DeepCuts

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NUCLEAR DISARMAMENT: THE LEGACY OF THE TRILATERAL INITIATIVE

by Thomas E. Shea and Laura Rockwood

About this Working Paper

One year following the 1995 indefinite extension of the Treaty on the Non-Proliferation of Nuclear Weapons (the NPT), the International Atomic Energy Agency (IAEA), the United States and the Russian Federation entered into a cooperative effort – the Trilateral Initiative – aimed at investigating the feasibility and requirements for a verification system under which the IAEA could accept and monitor nuclear warheads or nuclear warhead components pursuant to the NPT Article VI commitments of both States. Over a six year period, through 98 trilateral events, substantial progress was made on verification arrangements and technologies that could enable the IAEA to carry out such a mission without gaining access to design or manufacturing secrets associated with nuclear weapons. In addition, the parties succeeded in negotiating a Model Verification Agreement. Although the Trilateral Initiative ended in 2002, the Model Verification Agreement produced as a result of those negotiations could still serve as the basis for bilateral or multilateral agreements between the IAEA and nuclear-weapon States wishing to demonstrate, in a verifiable manner, that weapon origin and other fissile material released from defense programs remains irreversibly removed from nuclear weapons programs.

This paper examines the potential role for international verification of fissile material in relation to nuclear disarmament, what was accomplished under the Trilateral Initiative and, more importantly, what should be done now to preserve its legacy and take concrete steps towards such verification. The paper has two parts, one on the technical aspects of verification of fissile material in relation to nuclear disarmament and one on the legal aspects. The authors of this Deep Cuts Working Paper have long been professionally associated with the IAEA and have held crucial positions in the Trilateral Initiative.

Part I: The Technical Side

by Thomas E. Shea

Introduction

Plutonium (Pu) and/or highly enriched uranium (HEU) are essential elements in nuclear weapons in all nuclear arsenals[1], much of it in classified forms, as shown in **Figure 1**.[2]

Controls on the acquisition of Pu and HEU serve as the foundation of the international nonproliferation regime, and will be of critical importance in future steps associated with nuclear disarmament. The controls adopted may differ from State to State, and will most likely have to begin in a modest manner, and, if nuclear disarmament is to succeed, be extended as necessary to provide assurance to the nuclear-armed State that each next step will not undermine its national security.

Verification of nuclear disarmament will have to feature controls on fissile material, which must of necessity guarantee that classified properties of plutonium and/or HEU will not be divulged or discovered through the verification arrangements. This is especially important in relation to information pertaining to the design or manufacture of any part of a nuclear weapon.

Progress towards nuclear disarmament will also require that the technical means necessary for verification are designed, built, tested and demonstrated before a nuclear-armed State considers even allowing such a capability to be examined by its security authorities. And only when that State's national security authority has concluded that verification can proceed in confidence would it begin to permit the verification involving Pu and/or HEU in classified form.

Waiting for one or more nuclear-armed States to conclude an agreement before developing suitable verification systems would mean that implementation of such an agreement would

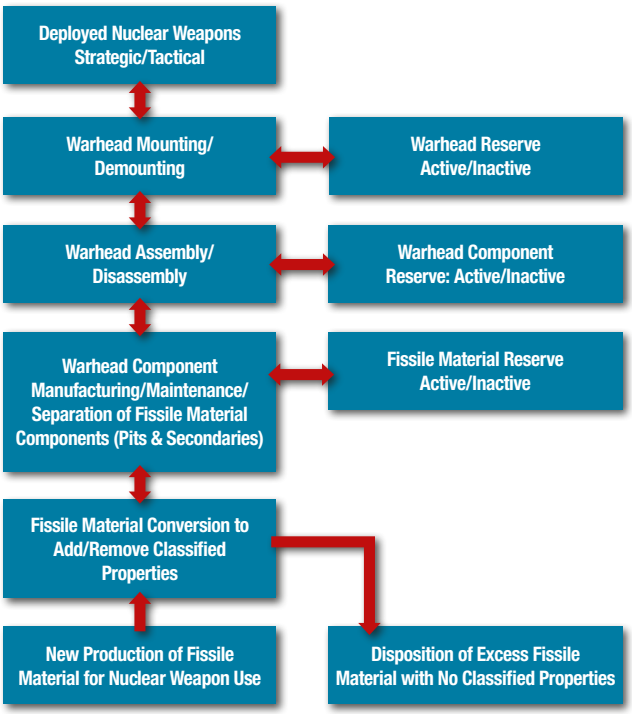

Figure 1. Functional Elements of a Nuclear Arsenal Involving Fissile Material

be delayed until the methods are agreed and prototype equipment is designed, built, tested and demonstrated – likely requiring more than five years. There will in any case be delays necessitated by confirming verification equipment and procedures, qualifying the manufacturing and assembly processes, commissioning the equipment and fixing the deployment arrangements, while assuring that the process protects classified information on the one hand, while assuring that the verification results will be authentic.

Verification could be implemented once a single nuclear-armed State so decided or two or more nuclear-armed States agree to proceed under some sort of nuclear disarmament agreement or treaty.

As of December 2014, the prospects for any new nuclear disarmament measures seem remote. However, it may be opportune to at-

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tempt to develop and demonstrate the capabilities that will be required once the political climate improves. Given such reluctance on the part of the nuclear-armed States, it may be best to have States that do not possess nuclear arms lead in this effort and drive the agenda.

The technical means necessary for IAEA verification can be developed as part of a program aimed at a specific agreement or treaty. The technical measures required for the Comprehensive Test Ban Treaty were developed and demonstrated before the Treaty negotiations were concluded, and a similar effort is now underway in relation to the verification capabilities that will be needed to enable a future fissile material cutoff treaty.

The essence of this paper is to emphasize the importance of continuing to develop the means for the IAEA to be able to verify items containing classified forms of fissile material. With that capability – in combination with chain-of-custody methods – the IAEA could create a monitoring regime whenever a single nuclear-armed State agreed, or any joint effort including two or more nuclear-armed States. Such a monitoring regime could begin at any stage in the progression identified in Figure 1, possibly even with monitoring warheads deployed on active delivery systems.

Extraordinary progress was made towards this goal under the Trilateral Initiative between the Russian Federation, the United States and the IAEA. In the next section, I describe how this Initiative came about, what technical accomplishments were achieved and why it didn't succeed. Then I will provide some suggestions as to what should be done now.

