Prospects for Excess Material Verification and Prospects for a Fissile Material Cut-off Treaty

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Abstract:

By September of 1994, the United States had declared some 227 tons of fissile material to be excess to its defense requirements, and submitted ten tons of HEU and two tons of plutonium to IAEA safeguards under its Voluntary Offer Safeguards Agreement. Nine years later, that amount remains unchanged although it is expected to increase in the near future. The US pays the IAEA to carry out its inspections. Similarly, the United Kingdom reviewed its defense requirements and as a result, released several tons of fissile material, which are now subject to Euratom safeguards and could be subject to IAEA safeguards if funding were made available.

In this paper, I consider the steps that could lead to determinations by States possessing nuclear weapons to declare portions of their inventories as "excess". Speculations on eight States possessing or assumed to possess nuclear weapons will be offered. A four-layer scheme will be shown which would encompass different forms of material and different levels of verification for proliferation and arms control purposes.

Three mechanisms for verification will be reviewed – the voluntary offer safeguards agreements, the Trilateral Initiative, and a "treaty banning the production of fissile material for use in nuclear weapons or other nuclear explosives". The types of considerations that States would likely go through to determine whether they might make undertakings related to excess fissile material stocks, and to an FMCT will be considered, together with a speculation on the current prospects and on steps that might lead to the adoption of such new measures.

Introduction

Fissile materials are essential for the operation of all nuclear weapons. Hence, controls on the production, use and export of fissile materials presents a means to prevent the proliferation of nuclear weapons. Applied in States possessing nuclear weapons, such controls provide a means to limit their ability of to expand their arsenals and to encourage and monitor progress towards nuclear disarmament. For the purposes of this paper, those States are: France, India, Israel, Pakistan, the People's Republic of China, the Russian Federation, the United Kingdom and the United States.

To progress towards nuclear disarmament, it will be necessary to turn off the tap – i.e., to halt further production of fissile material for use in nuclear weapons or other nuclear explosives, which is the purview of the FMCT. Moreover, it will be necessary to establish a mechanism to render excess increasing amounts of fissile material currently used in, or set aside for use in, or available for potential use in nuclear weapons, and to bring such excess material under verification to ensure that it is not taken back.

Excess Fissile Material

Fissile material might be ”excess” to the nuclear weapons program of a State possessing nuclear weapons for a variety of reasons:

- The fissile material was not created for or ever intended to be used for such purposes (including fissile material produced in peaceful nuclear activities and fissile material produced for non-explosive military applications);
- The fissile material was produced beyond the amounts stipulated by the State in its military planning (including plutonium being produced by production reactors that remain in operation to provide electricity and district heating at two complexes in the Russian Federation); and
- The fissile material results from dismantling nuclear warheads no longer required in the arsenal of the State, as a result of a unilateral reduction (for example, as in the case of the United Kingdom), or as a result of a negotiated reduction (for example, in the case of the Russian Federation and the United States).

“Excess” fissile material might be made subject to controls through a variety of means:

- The State might submit its excess fissile material to IAEA Safeguards under a voluntary offer safeguards agreement or, conceivably, under a safeguards agreement based upon INFCIRC/66 (in the case of France or the United Kingdom, it might also submit it to mandatory inspection by Euratom)
- The State might submit its excess fissile material to bilateral or IAEA controls in connection with an agreement developed for such a purpose (for example, in connection with the US-Russian bilateral Plutonium Management and Disposition Agreement (PMDA), or an agreement arising from the Trilateral Initiative)
- A future treaty banning the production of fissile material for use in nuclear weapons or other nuclear explosive devices could encompass civil stocks and excess fissile material resulting from dismantled weapons, for example. If so, the provisions of the treaty would likely supercede all other arrangements.

Today, excess fissile material has been committed to inspection in the United Kingdom, the United States and in the Russian Federation.

