similar to those used for military fissile material production in weapon states. These facilities could be used as test-beds to develop and demonstrate nuclear archaeology methods and tools. Ideally, weapon states and non-weapon states can jointly develop these methods, which would be a major confidence-building measure in its own right.

3. Strengthening enduring safeguards against nonproliferation and reconstitution of nuclear weapon programs

17. Draft 0 of the Convention calls on states to accept enduring safeguards. It is important to recognize that the IAEA's "safeguards system," is no longer limited to the 45-year old INFCIRC/153 (corrected) requirement. The IAEA's safeguards system for the past 20 years has included, albeit on a voluntary basis, the Additional Protocol (INFCIRC/540), which places increased reporting requirements on a state about its nuclear activities and grants greater access to the IAEA to confirm compliance with nonproliferation obligations. There are 124 states with additional protocols, out of the 172 non-nuclear-weapon states with comprehensive safeguards agreements.

18. The Annex to Article 3 (Draft 0) leaves out an important part of the NPT paragraph from which it draws, namely the obligation to accept safeguards "*in accordance with the Statute of the International Atomic Energy Agency and the Agency's safeguards system.*" This more capacious and forward-looking language allows for the continuing evolution of the safeguards system. An obligation to accept the "safeguards system" would maintain existing commitments under NPT Article III.1 and would create a verification baseline and a mechanism to accommodate future improvement of the verification regime.

19. The Convention would also be strengthened by obliging states to conclude the IAEA Additional Protocol or an agreement "equivalent in its scope and effect," or at least to implement such provisions on an interim basis until states can conclude such an agreement.

20. A key measure made possible by the Additional Protocol that should be required in any equivalent provision or accepted on an interim basis is the obligation to accept special inspections. A similar requirement is present in the nuclear-weapon-free zone treaties. The treaties of Tlatelolco, Rarotonga, Bangkok, and Pelindaba do not require the Additional Protocol, but they make detailed provisions for special inspections to deal with potential non-compliance, with inspections carried out either by the IAEA or relevant regional body. The Treaty of Semipalatinsk has no special inspection provisions, requiring instead the Additional Protocol.

21. For example, Tlatelolco Treaty, Article 16 requires:

"The Contracting Parties undertake to grant the inspectors carrying out such special inspections full and free access to all places and all information which may be necessary for the performance of their duties and which are directly and intimately connected with the suspicion of violation of this Treaty ..."

22. Universal adherence to both comprehensive safeguards agreements and additional protocols has already been envisioned. The final documents of the 2000 and 2010 NPT review conferences and the draft final document of the 2015 review conference envisaged that comprehensive safeguards and additional protocols should be universally applied once the complete elimination of nuclear weapons has been achieved. The draft Convention could incorporate this goal and encourage parties to adopt such measures as soon as possible.

23. If the Convention reaches its goal of universality, its safeguards requirement (separate from the measures to verify the elimination of weapon programs) will exist as an enduring standard for all states regardless of their past status. In effect, the safeguards system will

become the “steady state” monitoring mechanism for a world without nuclear weapons.

24. In this regard, it is important to note that the IAEA safeguards system was only designed for monitoring against possible proliferation activities in states that never had nuclear weapons. It was not designed as an instrument to monitor the possibility of the reconstitution of nuclear programs in former nuclear weapon states. Such an instrument may need long term development of emerging technologies to support an international nuclear disarmament monitoring system and other mechanisms.

25. Any system of nuclear verification would gain from access to information that could be provided by scientists and technicians inside nuclear programs, as well as by ordinary citizens, with regard to possible violations of a treaty. Under Article 7, Paragraph 1, each State Party is required to “adopt the necessary measures to implement its obligations under this Convention.” This Article offers an opportunity to qualitatively strengthen the long term verification of the treaty by including a “Whistleblower Clause” to require national laws making it a duty of every citizen to report possible prohibited activities and to protect those who do so.

26. The problem of reconstitution will endure as long as nuclear weapon legacy capabilities persist. Reconstitution would be made more difficult if the convention adopts the goal of ending the production and use of nuclear weapon-usable fissile materials for any purpose and the elimination of all stockpiles of such materials in a manner that is verifiable, environmentally sensitive, and as irreversible as possible.¹¹

¹¹ Harold A. Feiveson, Alexander Glaser, Zia Mian, and Frank N. von Hippel, *Unmaking the Bomb: A Fissile Material Approach to Nuclear Disarmament and Nonproliferation*, MIT Press, Cambridge, MA, 2014.