The History and Legacy of the Trilateral Initiative

As stated in the 1996 IAEA press release on the creation of the Trilateral Initiative, "[t]he Ministers of the United States and the Russian Federation agreed to discuss technical methods designed to protect sensitive nuclear weapons information and to prevent its disclosure, and to hold appropriate consultations with the IAEA on this matter. It was agreed that it was essential to ensure that IAEA verification of relevant fissile materials would not undermine the obligations of the United States and the Russian Federation under Article I of the NPT."[3]

To that end, the Russian Minister of Minatom, the U.S. Secretary of Energy and the Director General agreed to establish a Joint Working Group with the task of addressing the technical, legal and financial issues associated with implementing IAEA verification of weapon-origin material.

The Trilateral Initiative began in 1996 and ended in 2002 after a total of 98 trilateral meetings and events. It began as a suggestion by a member of the staff of the Minatom Ministry in the Russian Federation, Dr Nikolai Khlebnikov.[4] Once agreed between the Russian Federation and the United States, the two States proposed a trilateral project with the IAEA to examine the feasibility of IAEA verification of weapon-origin fissile material stocks in accordance with the provisions of Article III.A.5 of the IAEA Statute. The IAEA enthusiastically agreed.

The most fundamental technical issue associated with IAEA verification of classified forms of weapon-origin fissile material was whether the IAEA could be assured that its verification could be meaningful and authentic, while

Figure 2. The last meeting of the Trilateral Initiative Principals. From left to right, Russian Minatom Minister Rumyantsev, IAEA Director General ElBaradei and U.S. Secretary of Energy Abraham, during the 2002 IAEA General Conference. (Photo from IAEA Press Release.)

ensuring that no IAEA inspectors could gain access to classified information relating to the design or manufacture of nuclear weapons. The Joint Working Group recognized that, as a consequence, the information to be declared by the State to the IAEA, and inspector access to sites associated with nuclear weapons, must be limited.

Technical Accomplishments

1. A technical verification concept based on three unclassified attributes was agreed that would allow the IAEA to verify classified forms of fissile material without compromising secrecy.

2. Detailed functional specifications and equipment design for the attribute verification system were agreed. For plutonium, the equipment used would combine high-resolution gamma ray spectrometry and neutron multiplicity measurements, employing information barriers to provide the unclassified verification results. (No verification equipment for HEU was considered during the six years of the Trilateral Initiative.)

3. A proof-of-principle system was demonstrated during the six-year operational period of the initiative, and subsequently a full system was built and accepted for possible use in the Russian Federation by Russian FSB security authorities.

4. Special containment and surveillance systems were developed and tested that would allow the IAEA to maintain continuity of knowledge of contents of individual containers or groupings, so as to minimize the need to re-verify the results.

5. Alternative approaches for verification equipment authentication were identified that would allow IAEA verification equipment intended for use in the Russian Federation or the United States to be manufactured and maintained in each State, while providing assurance to the IAEA that the use of the equipment is not compromised.

6. Verification approaches for weapon-origin plutonium storage facilities were agreed as the lead facilities for developing facility-specific verification arrangements. These facilities were identified as the locations where verification would take place as the Trilateral Initiative made progress. A conceptual approach for verifying Pu while being processed at conversion facilities was also developed.

Figure 3. As foreseen, implementation of the Trilateral Initiative would have begun with storage facilities: the Fissile Material Storage Facility at Mayak in Russia and K-Area Material Storage Facility at Savannah River in the United States.
(Photos provided by Russian and U.S. experts during the Trilateral Initiative.)

Organization and Technical Activities

The Joint Working Group comprised the plenary level, which met in the margins of each Board meeting, a technical group charged with the verification measurement system and containment/surveillance systems, and the legal working group tasked with developing a model verification agreement (see second part of this paper by L. Rockwood).

The technical experts met frequently over the six-year period of the Trilateral Initiative. Their major activities were week-long workshops held at weapon laboratories and other selected facilities in the Russian Federation and in the United States. Technical workshops were also held in other States to benefit from their experience in applying relevant safeguards to peaceful nuclear activities. These latter workshops did not involve classified forms of fissile material.

1. The workshop at the British Nuclear Fuels Ltd. complex in Sellafield, England, provided an opportunity to observe an automated PuO2 powder receipt verification system in combination with an automated Pu storage system under EURATOM safeguards.

2. The workshop at the Japan Nuclear Fuel Cycle Development Corporation Plutonium Fuel Production Facility (PFPF) in Tokai-mura, Japan, enabled the participants to gain extensive insights into the integration of modern verification methods in an operating plutonium storage and mixed oxide fuel production facility under IAEA safeguards.

3. At the workshop at the Joint Research Centre of the European Commission in Ispra, Italy, the Trilateral Initiative experts participated in joint projects to demonstrate in situ verification capabilities and technical measures intended to facilitate equipment certification and authentication.

In addition to these workshops, many meetings were held at IAEA Headquarters in Vienna devoted to developing: the functional specifications and design documents for verification systems with a view to providing guidance for their manufacture; facility-specific implementation arrangements for Mayak and KAMS; facility design information requirements and forms; and the subsidiary arrangements required the implementation of a verification agreement based on the model.

While the extent of agreement on many aspects of the Trilateral Initiative was remarkable, the issue of authentication remained outstanding in 2002. The issue was as follows: It was anticipated that, if the Agency were to provide equipment to the State and request the State to certify that the equipment could be used at a sensitive facility, the State concerned would carry out its investigations of the equipment using methods that it would not reveal to the IAEA. If the equipment were found to be acceptable to the State, the Agency would then have to be able to assure itself that the equipment had not been tampered with, which could be very difficult to detect. If the equipment were not found to be acceptable to the State, the State would not tell the Agency the reason why, and in fact the equipment might not be returned to the Agency at all. The certification tests might require months to complete, with little assurance that the outcome would be positive. In any event, the equipment would have been dismantled to the point that any assurance the IAEA might have had that the equipment would have provided authentic results would have been lost.

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Faced with such constraints, it was agreed that IAEA equipment could only be obtained and used under arrangements that included: joint design under a trilateral format; manufacture of the equipment under joint supervision in each State where it would be used; joint acceptance tests to confirm that the equipment functioned according to the specifications; and an on-going authentication program,

including periodic IAEA selection for off-site testing and reverse engineering to ensure that the inspection data provided through its use allowed the IAEA to derive credible and independent verification findings. The IAEA accepted these conditions, noting that further work would be needed to develop and demonstrate the relevant equipment and procedures.

Verification Attributes

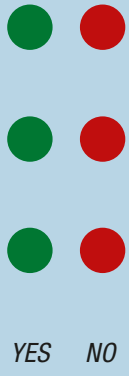
The method adopted under the Trilateral Initiative to allow the IAEA to gain sufficient information to warrant acceptance of an item into the monitored storage regime while respecting the restrictions on access to classified information is referred to as "attribute verification with information barriers."

