

Halting the Production of Fissile Materials for Nuclear Weapons

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Halting the Production of Fissile Materials for Nuclear Weapons

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Preface

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The Institute's work, which is based on the provisions of the Final Document of the Tenth Session of the General Assembly, aims at:

1. Providing the international community with more diversified and complete data on problems relating to international security, the armaments race and disarmament in all fields, particularly in the nuclear field, so as to facilitate progress, through negotiations, towards greater security for all States, and towards the economic and social development of all peoples;
2. Promoting informed participation by all States in disarmament efforts;
3. Assisting on-going negotiations on disarmament and continuing efforts being made to ensure greater international security at a progressively lower level of armaments, particularly nuclear armaments, by means of objective and factual studies and analyses;
4. Carrying out more in-depth, forward looking and long-term research on disarmament so as to provide a general insight to the problems involved, and stimulating new initiatives for new negotiations.

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UNIDIR takes no position on the views and conclusions expressed in these papers which are those of their authors. Nevertheless, UNIDIR considers that such papers merit publication and recommends them to the attention of its readers.

Sverre Lodgaard
Director, UNIDIR

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Chapter 1

A Convention on the Prohibition of the Production of Fissile Material: Uncertain Benefits for Non-Proliferation

Thérèse Delpech¹

The subject of an internationally agreed halt to the production of fissile material for explosive purposes has recently resurfaced. A General Assembly resolution opened the way to negotiations, which are to be undertaken within the Conference on Disarmament (resolution 48/75 of 16 December 1993, adopted without a vote). The foreseeable difficulties of the negotiations, the ambiguity of the proposal in terms of the objective of non-proliferation and the uncertainties weighing upon the participation of the main parties concerned seem to suggest that such a convention may well offer only limited benefits.

- I -

On 26 September 1993, the United States put forward a major *non-proliferation initiative*. The new administration announced that this would be a priority issue on account both of the fresh attention given to proliferation at the end of the cold war, particularly after the Iraqi experience, and of the prospect of the NPT Extension Conference in 1995. The continuation of the United States moratorium on nuclear testing and that country's determination to play a leading role in the negotiation of the future test-ban treaty were to be seen in that context.

The American initiative included, among the most important proposals, a projected convention on the halting of the production of plutonium and highly-enriched uranium for explosive purposes. The first American proposal on this subject dates from the early 1950s, at a time when the concern was to try to halt Soviet production. This was not an outright success, but since then the

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subject has regularly come up again. Recently, political conditions seemed particularly favourable to the concluding of an agreement, with the end of the East-West confrontation. A unilateral initiative by the Bush administration, made public in July 1992, had already made it possible to announce the interruption in the United States of the production of fissile material for explosive purposes. At the United Nations General Assembly in autumn 1992, there was a revival of interest in this issue. France, for its part, chose for the first time abstention rather than a negative vote on the First Commission's traditional resolution on this subject.

The aim underlying the new proposal was to give another dimension to the unilateral initiative by clearly announcing that the overall objective was to reduce the stockpiling of fissile material deriving both from weapons and from civil activities while seeking to secure the cooperation of all the parties concerned. The proposed convention banning the production of fissile material for explosive purposes was to be understood in this context. It was addressed to nuclear powers and threshold nuclear countries alike. For the former, it would involve a solemn undertaking, through a legally binding instrument, not to produce the material concerned and thereby to participate in a disarmament measure; for the latter, it would lead to the freezing of their production capacities.

This proposal was made in a new strategic scene. Measures towards nuclear disarmament were beginning to be truly far-reaching with the signing of the START I and START II Treaties. The Secretary of State for Energy announced in May 1992 that for the first time since 1945 the United States was no longer producing nuclear weapons. The implementation of the new disarmament treaties was to release hundreds of tonnes of fissile material. The future fate of these products (storage, recycling, etc.) was becoming especially important in view of the fact that the situation prevailing in the former USSR following the break-up of the Soviet Empire could legitimately arouse concern as to their control (physical protection and accountancy system). To this should be added the United States conviction that nuclear weapons would no longer play in future the central role that had been theirs since the end of the Second World War, and that there was therefore no point in continuing to produce material that was already available in huge quantities when there did not appear to be any call to use it in future for explosive purposes.

On this sensitive issue of the *legitimization of existing stocks*, a regional approach is clearly called for, as the situation of the various countries is scarcely comparable.