- In the United Kingdom, as part of a defense restructuring program, Britain’s bomber weapons and Polaris submarine weapons were scrapped, leaving its Trident fleet. In that reduction, 300 kgs of weapon-grade plutonium was released from weapon use and submitted to safeguards;[1]
- In the United States, ten tons of HEU is under IAEA safeguards at Y12, plus approximately two tons of plutonium is under IAEA safeguards at the Hanford Site and the Savannah River Site;
- In the Russian Federation, the United States has contracted to purchase 500 tons of HEU, which is being blended down to LEU in Russia before being shipped to the United States for use in the manufacture of light water reactor fuel;
- In the United States, HEU is being downblended to LEU at the BWXT plant in Lynchburg, Virginia; and
- The Russian Federation and the United States have entered into a bilateral agreement under which each will “disposition” 34 tonnes of weapon-grade plutonium. Implementation will

involve processing that plutonium into fuel for nuclear power reactors and irradiating the fuel to minimum specified levels. To commence, adequate financial resources must be obtained to support the operations in the Russian Federation, and outstanding issues of liability and verification need to be resolved.

There is no single binding framework for these submissions – some are voluntary in nature, while others have a legal basis. Clearly, the three States are concerned with showing progress in relation to their commitments under Article VI of the NPT.

The Security / Verification Dilemma

Much of the weapon-grade fissile material that has been designated as "excess" is in the form of nuclear warhead components, with classification and protection measures implemented to prevent any access to information related to the design or manufacture of such weapons. It will take a long time and a large amount of money to process these materials to remove their unclassified characteristics.

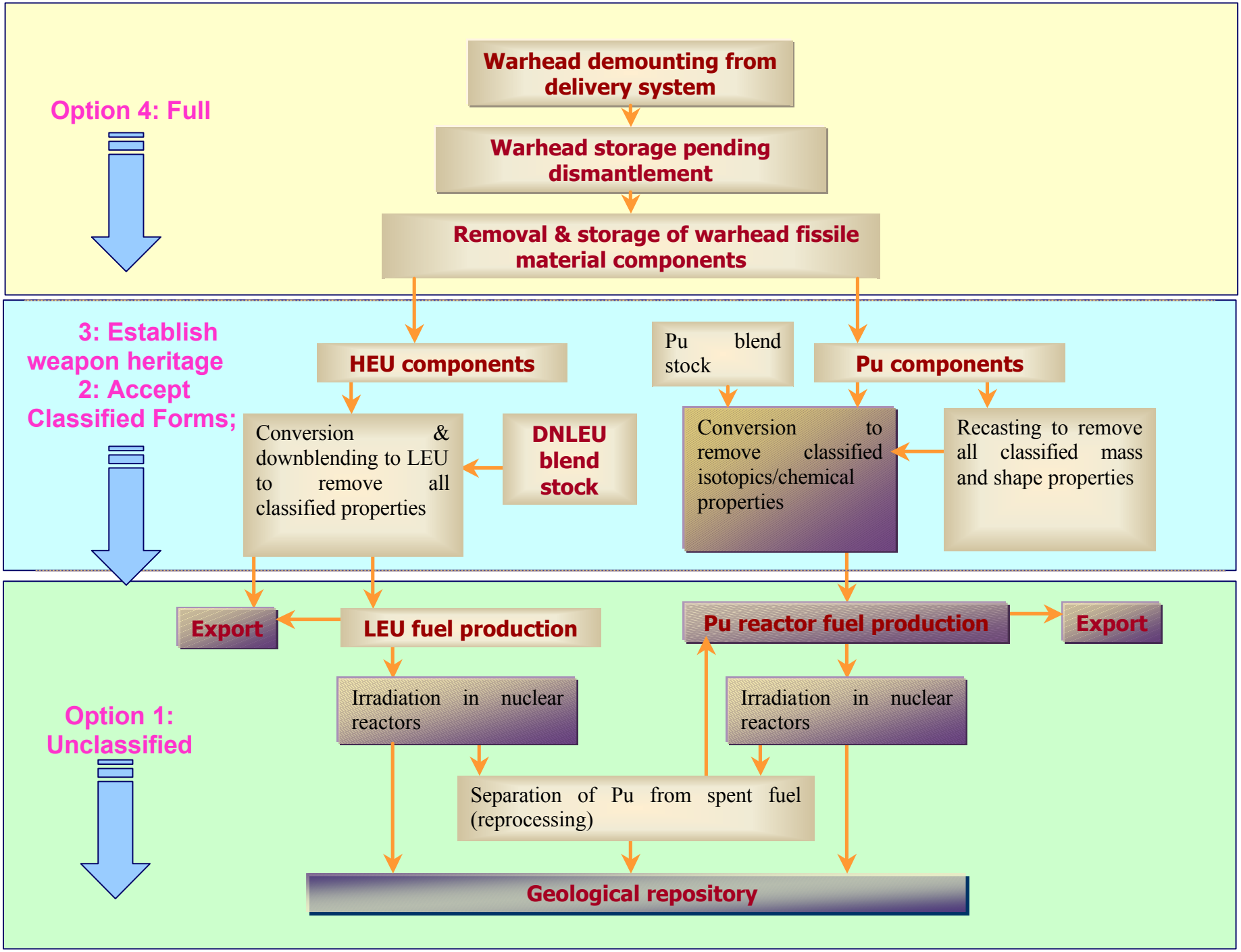
Finding a means that could allow fissile material with classified characteristics to be submitted for verification would allow much greater amounts of fissile material to be brought under verification much faster than if it became necessary to wait until the conversion operations had been completed. From an arms control point of view, this would be highly advantageous.