The Joint Working Group agreed that the verification measurements made by the IAEA would answer the following questions with a "yes" or "no" response, and that no additional information could be made available to the IAEA – intentionally or accidentally.

Is plutonium present in the container?

Is it weapon-grade plutonium (i.e., are the isotopic ratios consistent with plutonium used in nuclear weapons)?

Is the mass of weapon-grade plutonium greater than a threshold mass specified for each facility where verification will take place?



YES *NO*

Neutron multiplicity counting[5] was selected as the primary means for determining the mass threshold attribute, and high-resolution gamma spectrometry for determining the isotopic ratio attribute. An information barrier comprising a combination of hardware, software and procedural protective systems would be used to isolate the classified information and allow only unclassified "yes/no" information to be displayed. These are not the only methods that might be applied, but they were agreed as acceptable for the first generation of equipment to expedite the completion of the Trilateral Initiative.

Figure 4. American and Russian experts examine an attribute verification system employing neutron multiplicity counting and high resolution gamma ray spectrometry with information barriers (AVNG) built at Sarov and approved for use in Russian facilities by Russian security authorities (FSB). (Photo courtesy of D. MacArthur, Los Alamos National Laboratory.)

Technical Conclusions of the Trilateral Initiative Joint Working Group

The following are taken from the final report submitted by the Joint Working Group to the Trilateral Initiative Principals in 2002.

1. "The technical concepts explored under the Trilateral Initiative could be used for negotiating bilateral verification agreements between the IAEA and the United States in one case, and with the Russian Federation in a separate agreement. Using the concepts developed and agreed under the Trilateral Initiative, the IAEA would be able to derive credible and independent verification conclusions, and the States would be able to ensure that sensitive information relating to the design or manufacture of nuclear weapons would not be divulged.

2. The technical measures explored were found to be suitable for use by the IAEA to verify any form of plutonium in sensitive facilities without revealing nuclear weapons information.

3. The technical work focused first on the question of whether international verification could be carried out on weapon-origin fissile material with classified characteristics, without revealing sensitive information. The Joint Working Group was satisfied that this challenge could be met using the measurement and monitoring techniques developed under the Trilateral Initiative and the methods agreed on for information protection, including attribute verification with information barriers, and the production of measurement and monitoring systems for IAEA use within the host State.

4. Just as the IAEA recognized that verification must pose no threat of revealing classified information, both States recognized that effective authentication was essential for verification to proceed. The Joint Working Group was of the view that appropriate combinations of the hardware, software and the administrative procedures that had been considered under the Trilateral Initiative would allow the IAEA to authenticate the measurement and monitoring systems developed under the Initiative.

5. Specific inspection arrangements are required for each sensitive location, and specialized equipment would have to be provided under agreed conditions that would ensure the basis for credible and independent IAEA verification."

Creating a Model IAEA Verification Regime to Monitor Pu and/or HEU in any Nuclear-Armed State

By the time of the 2002 IAEA General Conference, the Russian Federation and the United States had new political leaders. Setting aside the Board's endorsement of the Trilateral Initiative in 1999, the 2000 NPT Final Statement calling for the completion and implementation of the Trilateral Initiative, and the expectations of the three parties reflected in successive IAEA press releases, the new leaders in both the United States and Russia decided that the Trilateral Initiative should be concluded. The final report on the results of the Trilateral Initiative concludes that the arrangements developed would permit either Russia or the United States to implement a bilateral agreement with the IAEA based on the results achieved, but nothing has happened in the intervening 12 years. The three parties have never met again to discuss any matter related to the Trilateral Initiative or the "trilateral format."[6]

The Trilateral Initiative was a creature of the 1990s reflecting the unique circumstances posed by the permanent extension of the NPT and the emergence of the Russian Federation, a time when Presidents Yeltsin and Clinton found common ground on a range of security issues. Today, regrettably, the situation is very

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different and resurrecting the Trilateral Initiative in its original form seems impossible. For the present and the future, the international community should recognize that the Trilateral Initiative made extraordinary achievements that could serve as the foundation for a new, more general verification regime for fissile material associated with nuclear weapon programs.

While such agreements might be pursued individually by any State possessing nuclear arms, or by two or more States acting together, the first State to conclude such an agreement could set the precedent for all other nuclear-armed States to follow. It would be far simpler if the first State were to act unilaterally. Note that it is not essential to begin implementation with classified forms of fissile material. It could be expedient to begin with *unclassified* plutonium no longer designated for military applications, and later include *classified* forms once the State and the Agency have resolved all issues affecting access and verification methods.

Efforts were made to cast the Trilateral Initiative as a symmetric arms control measure, but the Russian Federation and the United States had different plans for the disposition of their excess fissile material stocks, and hence, no agreement could be found on this issue. It would be far easier for States to conclude separate agreements with the IAEA, and to coordinate their steps by participating in a consultative commission that could include all parties to such agreements.

Creating an Centre for Nuclear Disarmament Research, Development, Testing and Demonstration for Classified Forms of Fissile Material

Under the Trilateral Initiative, the intention was to begin with verification of the storage of weapon-origin Pu components or modified Pu forms having classified properties.[7] However, verification provisions were also developed in anticipation of progression to conversion during which all classified properties would be removed. These provisions included maintaining continuity of knowledge on the containers from a verified storage facility using containment and surveillance measures and using attribute verification again at the input to the conversion plant. The conversion operations would be carried out while all ingress and egress routes were secured. Verification of the flow of materials and output measurement would involve traditional, unrestricted safeguards methods once the classified properties were removed. In addition, the conversion plant would periodically be shut down and cleaned out and IAEA inspectors allowed into the conversion plant to ensure that no additional Pu remained and that no new ingress or egress routes had been created.

Coupling the verification methods that were developed, tested and accepted (at least in the Russian Federation) under the Trilateral Initiative with chain-of-custody methods to assure continuity of knowledge, IAEA verification could be applied to *every* step shown in Figure 1, at least in principle. While the degree of agreement achieved was remarkable, before an agreement could be brought into force, any nuclear-armed State would have to assure itself that IAEA verification would not endanger the State's national security. And the IAEA would have to assure itself that the compromises required by the State to meet its security objectives would not undermine the authenticity of the verification the IAEA would provide.

By the time of the Ispra workshop, the technical experts recognized the need to create a center where American, Russian and Agency experts could work together toward reaching full agreement pending implementation. At the time, the Joint Research Centre of the European Commission at Ispra had an available facility, and the technical experts and Ispra staff discussed informally the possibility of creating an "international centre for nuclear disarmament verification research and development" making use of that facility. It was anticipated that, if such a proposal were successful, the technical experts would

work together at the centre for periods of about two years. The delegations explored the possibilities when they returned home, but the Russian Federation was not in favor of it.