- In the case of *India*, it is true that in 1954 that country proposed a universal, non-discriminatory convention of this type, but that was 40 years ago. At that time, India had not produced a nuclear explosion, which did not occur until 20 years later, the NPT did not exist and China was not the rising power it is today. Despite that, India took the idea up again in 1982 and has expressed its willingness to enter into negotiations on this subject, on the twofold condition that they be non-discriminatory and that the commitments under the Convention be interpreted very restrictively. From the Indian standpoint, the best way of justifying a convention of this type in the eyes of public opinion is both to claim that it puts Pakistan in an awkward position and to deny precisely what others would like to see acknowledged, namely that this is a first step and that the second could lead to the acceptance of comprehensive safeguards and accession to the NPT.

- In the case of *Pakistan*, the ambiguity is just as great. Pakistan refuses any approach that could lead it to sign the Non-Proliferation Treaty unless India undertakes to do likewise. It could also, after comparing its stocks of fissile material with those of India, have come to the conclusion that it would be advantageous to it today to halt production in both countries now. The fact is that the current disproportion between the two could be expected to increase in coming years. Pakistan could therefore have chose to accept the terms of the convention so as to ensure that the present disparity between stocks of fissile material in the two countries does not increase, leaving it at a greater disadvantage if production is not frozen. Such is not exactly, however, Pakistan's position on this matter at the present time, since this country insisted in having the existing stocks within the scope of the convention, a move with prevented the CD from adopting a mandate in September (1994) on the issue. But still the disproportion between the Indian and the Pakistani current stocks is the major problem to solve for Islamabad.

- In the case of *Israel*, the problem is somewhat different, for while it may refuse the NPT as sharply as India or Pakistan, it has never been that country's intention to acquire an intermediate status or to have its military capacity officially recognized. The Israeli position in the nuclear field is ambiguous and is summed up by the formula: "Israel will not be the first country to introduce nuclear

problem raised by the future instrument, particularly since the cases of Iraq and especially North Korea show how central the question of fissile material is and how difficult it is to find an adequate response to flagrant cases of non-fulfilment of the obligations assumed.

- It has never been possible in *Iraq*, where the clandestine nuclear programme has assumed exceptional proportions, to prove that fissile material for explosive purposes had been produced by means of the clandestine facilities detected. There can be no doubt about Iraq's intentions to produce highly-enriched uranium, amply attested to by the sites of Tarmiyah, ash-Sharqat and al-Furat. The facts have not, however, yielded evidence of Iraq having produced uranium more than 14 per cent enriched.

As regards plutonium, only a few grams of plutonium have been identified and it is now firmly believed, even though it continues to be maintained in some quarters that this had to be the "logical" choice for Iraq, that the plutonium option was not the one favoured by the Iraqi authorities. All the enrichment processes seem to have been explored at great expense, sometimes in quite unnecessary ways that cannot easily be explained, but we have no evidence of any serious effort in regard to reprocessing.

- This does not hold true in *North Korea*. For a year, Governments have been particularly troubled about the quantity of plutonium that the North Koreans may have diverted and used for military purposes, and the possible existence of a reprocessing pilot plant. If certain recent statements are to be believed, enough plutonium has in any case been produced to enable them to manufacture at least one nuclear weapon. The attitude of the international community is very telling here: over a period of a year, no satisfactory response has been found to the Korean case. The view could however be taken with some justification that observance of existing international commitments is the only way of giving sufficient credit to new non-proliferation initiatives.

The prospect of a convention prohibiting the production of fissile material consequently inspires mixed feelings where non-proliferation is concerned. The negotiations should offer an opportunity to reflect on ways of improving the means of detecting clandestine activities. They should also be an occasion for reconsidering the measures to be taken in cases of non-fulfilment of the obligations assumed.

Chapter 2

A Nuclear Weapons Materials Production Cut-Off: An Idea Whose Time Has Come

*Lewis A. Dunn*¹

In September 1993, President Clinton proposed negotiation of a global, multilateral, and verifiable convention to ban the production of plutonium or highly enriched uranium for nuclear weapons, nuclear explosives, or not under international safeguards - or, for short, a cutoff. Since then, a number of steps have been taken. The United Nations General Assembly has endorsed the concept, consultations have been held among nations and at the Geneva Conference on Disarmament (CD), and progress made toward creation of a formal CD Ad Hoc Committee with a mandate to negotiate a cutoff agreement.

Nonetheless, reactions to the proposed cutoff remain mixed. Skeptics argue that with the end of the Cold War, a global cutoff convention is an idea whose time has passed. Even among many of its potential supporters, concerns have been expressed, for example, that negotiation of a cutoff would divert the Conference on Disarmament from the more urgent task of concluding negotiations on a Comprehensive Nuclear Test Ban Treaty, could adversely impact support for the Nuclear Non-Proliferation Treaty (NPT) and pursuit of its indefinite extension, and would "legitimize" the unacknowledged nuclear capabilities of Pakistan, India, and Israel.

