Those seeking to design a system for verifying the dismantlement of nuclear weapons do not have to start from a blank slate. They can benefit a great deal from building on the experience of the Trilateral Initiative. This was a six-year (1996-2002) effort to develop a verification system under which Russia and the United States could submit classified forms of weapons-origin fissile material to International Atomic Energy Agency (IAEA) verification and monitoring in an irreversible manner and for an indefinite period of time.

Russia and the United States needed a new system because the IAEA's normal safeguards system, designed to prevent peaceful nuclear materials and facilities from being used for military purposes, is not set up to cope with nuclear materials still tied to weapons programs or with inspections at locations that have or had such programs. The initiative sought to broaden the items that could be brought under IAEA monitoring to include any classified items containing plutonium or highly enriched uranium, including nuclear warheads, warhead components, pits, or secondaries. The initiative also sought to ensure that these would be permanently safeguarded, unlike material submitted to IAEA monitoring under existing voluntary agreements. In 1993, for example, the United States had submitted 10 metric tons of highly enriched uranium and two metric tons of plutonium to voluntary IAEA safeguards, but this material could have been withdrawn at will.

Moreover, the methods and the overall framework had to be designed to protect classified information and to ensure that both countries met their obligations under Article I of the nuclear Nonproliferation Treaty (NPT). Under that article, nuclear-weapon states-parties to the NPT are prohibited from assisting, encouraging, or inducing any non-nuclear-weapon state to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices, and this obligation logically extends to the IAEA or any other multilateral entity. Therefore, the IAEA recognized that its access would be restricted so as to prevent nuclear secrets from leaking out.

Some of the early decisions reached under the initiative related to defining the nature and scope of verification so that it could be politically acceptable and provide sufficient confidence that disarmament was actually taking place. One decision involved the nature of the disarmament-related nuclear material that the countries would seek to verify. Four verification levels were considered:

- **Level 1:** limit the initiative to accepting only unclassified materials, which would have removed those materials from reuse;
Level 2: accept classified forms of fissile material without attempting to establish that the forms actually represent nuclear warheads or components thereof;

Level 3: verify the fact that the items presented are in fact nuclear warheads or specified components thereof, including specific model identifications; or

Level 4: start with the dismantlement of weapon systems or subsequent stages so that the monitoring could attest to the removal of warheads from delivery systems.

For practical purposes, the parties decided that the initiative should aim for Level 2, which posed significant challenges but was considered to be achievable. Level 1 would not have required a new framework. Going to Level 3 would have presented far greater security concerns and challenges related to authenticating warhead templates that could be used by the IAEA. Level 4 would have been a simple extension of Level 3.\[^1\]

Participants also decided on a metric of effective verification, "the 1 percent solution." The working group proceeded on the basis that a breakout involving on the order of 1 percent of the monitored inventory at any time could portend a strategic change. Although never formally adopted, the 1 percent figure served as the de facto reference for determining sample-plan sizes for verification and reverification.

Participants examined various technical means of verification, looking first at whether a technology might be found that would allow unrestricted measurements but would not be capable of extracting any classified information from the objects being measured. Not finding any suitable methods, the working group agreed to base IAEA verification measurements on references to unclassified attributes, using sensitive measurements operating behind "information barriers."\[^2\] Although attribute verification would provide far less information than the IAEA obtains under routine plutonium safeguards, it was deemed to be sufficient to be formally accepted as the basis for the IAEA verifying the classified materials involved in the initiative.

Attribute verification involves comparing an object to a set of reference characteristics. For example, the presence of a militarily significant quantity of weapons-grade plutonium would be assessed by measures that first determined the presence of plutonium, then assessed that the isotopic composition of the plutonium was such that it was weapons-grade material rather than reactor-grade,\[^3\] and finally calculated that the mass of plutonium fell above an agreed minimum defined in relation to each facility.

Several measurement methods were identified that could satisfy this requirement. In the end, the working group settled on high-resolution gamma ray spectroscopy to establish the presence of weapons-grade plutonium and the combined use of neutron multiplicity counting and high-resolution gamma ray spectroscopy to measure the plutonium mass.

The scheme for monitoring and verifying this material as it was converted to eventual peaceful use in nuclear fuel was straightforward: sealed containers would be transported to facilities where the material would be converted and shorn of classified isotopics and chemical properties. IAEA monitoring would begin with the arrival of the classified material at the entry point to the conversion facility. A perimeter monitoring system would assure that only monitored containers, plus other nonweapons materials needed in the peaceful fuel, would be allowed in. All fissile material containers exiting the conversion facility would be measured using normal IAEA safeguards methods, and then seals would be applied to the containers for storage or transport to processing facilities where they would be converted to fuel for nuclear reactors. Managed access
would be allowed into the conversion facility annually to ensure that no warhead components accumulated and that no undeclared penetrations occurred that could have resulted in undeclared additions or removals of fissile material. IAEA inspectors could witness containers entering the measuring system, identify tag measurements, confirm seal data, and observe the attribute measurement results on a pass-fail basis.