Further technical work is needed to pave the way for the implementation of IAEA verification to cover the scope of activities shown in Figure 1. Ideally, an 'Institute for Nuclear Disarmament Research, Development, Testing and Demonstration' could be created, primarily under the support of non-nuclear weapon States and philanthropists, to be operated under by the IAEA, and to be located in Vienna so as to be available to the Vienna nuclear diplomatic community, the IAEA and the CTBTO. All nuclear-armed States should be encouraged to contribute and cooperate with this Institute.

Recommendations

To gain support and commence concrete steps, the following actions are recommended to establish a formal framework for the IAEA to engage in verification agreements with nuclear-armed States.

1. At the 2015 NPT Review Conference, States Parties should recall the practical steps for the systematic and progressive efforts to implement Article VI of the NPT and paragraphs 3 and 4(c) of the 1995 Decision on "Principles and Objectives for Nuclear Non-Proliferation and Disarmament" agreed to at the 2000 NPT Review Conference, in particular paragraph 8: "The completion and implementation of the Trilateral Initiative between the United States of America, the Russian Federation and the International Atomic Energy Agency."[8] The 2015 NPT Review Conference might call upon the IAEA to take the following actions, which could be endorsed in a resolution of the 2015 IAEA General Conference to the following effect:

2. The resolution should provide that verification of fissile material in relation to any aspect of nuclear disarmament should, on the basis of the Trilateral Initiative, be understood to be a mission for the IAEA, provided for under Article III.A.5 of the IAEA Statute.

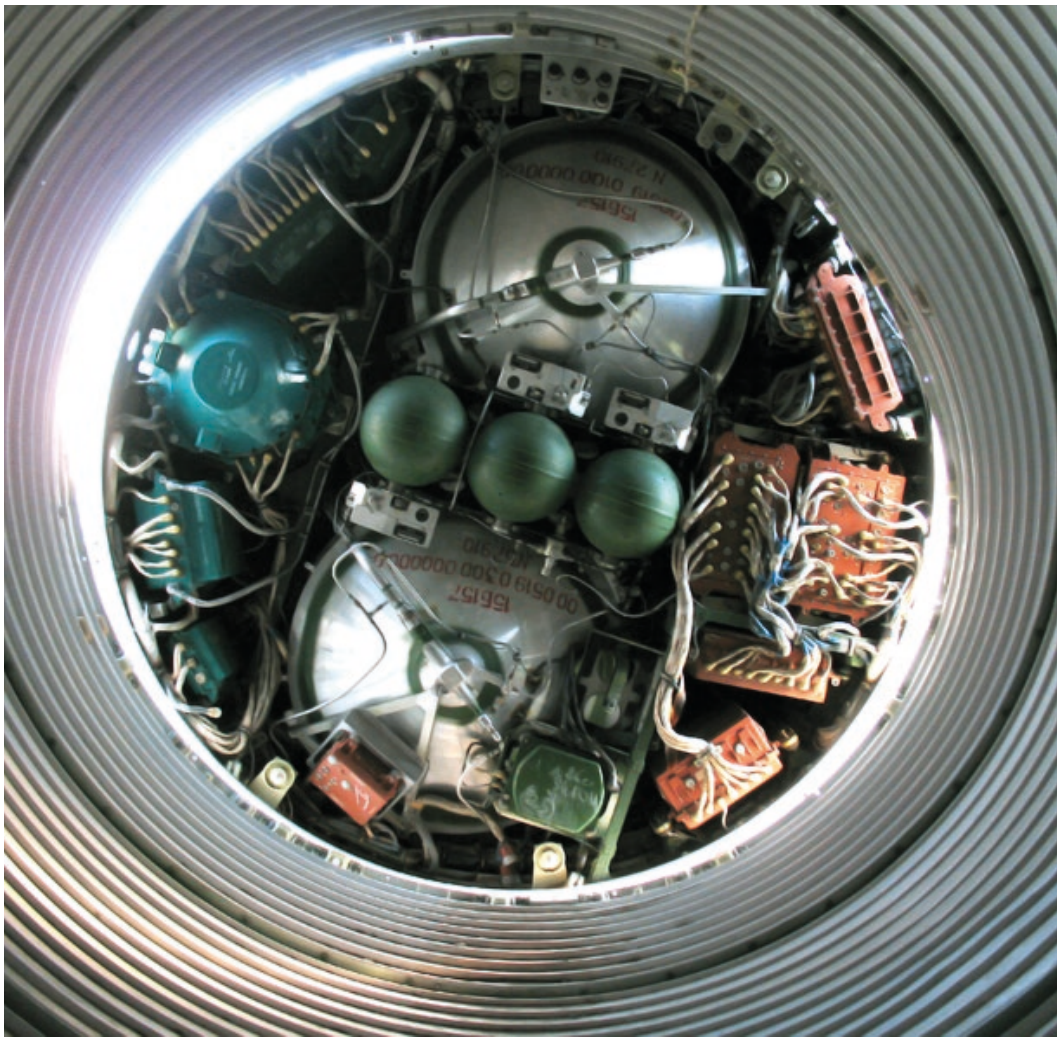
3. The resolution should call upon the IAEA Secretariat to create a permanent staff unit to preserve the legacy of the Trilateral Initiative. This unit should be tasked with coordinating and engaging in R&D related to nuclear disarmament verification and providing technical advice in connection with proposals for IAEA verification of nuclear disarmament. The new unit should be given a name to reflect this mission and appropriate stature to assure its success.

4. The resolution should call for the creation of an International Institute for Nuclear Disarmament Verification Research and Development, to be agreed upon by the Board of Governors and endorsed by the 2016 IAEA General Conference. The Centre should be created under the auspices of the IAEA, and should provide for leadership and direction by IAEA non-nuclear-weapon Member States. It should be located in Vienna to take advantage of the nuclear community. The Centre should not require actual stocks of plutonium or uranium, but work with surrogate materials and shapes and forms sufficiently similar so as to allow progress to be made. The scope should include all steps anticipated in relation to disarmament, including verified reductions of deployed and reserve nuclear warheads, demounting, dismantling, conversion, and all subsequent steps arising from such progress. The Centre should study possibilities for future progress towards nuclear disarmament, the mechanisms under which progress could be attained, applicable verification sciences and technology, engineering, test and demonstration. The Centre should facilitate participation by all IAEA Member States.

Ideally, an 'Institute for Nuclear Disarmament Research, Development, Testing and Demonstration' could be created.

Progress in bringing these capabilities to fruition should be supervised by the IAEA Board of Governors and the IAEA General Conference, and should be brought to the attention of successive NPT Review Conferences in the context of Article VI of the NPT.