I - Why Cutoff?

Despite these concerns, there are good reasons to continue to believe that overall a cutoff would strengthen not weaken global efforts to contain and then

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reduce the nuclear danger. Each of these potential payoffs of a cutoff agreement is discussed briefly in turn.

1. Buttressing Superpower Nuclear Rollback

A process of rolling-back four decades of US and Russian nuclear competition has begun. Based on formal agreements and informal undertakings, rollback is typified by such steps as sharp reductions of nuclear warheads, decisions no longer to target each other, and agreement to mutually monitored dismantlement of surplus warheads. A cutoff agreement would buttress this process by making legally binding both countries' current political decisions no longer to produce plutonium or highly-enriched uranium for weapons. Its verification provisions at the least would further increase transparency between them. Depending on their specifics, such provisions could also indirectly reinforce other efforts to enhance nuclear materials controls and accounting in Russia, e.g., by requiring precise accounting and tracking of any future production of plutonium and highly-enriched uranium for permitted purposes. Not least, should more nationalist political forces gain power in Russia, a legally-binding cutoff agreement would make it more difficult to reverse the process of superpower nuclear rollback.

2. Capping Regional Proliferation

Negotiation of a global cutoff convention would also support intensified efforts at the least to cap proliferation in South Asia and the Middle East. In particular, a cutoff agreement would provide a vehicle for India and Pakistan to signal their political commitment to avoid open nuclear competition and to restrain their nuclear programs. This step would be consistent with the reluctance of both countries' leaders to cross the nuclear threshold to open nuclear competition. By constraining China as well, a global cutoff convention would also offer a more politically palatable approach to regional restraint from India's perspective. Within a Middle East moving toward peace, adherence to a future cutoff agreement could come to be viewed by Israel as the "least unacceptable" means to signal nuclear restraint. This be an valuable step, though still short of calls from its Arab neighbors and other countries for Israel to join the NPT.

3. Demonstrating Progress on Nuclear Disarmament

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II - Some Negotiating Issues and Choices

It is increasingly clear that negotiation of a cutoff convention raises a number of complex questions and choices. How these questions are answered will influence the extent to which a cutoff's potential non-proliferation and arms control payoffs are realized in practice. Among the most important of these questions are:

- Should the scope of a cutoff agreement be limited to a ban on future production of plutonium and highly-enriched uranium for nuclear explosives purposes?
- If no limits are placed on uses or stockpiles of previously produced materials, should stocks of such materials be declared?
- Should continued production of plutonium or highly-enriched uranium for non-weapons military purposes be permitted?
- Should providing assistance to other countries in production of plutonium or highly-enriched uranium be banned outright, or only for nuclear-explosives purposes?
- Should a more comprehensive or more streamlined approach be taken to cutoff verification?
- What should be the duration of a cutoff agreement?
- What steps, if any, can be taken to contain concerns that a cutoff convention that excludes previously-produced materials will "legitimize" the unacknowledged nuclear powers? and
- What countries' adherence should be considered critical for eventual entry-into-force?

Space precludes a full discussion of all of these questions. Suffice it instead to highlight some considerations that need to be borne in mind in approaching several of the most important of them: treatment of previously produced materials; declarations; verification; and legitimization.

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1. "Grandfathering" Previously Produced Materials

President Clinton's proposal would ban only future production of plutonium and highly-enriched uranium for nuclear explosives purposes. No limits would be set on the use of previously-produced materials, which, in effect, would be "grandfathered." More recently, it has been suggested by some countries during CD informal discussions that a cutoff agreement be extended to include a ban on "stockpiling" fissile material for nuclear weapons or explosives.

This later proposal should be resisted. Efforts to ban stockpiles, rather than focusing only on future production, are all but certain to jeopardize the possibility of eventual agreement. It is very difficult to envisage countries such as India, Pakistan, and Israel - and for that matter, the acknowledged nuclear countries - ultimately choosing to adhere to a cutoff convention unless it excludes previously produced stocks.

2. Declarations of Previously Produced Materials

Even assuming no restrictions on uses of previously produced plutonium and highly-enriched uranium (and no ban on stockpiles), whether or not a cutoff should require that stocks of such materials be declared is another question. Such declarations could take several forms, including declarations of current stockpiles of plutonium and highly-enriched uranium in weapons programs, of current stockpiles without reference to ultimate civil or military status or intended ultimate end use, or of quantities of materials produced in the past for weapons or other purposes.