The Trilateral Initiative between the Russian Federation, the United States and the International Atomic Energy Agency was undertaken for just this purpose. The initial charge of that Initiative was to investigate the technical, legal and financial issues that would have to be resolved before the IAEA could be assigned such a mission. This initial charge was successfully completed last year: it was agreed that the technical measures developed under the Trilateral Initiative could allow the IAEA to verify any form of fissile material without gaining access to sensitive information. The legal framework developed was ready to go, and the financing of verification was explored.[2] It is anticipated that work will commence in the coming months to move from this focus to the initial stage of verification, concentrating on unclassified fissile material under the PMDA.

The extent to which security and verification present a dilemma would depend upon the material submitted and the nature of the verification undertaking. As shown in the following illustration, four levels of verification might be considered.[3]

As illustrated, at the lowest level, only unclassified forms of fissile material are irrevocably removed from weapon use, and verification is undertaken to ensure that those materials are not used thereafter for such purposes. This is important in its own right, but in the case of the PMDA, for example, the throughput of the MOX fabrication plants is planned for 2 tonnes per year, meaning that it will take at least 17 years after the plants are built and commissioned before the 34 tonnes has been brought under verification.

At Level 2, classified forms of fissile material could be admitted for verification, making it possible (in the PMDA case) to bring all 34 tonnes under verification even before the MOX plants are built. Level 2 does not entail verification of heritage; it simply speeds the process of accepting the materials and assuring that they are not returned thereafter to weapon use. (This was the basis for the Trilateral Initiative.)


Option 4: Full
Warhead demounting from delivery system
Warhead storage pending dismantlement
Removal & storage of warhead fissile material components
3: Establish weapon heritage
2: Accept Classified Forms;
HEU components
Pu blend stock
Pu components
Conversion & downblending to LEU to remove all classified properties
DNLEU blend stock
Conversion to remove classified isotopics/chemical properties
Recasting to remove all classified mass and shape properties
Export
LEU fuel production
Pu reactor fuel production
Export
Option 1: Unclassified
Irradiation in nuclear reactors
Irradiation in nuclear reactors
Separation of Pu from spent fuel (reprocessing)
Geological repository

At Level 3, additional attributes would be confirmed that would establish that the fissile material in a container was a nuclear weapon or a component thereof. Several attributes have been considered for this purpose, under programs carried out in the United States and the Russian Federation, and also in the United Kingdom. Level 3 makes it possible to monitor the process of nuclear arms reductions in addition to assuring that the fissile materials are permanently removed from weapon use.

With the capabilities for either Level 2 or 3, it would be possible to verify the removal of warheads from delivery systems, through the use of tags and seals and perimeter monitoring of conversion plants, which would establish continuity of knowledge from removal through irradiation. This capability would enable verification of the dismantlement of warheads from specific delivery systems.