Resolving the technical issues associated with verifying progress towards disarmament will not guarantee that States possessing nuclear arms will enter into binding agreements to that effect. And no such agreement would in and of itself result in the destruction of a single warhead. But creating the technical capabilities now would remove one barrier to progress.



Inside view of ICBM SS-18, Satan. Copyright: Nataliia Pogrebna.

Part II: A Legal Framework for the Future

by Laura Rockwood

Introduction

The Trilateral Initiative was launched in 1996 in the context of Article VI of the Treaty on the Nuclear Non-Proliferation Treaty (NPT), in accordance with which each of the Parties to the NPT undertakes "to pursue negotiations in good faith on effective measures relating to the cessation of the nuclear arms race and at early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control." In furtherance of their commitments under that Article, the Russian Federation and the United States wished to demonstrate that weapon-origin and other fissile material specified by each of them as released from its defence programmes remained removed from nuclear weapons programmes.[9]

While it has recently become popular to think of verification in nuclear weapon States as "not safeguards", the IAEA's authority to carry out such activities derives from its statutory authority under Article III.A.5, which, inter alia, explicitly authorizes the IAEA to apply safeguards, "at the request of the parties, to any bilateral or multilateral arrangement, or at the request of a State, to any of that State's activities in the field of atomic energy".

From the very outset of the Trilateral Initiative, there was no dispute among the parties about the IAEA's authority pursuant to Article III.A.5 to implement the requested verification. It was also noted that Article III.B.4 of the Statute provides further that the IAEA is obliged to "conduct its activities in accordance with the purposes and principles of the United Nations to promote peace and international co-operation, and in conformity with policies of the United Nations furthering the establishment of safeguarded worldwide disarmament and in conformity with any international agreements entered into pursuant to such policies".

A Legal Framework for IAEA Verification of Classified Forms of Pu and HEU under the Trilateral Initiative

In May 1999, before the three parties embarked on their detailed tripartite discussion on the legal issues associated with the Trilateral Initiative, the Director General of the IAEA submitted to the Board of Governors a progress report on Trilateral Initiative activities which had taken place since its inception.[10] As indicated in that report, these activities included the establishment of a Joint Working Group to investigate technical, legal and financial issues associated with IAEA verification of weapon-origin fissile material in the Russian Federation and in the United States.

In that report, the Director General also provided preliminary information on the development of a Model Verification Agreement (MVA) which, subject to approval by the Board, could be used as the basis for negotiating bilateral agreements between the Agency and each of the States for the verification of fissile material pursuant to this initiative.[11]

As described in the report, the purpose of IAEA verification under such agreements was to be the promotion of international confidence that weapon origin fissile material (or any other fissile material) subject to IAEA verification under the agreements remained removed from nuclear weapon programmes. It was therefore anticipated that the basic undertaking of States parties to such agreements would likely include the following elements:

"1. a commitment by the State not to withdraw material submitted to IAEA verification under the agreement, thereby establishing an irrevocable commitment by the State to continue IAEA verification

Workers at Pantex Plant near Amarillo, Texas, begin disassembling a B61 gravity bomb by separating it into its major subcomponents (the weapon has a total of 5,919 parts). The bomb's warhead is in the section directly behind the nose. Copyright: Department of Energy.

on such material indefinitely, or until the material has been altered so as to be unsuitable for use in nuclear weapons, or exported in unclassified form to a non nuclear weapon State subject to IAEA safeguards or to a nuclear weapon State subject to IAEA verification under a similar agreement, or determined to be practicably irrecoverable; and

2. provisions on the nature, scope and modalities of IAEA verification measures that would serve the goal of providing assurance of the irreversible removal of material submitted to IAEA verification under the agreement from nuclear weapon programs; and a stipulation that the IAEA would be permitted to implement its verification activities in a manner that will permit it to derive credible, independent conclusions based upon the activities carried out and the results obtained."[12]

In mid-1999, the Joint Working Group established a sub group to develop the text of the MVA.

Format and Structure

The first order of business in discussions on the possible legal framework for IAEA verification of classified forms of plutonium (Pu) and highly enriched uranium (HEU) within the Trilateral Initiative was to identify the available options. These included: using the nuclear weapon States' voluntary offer safeguards agreements (VOAs)[13]; "re-engineering" the VOAs; or developing a new legal instrument.[14]

The VOAs were deemed not ideally suited for two main reasons:

1. The voluntary offer agreements are just that: voluntary. They place no continuing and irrevocable obligation on the State to maintain safeguards on nuclear material submitted under such an agreement. They permit each State to withdraw at its own discretion nuclear material from safeguards and to remove facilities from the list submitted by the State under the VOA. Moreover, the IAEA's right to implement safeguards under those agreements is by and large discretionary; there is no obligation on the Agency to implement safeguards at facilities or on material submitted by the State under the VOAs. This was deemed not acceptable as the basis for a verification regime related to nuclear disarmament. In addition, verification by the IAEA under the VOAs depends, by and large, on the availability of resources; such an arrangement would not be consistent with obligatory verification requirements.

2. The VOAs require declarations concerning nuclear material that would entail the release of information about the classified forms of fissile material, which neither State could do without breaching Article I of the NPT and their respective national laws. As for the IAEA, the traditional safeguards measures it carries out under the VOAs, such assembling, unrestricted non-destructive measurements and laboratory analyses that provide independent measurements of all safeguards-relevant characteristics of nuclear material, would not be permitted for classified materials.[15]

Likewise, the option of "re-engineering" the VOAs – e.g. concluding protocols with the effect of modifying the substantive provisions of the VOAs – was considered undesirable. Accommodating the necessary restrictions within VOAs would require extensive and fundamental modifications of those agreements.

For those reasons, it was concluded within the Trilateral Initiative that a new legally binding framework would be the optimum approach. Having determined that a new legal framework was called for, the next question to address was whether that framework should consist of a multilateral verification agreement to which both of the States and the IAEA would be party, or a model for bilateral agreements between the Russian Federation and the IAEA and between the United States and the IAEA. There was general consensus among the Trilateral Initiative participants that the negotiation of a model for bilateral verification agreements would have the greatest likelihood of success. The model could establish common basic elements, but could be crafted in such a way as to accommodate the respective commitments of each State.[16]

Although the scope, objective and verification activities under the Trilateral Initiative were to be different from those provided for in the NWS VOAs and the non nuclear weapon State comprehensive safeguards agreements (CSAs), the provisions of INFCIRC/153 were used to shape the format and structure of the Model Verification Agreement. As a result, the model drew heavily from provisions corresponding, mutatis mutandis, to Part 1 of INFCIRC/153 on such matters as the basic undertaking, the provision and protection of information and final clauses (e.g. entry into force, privileges and immunities), and to Part 2 of INFCIRC/153 on verification activities and related provisions (e.g. objective, subsidiary arrangements, reporting and record-keeping, inspections and definitions).