Working group participants judged that if such a scheme were to be practical, the conversion facilities would have to be constructed following mutually agreed architectural plans. No discussions took place on specific agreements, however.

The initiative developed slowly because of some highly arcane technical differences between Russia and the United States and because the 2000 conclusion of a separate bilateral Plutonium Management and Disposition Agreement between Russia and the United States drained some of the necessary political impetus and attention.[4]

Nonetheless, by November 2001, Russia and the United States were on the brink of agreeing to a model verification agreement. Unfortunately, the new Bush and Putin administrations brought the initiative to a halt. When President George W. Bush took office, his administration announced that it did not support a 13-point Article VI agenda from the 2000 NPT Review Conference that included support for the initiative. The Putin administration was also not as supportive as its predecessor. By the time of the 2002 IAEA General Conference, the two sides had agreed that the initiative should be brought to a close, concluding that it had been a success and that it was now up to the states to enter into individual implementation agreements with the IAEA.

Accomplishments

In many ways, Washington and Moscow were correct. From a legal perspective, the Trilateral Initiative was ready at that point to be carried out, although some implementation details still required further negotiation. As the final report of the Joint Working Group to the Trilateral Initiative Principals put it in 2002:

Over the course of six years, the Joint Working Group addressed the technical, legal and financial issues associated with implementing IAEA verification of weapon-origin and other fissile material released from defence programmes and can now recommend the successful completion of the original task. The enabling technologies developed under the Initiative could be employed by the IAEA on any form of plutonium in nuclear facilities, without revealing nuclear weapons information. The Working Group found no technical problem that would prevent the IAEA from undertaking a verification mission in relation to such fissile materials released from defense programmes, and believes that many of the technical approaches could have broader applicability to other forms of fissile materials encountered in conjunction with nuclear arms reductions.

In addition, verification arrangements essentially were agreed on for initial implementation at the Fissile Material Storage Facility at Mayak in Russia and at the K-Area Material Storage (KAMS) Facility at the Savannah River site in the United States. In placing the KAMS Facility under voluntary-offer safeguards, the United States stated its intention to alter these safeguards once an agreement pursuant to the initiative entered into effect.

Could the Trilateral Initiative Be Reactivated?

States looking at verifying nuclear disarmament might consider reactivating the Trilateral Initiative. In particular, two options might be pursued:

1. The initiative could be reactivated as a three-way study effort to continue work aimed at fleshing out a verification system in relation to nuclear disarmament. With no obligations to commit, that would be the low-risk option,
more likely to gain support but running the risk of being a perpetual experiment.

2. Alternatively, Russia, the United States, or both acting together could negotiate agreements in a few months that could allow them to begin to submit weapons-origin fissile material to IAEA verification. Although the preparatory work carried out was extensive, significant practical issues remain. Phasing in the agreements over time could allow progress to be made while gaining confidence in the security measures implemented. Under such an arrangement, Russia or the United States would retain the right to determine which fissile materials to submit, when to submit them, and the conditions necessary. Through such provisions, Russia, the United States, and any other state possessing nuclear weapons that would enter into such an arrangement could gain the assurances needed to protect their security interests. The agreements could have a specified duration to provide an out if the parties could not reach agreement.

Concluding the first verification agreement based on the Trilateral Agreement would energize the international community, bolster support for the NPT, and provide the foundation for engaging other states possessing nuclear weapons. Such a step could be carried out in time for the 2010 NPT Review Conference.

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ENDNOTES


2. An information barrier would permit unrestricted measurements on a secure basis. The results would be compared to unclassified parameters in a way that questions could be answered in a pass-fail manner. For example, the measured ratios of the key isotopes would be compared to a limit. If less than the limit, the answer would be "pass," and conversely, if greater than the limit, then "fail."

3. The isotopic ratio chosen was such that there was at least 10 times as much plutonium-239 as plutonium-240, which is true for plutonium used in nuclear weapons in Russia and the United States.

4. The Plutonium Management and Disposition Agreement (PMDA) focused on the implementation of the steps for verification as one objective, but disposition was its primary focus. It called for reusing 34 metric tons of excess weapons plutonium in each country in mixed-oxide fuel for nuclear reactors. Although the IAEA was an equal partner in the Trilateral Initiative, in the PMDA, a different team of U.S. officials carried out the bilateral negotiations, and the IAEA was informed of the PMDA for the first time when the negotiations were essentially concluded. Nor did the PMDA include provisions for taking classified forms of fissile material into monitored operations. To be sure, the
PMDA provides for the possibility of IAEA verification and calls for "early consultations" with the IAEA to work out the verification arrangements, but those consultations have yet to be held.

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