The capabilities exist – further development would be required to field such devices, to allow security officials of the States where inspections would be carried out to satisfy themselves that there could be no inadvertent or intentional ways through which inspections might lead to releasing classified information. Similarly, further development would be required to convince the inspecting party that the verification equipment and the special procedures that would govern its use would still allow for credible and independent findings.

Excess Fissile Material in a Cut-Off Treaty

2003 marks the tenth anniversary of a United Nations Resolution calling for a treaty banning the production of fissile material for use in nuclear weapons or other nuclear explosive devices. That treaty is to be drafted by the United Nations Conference on Disarmament (CD), which has been blocked by political interventions and essentially no progress has been made on that treaty up to now.

In today's world where seven nations have tested nuclear weapons, one other is assumed to have an extensive arsenal, and a small number of additional States that harbor nuclear ambitions, the role of such a treaty should be seen in relation to nuclear disarmament (capping the sources of fissile material and encouraging subsequent arms reductions), non-proliferation and preventing nuclear terrorism.

The words "banning the production" can be seen as having both a backward and forward relevance. Specifically, they can be interpreted to mean:

- Ceasing production activities carried out for nuclear weapons manufacture prior to the entry into force of the treaty;
- Prohibiting future production intended for nuclear weapons or other nuclear explosives subsequent to entry into force in all States;
- Submitting to verification under the treaty, fissile or fissionable material produced prior to the entry into force of the treaty which has been declared by a State Party to be excess to its military program requirements,
- Submitting to verification under the treaty, fissile or fissionable material produced in peaceful nuclear applications prior to the entry into force of the treaty;
- Conducting all future production for peaceful applications and non-explosive military applications under approved conditions and subject to verification; and
- Assuring that fissile material permitted under the treaty for peaceful use or for non-explosive military applications does not become available – intentionally or unintentionally – for use in the manufacture of nuclear weapons or other nuclear explosive devices by other States or sub-national entities.

Under such an interpretation, a treaty banning the production (past, present and future) of fissile material (not already in nuclear weapons or set aside in "strategic reserves") would encompass stocks

of fissile material that are determined by the State to be excess to its requirements. The treaty might also require that additional amounts of fissile material would be declared as excess and become subject to the treaty on the occasion of any unilateral or negotiated arms reduction.[4]

Prospects for Excess Material Verification

Progress could come about through various means:

- Unilateral steps might be taken by any State possessing nuclear weapons, if it were to determine that the stocks it possessed were beyond any need and that there might be political or economic benefits to declaring fissile material to be "excess" and submitting it to verification.

- Additional bilateral steps might be negotiated by States that have moved past the likelihood of confrontation.

- Progress is made in relation to a multilateral treaty, specifically, on the FMCT, banning the production of fissile material for use in nuclear weapons or other nuclear explosive devices.

The driving force might be inward, as a State seeks to evidence leadership, or might be in response to increasing pressure. The non-nuclear weapon States Parties to the NPT, for example, continue to exert pressure at the five-year Review Conferences, and at the three PrepCons held prior to each Review. Moral suasion had not been adequate to motivate any significant steps thusfar.

The best bet, to my mind, is for the international community to come together around a treaty banning the production of fissile material for use in nuclear weapons or other nuclear explosive devices, one that encompasses the scope laid out above, that offers the prospect for changing the world through a multilateral (hopefully universal), non-discriminatory and effectively verifiable treaty.

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[1] United Kingdom Ministry of Defence, Strategic Defence Review, 1998.

[2] T. Shea, The Trilateral Initiative: The Initial Charge and What Follows, Proceedings of the Annual Meeting of the Institute of Nuclear Materials Management, July 2003.

[3] **Transparency in Nuclear Warheads and Materials: The Political and Technical Dimensions (Sipri Research Reports),** Nicholas Zarimpas (Editor), Oxford University Press, 2003.

[4] A draft treaty addressing this scope will be published in the Fall 2003 issue of the Journal of Nuclear Materials Management.