Substantive Issues

Basic Undertaking and Objective: The draft Model Verification Agreement includes basic undertakings on the part of the State and provides for mandatory verification by the IAEA.

The draft Model Verification Agreement includes basic undertakings on the part of the State and provides for mandatory verification by the IAEA.

In developing the model, it was understood that the Russian Federation and the United States would determine independently the forms and amounts of fissile material that each would submit for verification, the locations where that material would be submitted, and the timing of the submissions. Thus, the basic undertaking provides for the voluntary submission by the State of weapon-origin and other fissile materials to the IAEA for verification under such an agreement. However, it also provides that, once submitted, the material cannot be withdrawn. The State would undertake to accept IAEA verification for so long as the material was subject to that agreement for the purpose of promoting international confidence that the material remained removed from the manufacture of nuclear weapons or any other nuclear explosive devices, from research development, design or testing for such devices, and from any other military purposes.

The IAEA would assume a corresponding obligation to apply verification to materials submitted to and accepted by it, and would have the right to reach independent conclusions related to the verification objectives under each agreement.

The objective of the verification agreement would be framed in a nuclear disarmament context rather than the non-proliferation context of IAEA safeguards agreements. Thus, instead of the INFCIRC/153 objective of "the timely detection of the diversion of significant quantities of nuclear material," the objective under the Trilateral Initiative would be to confirm that the material remained accounted for under the agreement.

Protection of Classified Information: Neither the IAEA nor the States wished to be responsible for the proliferation of weapons-sensitive information as a result of Trilateral Initiative activities. Thus, in order to prevent proliferation through the verification process, the State would have the absolute right and responsibility to protect any information that it considered classified due to its relationship to nuclear weapons.

Intensive technical discussions and activities were undertaken with a view to developing a verification mechanism that would protect classified information the direct verification of which would not be permissible (such as mass, isotopics and/or physical and chemical characteristics), while permitting the IAEA to independently conclude that material presented for verification was of the nature contemplated under the agreement. This resulted in the development of what became known as "attribute verification". Upon submission of material in a sealed container to the IAEA for monitored storage, the IAEA would be able, using techniques described in the companion paper by T. Shea, to query the material using techniques that would obviate the need for access to classified information while permitting the IAEA to an answer three specific yes/no questions: Is Pu/HEU present in the container? Is it weapon grade (e.g.if it is Pu, is the ratio of 240Pu to 239Pu 0.1 or less)? Is the mass greater than a minimum amount (to be specified for the particular facility in the subsidiary arrangements to the agreement)? Process for submission of material under the verification agreement: While it would be for the State concerned to determine the forms and quantities

Verification under the proposed arrangement could — if the State were willing — begin while the warheads remain mounted on a missile, or at any other stage of a nuclear arsenal. Copyright: Kolago.

of fissile material it wished to submit for verification under the agreement, the IAEA would only be obliged to accept the material if it were able to verify that it satisfied the criteria described above, with a view to providing some assurance that the material was indeed of the type normally associated with nuclear weapons material.

The process for bringing weapon-origin fissile material under such a verification agreement would involve three steps:

1. The State would declare that the material has been released from its defense programmes and provide specified information about the material for attribute verification;
2. The State would submit the material for verification; and
3. The IAEA would be obliged to accept the fissile material if the results of the receipt verification measurements satisfied the technical criteria. If the results were not satisfactory, the IAEA would have no further recourse. Hopefully, the State would fix the problem and resubmit the material.

Verification Arrangements: Just as for the VOAs and CSAs, subsidiary arrangements would be necessary to facilitate the implementation of inspections in accordance with the MVA. As envisioned in the model, the sub-

sidiary arrangements would include general considerations, technical criteria and facility information and verification arrangements.

The expected norm for verification arrangements would be routine inspections as agreed in the subsidiary arrangements. Ad hoc inspections could be carried out in the event that the subsidiary arrangements had not been concluded, but only at those facilities agreed to by the State concerned. Provision was also made for special inspections.

While the primary focus of the Trilateral Initiative was on the verification of fissile material with classified attributes, the MVA also addressed the possibility that verification might follow such material through processes for converting material subject to the agreement with classified characteristics into material subject to the agreement without classified characteristics.

Before the Trilateral Initiative was concluded, the participants had produced draft subsidiary arrangements, and made substantial progress in developing the verification approach and inspection criteria for a plutonium storage facility.

Relationship to Other Agreements: In recognition that a State might conclude other verification arrangements imposing verification requirements on material considered under the Trilateral Initiative, provisions were included obliging the State and the IAEA to cooperate with a view to reconciling the verification procedures under the different agreements, and avoiding unnecessary duplication of verification activities, subject to the IAEA's right to reach independently its conclusions under the Trilateral Initiative agreement.

Standing Consultative Committee: One of the most novel aspects of the model verification agreement was provision for the establishment of a Standing Consultative Committee responsible for reviewing and coordinating matters arising in the implementation of agreements based on the model verification agreement (and other agreements entered into by any of the members of the committee which had a bearing on the implementation of those agreements). The Committee was to be composed of representatives of the States party to any agreement concluded on the basis of the model verification agreement, representatives of the IAEA and representatives of any other States which had in force similar agreements with the IAEA. What makes this arrangement unique is that, ordinarily, the parties to a bilateral agreement cannot bind a third party to fulfill obligations under that bilateral agreement. It was recognized, however, that, even though there would be individual bilateral agreements between each of the States and the IAEA, the States had a collective interest in ensuring consistency and coordination in the implementation of those agreements.

Termination and Irreversibility: An issue that remained unresolved in 2002 was what precisely constituted irreversibility. In the view of some, to achieve "irreversibility", verification procedures would have to be applied until the material in question is exported out of the State, transferred to coverage under another verification agreement or consumed, diluted or otherwise rendered practicably irrecoverable (similar to the mechanisms for terminating safeguards under comprehensive safeguards agreements). In the view of others, irreversibility could be achieved through a combination of verification and physical transformation (such as Pu burn-up and the down-blending HEU); verification could terminate when the material is rendered into forms no longer readily usable for nuclear explosives. An alternative might be to require the spent MOX fuel and the down-blended HEU (assuming it is less than 20% enriched) to remain subject to IAEA safeguards under the VOA, which would not require special funding but would make it less "voluntary".

One of the most novel aspects of the model verification agreement was provision for the establishment of a Standing Consultative Committee responsible for reviewing and coordinating matters arising in the implementation of agreements based on the model verification agreement

It would be unfortunate for the remarkable achievements under the Trilateral Initiative to be buried in the shifting sands of time. Copyright: hoboton.

Outcome

The last meeting of the Joint Working Group on the Model Verification Agreement was convened in June 2001, followed immediately by a Plenary Meeting of the three parties. At that meeting, the parties agreed that work should continue on the development of the Model Verification Agreement as a model for bilateral agreements between a State and the IAEA that could be tailored to the commitment of that State. At the request of the States, the IAEA prepared the ninth – and final – draft of the Model Verification Agreement in November 2001.

Financing IAEA Verification of Arms Control and Reduction Measures

As indicated above, simultaneously with the Director General's progress report to the Board in 1999, the Secretariat submitted another report to the Board which discussed a number of options for the financing of IAEA verification of nuclear arms control and reduction measures, including those of the Trilateral Initiative.[17] A preliminary description of two categories of options for financing the new verification tasks were identified in the report. As detailed in that document, in assessing the possible options, the following key considerations should be taken into account:

- the IAEA's authority to conduct the relevant activities stemmed from Articles III.A.5 and III.B.1 of the Statute (as described above);
- effective verification of nuclear arms control and reduction is in the interest of all States;
- the funding mechanism needed to be predictable and reliable;
- the mechanism should be sufficiently flexible to accommodate a range of possible future verification tasks; and
- the mechanism had to be compatible with the provisions of the IAEA's Statute.

The two options for financing mechanisms were: (1) voluntary funding arrangements; and (2) mandatory (assessed) funding.

The mechanism for voluntary funding would involve the establishment of an extra-budgetary fund to which contributions would be made by Member States – or even by other people and/or entities such philanthropists and non governmental organizations – on a voluntary basis. The advantage of such a mechanism would be its flexibility, but it would not provide predictability and reliability – crucial elements for credible and effective verification.

Within the mechanism of mandatory funding, the Secretariat identified four variations: three based on a regular budget funding, and one involving the establishment of a non-regular budget fund.

Under regular budget funding, the variations depended on the formula to be used for determining Member State assessments: (a) funding in accordance with the regular budget scale of assessment; (b) funding in accordance with the then existing formula for assessed contributions to safeguards costs; or (c) funding in accordance with a different formula(s). While each of these variations would provide reliable and predicable funding, all three were identified as being susceptible to difficulties arising from the policy advocated by some Member States of zero real growth in the IAEA's budget, and demands for a certain balance in the regular budget between verification and non verification activities.

The fourth option identified by the Secretariat would entail the establishment of a non-regular budget fund based on mandatory assessed contributions. This option had the advantage of not just providing the necessary predictability and reliability, but avoiding the difficulties associated with regular budget funding, i.e. zero real growth and balancing. The Secretariat identified two examples of special funds based on assessed contributions. One example was the 1973 United Nations Peacekeeping Formula, which took into account the relative capacities of economically developed, less developed and least developed countries to contribute, and the special responsibilities of the permanent members of the UN Security Council. Applied to the Trilateral Initiative, this could shift the burden from economically less developed countries to the more developed countries and reflect the special responsibilities of the nuclear weapon States.

The other was the NPT Review Conference Formula. Under that formula, costs are apportioned with 55% being paid by the nuclear weapon States, and the remaining 45% dividing among the other participating States Parties using the UN scale of assessment. Adapted for the Trilateral Initiative, the 45% could be apportioned among all IAEA Member States, minus the nuclear-weapon States, with the remaining 55% being paid by the latter.

Although the Board of Governors took no decision on the matter of financing arrangements, it did reflect support for the Trilateral Initiative as a valuable contribution to arms control and disarmament and to the fulfillment of the States' disarmament obligations under the NPT, with many Board members expressing support for the principle of mandatory funding as the more appropriate solution in terms of predictability and reliability.

The Model Verification Agreement as the Basis for Future Disarmament Verification

In the Final Document of the 2000 NPT Review Conference, the 8th step of the 13 "practical steps for the systematic and progressive efforts to implement Article VI of the NPT and paragraphs 3 and 4(c) of the 1995 Decision on "Principles and Objectives for Nuclear Non Proliferation and Disarmament" called for:

"The completion and implementation of the Trilateral Initiative between the United States of America, the Russian Federation and the International Atomic Energy Agency."[18]

Ten years later, the action plan for nuclear disarmament agreed upon at the 2010 NPT Review Conference included two directly relevant actions in connection with fissile material, albeit without explicit reference to the Trilateral Initiative:[19]

"Action 16: The nuclear-weapon States are encouraged to commit to declare, as appropriate, to the International Atomic Energy Agency (IAEA) all fissile material designated by each of them as no longer required for military purposes and to place such material as soon as practicable under IAEA or other relevant international verification and arrangements for the disposition of such material for peaceful purposes, to ensure that such material remains permanently outside military programmes.

Action 17: In the context of action 16, all States are encouraged to support the development of appropriate legally binding verification arrangements, within the context of IAEA, to ensure the irreversible removal of fissile material designated by each nuclear-weapon State as no longer required for military purposes."

Extensive practical work was carried out under the Trilateral Initiative on the technical aspects of IAEA verification of fissile material with classified characteristics. Significant achievements were also made in the development of the legal framework, including the drafting of a Model Verification Agreement, model subsidiary arrangements and technical verification criteria. Considerable and specific consideration has also been given to the financing of such activities.

While there remained unresolved issues in connection with the MVA in 2002, the IAEA should be encouraged to build on the practical work of the Trilateral Initiative. That process could be initiated with a revitalization of the efforts undertaken between 1996 and 2002, both in the technical aspects and the legal framework.

Although the current prospects for substantive progress in multilateral disarmament efforts seem dim, the Model Verification Agreement produced through the Trilateral Initiative could provide a mechanism for individual States to take unilateral steps towards internationally verified disarmament.

Some have suggested that the current political climate points to the desirability of "rebranding" the exercise. Be that as it may, it would be unfortunate for the remarkable achievements under the Trilateral Initiative to be buried in the shifting sands of time.

Recommendations

The upcoming 2015 NPT Review Conference offers an opportunity for renewed attention to the Trilateral Initiative and its very concrete achievements in the technical, legal and financial aspects of IAEA verification in support of nuclear disarmament. Nuclear-weapon States should be encouraged – individually or in concert – to resume discussions on the basis of these achievements and to conclude agreements to ensure the irreversible removal of fissile material designated by each nuclear-weapon State as no longer required for military purposes as a means of contributing to the fulfillment of their disarmament commitments under the NPT.

To that end, the participants in the 2015 NPT Review Conference should, recalling the language of 2000 and 2010 NPT Review documents, and noting the significant achievements of the Trilateral Initiative:

- Call upon the Director General of the IAEA to prepare a model bilateral agreement for IAEA verification of classified (and unclassified) forms of fissile material released from nuclear weapons programmes, using as a basis the last draft of the Model Verification Agreement produced as a result of the Trilateral Initiative;
  and
- Call upon each of the nuclear-weapon States to conclude an agreement with the IAEA on the basis of that model.

Although the current prospects for substantive progress in multilateral disarmament efforts seem dim, the Model Verification Agreement produced through the Trilateral Initiative could provide a mechanism for individual States to take unilateral steps towards internationally verified disarmament.

1 There is no magic number for the percentage of 239Pu in plutonium to be useful in a nuclear weapon, or for the enrichment of 235U in uranium, for that matter. Terms such as "weapon-grade" or "super-grade" are useful distinctions, but nuclear weapons can and have been built with less than ideal concentrations. Note that while nuclear weapons can also be made using 233U, 237Np and 241Am, plutonium containing more than 93% 239Pu or 90% 235U remain the ideal choices for several reasons.

2 HEU may also be employed in classified forms not related to nuclear weapons, chiefly as fuel for naval propulsion reactors. Unclassified forms of Pu and/or HEU may be employed in other governmental programs or in peaceful use.

3 The IAEA issued a press release following each meeting of the Russian Minister of Minatom, the U.S. Secretary of Energy and the Director General, referred to as "the Principals". These press releases are available on the IAEA website as documents associated with the General Conferences from 1996 to 2002.

4 Dr Khlebnikov previously served twice on the staff of the Department of Safeguards and currently serves on the Director General's Standing Advisory Group on Safeguards Implementation (SAGSI).

5 Each fission event releases some number of neutrons within a very brief time interval. Neutron multiplicity counting systems employ neutron detectors capable of registering single neutrons, two-fold coincidence and three-fold coincidence within a time window typically set at 64 μsec.

6 See the press release from the General Conference in 2002, http://www.iaea.org/newscenter/pressreleases/iaea-verification-weapon-origin-fissile-material-russian-federation-and

7 The United States intended to submit Pu in the form of pits, while Russia melted its pits into 2 kg spheres that no longer had any shape sensitivity but were still classified as "State Secret" owing to their isotopic composition.

8 See, for example, http://www.un.org/disarmament/WMD/Nuclear/pdf/finaldocs/2000%20-%20NY%20-%20NPT%20Review%20Conference%20-%20Final%20Document%20Parts%20I%20and%20II.pdf

9 This paper builds on a presentation submitted to the 2014 IAEA Safeguards Symposium. For more detailed background on the Trilateral Initiative, see the companion paper presented to the Deep Cuts Commission by T. Shea.

10 GOV/INF/1999/8, 21 May 1999, "IAEA Verification of Weapon-Origin Fissile Material in the Russian Federation and the United States of America".

11 As discussed later in this paper, the Secretariat simultaneously submitted a report to the Board entitled "Financing IAEA Verification of Nuclear Arms Control and Reduction Measures" (GOV/INF/1999/9).

12 GOV/1999/8, para. 20.

13 The text of the Agreement of 18 November 1977 between the United States of America and the Agency for the application of safeguards in the United States of America is reproduced in INFCIRC/288.The text of the Agreement of 21 February 1985 between the Union of Soviet Socialist Republics and the Agency for the application of safeguards in the Union of Soviet Socialist Republics, which entered into force on 10 June 1985, is reproduced in INFCIRC/327.

14 No serious consideration was given to the use of the safeguards procedures provided for in INFCIRC/66/Rev.2, which serve as the basis for the item-specific safeguards agreements implemented in the non-NPT States of India, Israel and Pakistan. As with the procedures provided for under comprehensive safeguards agreements, the safeguards procedures provided for in INFCIRC/66/Rev.2 would not be suitable for the verification of classified forms of fissile material.

15 Articles 3.c. and 3(c) of the US and RF VOAs, respectively, read as follows: "The safeguards to be applied by the Agency under this Agreement [US VOA: on source or special fissionable material in facilities in the United States] shall be implemented [US VOA: by][RF VOA: using] the same procedures followed by the Agency in applying its safeguards on similar material in similar facilities in non-nuclear-weapon States under agreements pursuant to paragraph 1 of Article III of the Treaty."

16 For the Russian Federation, the agreement would cover only Pu and only while in storage; for the United States, the agreement would cover Pu and HEU in storage, but could also involve processes involving the conversion of material to unclassified forms.

17 GOV/INF/1999/9, 21 May 1999, "Financing IAEA Verification of Nuclear Arms Control and Reduction Measures"

18 http://www.un.org/disarmament/WMD/Nuclear/pdf/finaldocs/2000%20-%20NY%20-%20NPT%20Review%20Conference%20-%20Final%20Document%20Parts%20I%20and%20II.pdf

19 NPT/Conf.2010/50, Vol. I, Part I, Conclusions and recommendations for follow-on actions, Section I. Nuclear Disarmament, E. Fissile Materials, at pages 23-24, http://www.un.org/ga/search/view_doc.asp?symbol=NPT/CONF.2010/50%20%28VOL.I%29

Front page: Image of Geiger counter before radiation sign. Copyright: djama.

About the Authors

Dr Thomas E Shea served for 24 years in the IAEA Department of Safeguards and headed the IAEA Trilateral Initiative Office from its creation until his departure from the IAEA at the end of 2003. Shea also headed the IAEA FMCT working group, and headed a study group that analyzed the CTBT before it was completed.

Contact: tomsheanuclear@me.com

Dr Laura Rockwood was Section Head for Non-Proliferation and Policy Making in the Office of Legal Affairs of the International Atomic Energy Agency until 2013. She was involved in all aspects of the negotiation, interpretation and implementation of IAEA safeguards, and was the principal author of the document that became the Model Additional Protocol.

Contact: Laura_Rockwood@hks.harvard.edu

About Deep Cuts

The Deep Cuts project is a research and consultancy project, jointly conducted by the Institute for Peace Research and Security Policy at the University of Hamburg, the Arms Control Association, and the Institute of World Economy and International Relations of the Russian Academy of Sciences. The Deep Cuts Commission is seeking to devise concepts on how to overcome current challenges to deep nuclear reductions. Through means of realistic analyses and specific recommendations, the Commission strives to translate the already existing political commitments to further nuclear reductions into concrete and feasible action. Deep Cuts Working Papers do not necessarily reflect the opinion of individual Commissioners or Deep Cuts project partners.

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Impress:
Institut für Friedensforschung und Sicherheitspolitik
an der Universität Hamburg (IFSH)
Beim Schlump 83
20144 Hamburg, Germany

Phone: +49 (0)40-86 60 77-42
Fax: +49 (0)40-866 36 15

Project Management
Ulrich Kühn
Götz Neuneck
Email: kuehn@ifsh.de


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