In the case of the five acknowledged nuclear powers, declarations of on-hand stockpiles of plutonium and highly-enriched uranium (whether in weapons programs or without reference to whether in the civilian or military sectors) would enhance the overall transparency of their nuclear-weapons programs. Particularly for the United States and Russia, but also for others, greater nuclear transparency could be a valuable confidence-building step. It also would reinforce other initiatives (e.g., mutual visits to nuclear-weapons facilities, discussions of nuclear doctrine, and force posture changes) to break down past suspicions and enhance cooperation.

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With regard to the threshold or unacknowledged nuclear countries, the situation is different. Given their long-standing commitment to nuclear ambiguity, India, Pakistan, and Israel might well reject the very idea of declarations of current stockpiles of plutonium and highly-enriched uranium, even if made without reference to civil or military uses. If so, efforts to include required declarations within a cutoff convention could clash with one of cutoff's major non-proliferation goals - capping these countries' nuclear weapons programs. Conversely, should these countries unexpectedly be prepared to declare on-hand stocks, such declarations could backfire. Confirmation of India's large stocks of unsafeguarded plutonium could fuel domestic pressures in Pakistan to step up, not cap, that country's nuclear activities. Similarly, even if Israeli stocks are less than presumed in worst-case Arab analyses, public confirmation of their existence could reopen the nuclear debate in some Arab countries and otherwise prove politically unsettling in a future Middle East moving to implement peace agreements.

3. Verification Choices

Verification of a cutoff agreement is likely to prove one of the most politically difficult and in varying degrees, technically complex issues once full-fledged negotiations begin. Two closely related but separable questions already stand out: What should be the role of the IAEA in cutoff verification? What overall verification approach or architecture should guide crafting of a cutoff verification regime?

There is little if any reason to argue against assigning the eventual responsibilities for *implementing verification* under a cutoff convention to the International Atomic Energy Agency (IAEA). It is an up-and-running inspection organization, has personnel trained in nuclear materials verification, and since its missteps in Iraq has demonstrated creditable rigor in pursuing safeguards in North Korea. Indeed, for parties to the NPT, current verification of that commitment by full-scope IAEA safeguards should suffice to verify any complementary commitment under a cutoff agreement.

Nonetheless, it should not be assumed *a priori* that cutoff *verification* will entail virtual turn-key application of IAEA safeguards, either in the five acknowledged nuclear-weapon states or in non-NPT parties to a future cutoff agreement. The unique characteristics of monitoring former nuclear-weapons facilities in the five acknowledged nuclear powers will all but certainly require

streamlined approach to cutoff verification already are a subject of growing debate. A more streamlined approach would be consistent with the limited goals of cutoff. It also would reflect the fact that significant stocks of unsafeguarded previously produced materials would remain outside a cutoff's purview. This approach also would hold down costs, avoiding a situation in which considerable resources were expended on monitoring activities in the five nuclear powers.

In comparison, a more comprehensive approach would avoid possible perceptions of discrimination between treatment of non-nuclear weapon states under cutoff and under the NPT. It also would avoid similar perceptions of discrimination between treatment of nuclear facilities in the nuclear and non-nuclear NPT parties. A more comprehensive approach, moreover, would reinforce past hard-won IAEA practices (e.g., monitoring of source materials) and help set desirable precedents (e.g., with regard to suspect-site inspections and attempted detection of undeclared activities.)

Striking a balance between these competing considerations, prudence suggests erring initially toward a more not less comprehensive approach in defining the broad outlines of cutoff verification regime. In particular, efforts should be made to contain perceptions of unfair discrimination between non-nuclear and nuclear countries as well as to avoid major inconsistencies between traditional IAEA verification and that of a cutoff convention. Nonetheless, in the end game, winning adherence of some key countries to cutoff as a means to cap their nuclear programs may ultimately require accepting a less not more comprehensive verification regime.

4. The "Legitimization" Conundrum

During preliminary discussions of the idea of a cutoff convention, concerns have been expressed that such an agreement would "legitimize" the unacknowledged nuclear countries. Specifically, skeptics argue that if such a convention would places no limits on previously produced plutonium or highly-enriched uranium, it would be taken to indicate international acceptance of the past nuclear-weapons activities of India, Pakistan, and Israel. It also is feared that efforts to cap not roll back proliferation would be viewed by bystanders as a lessening of international opposition to proliferation.

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representatives visited a US chemical weapons storage site at Tooele, Utah and parties held "trial inspections."

Technical exchanges on verification of a global cutoff could also be arranged on a regional basis, including participation by appropriate outside countries and by the IAEA. Within Asia, for instance, such a session could bring together representatives from China, India, Pakistan, Russia, Japan, and the United States. Within the Middle East, such a meeting would be consistent with Egypt's long-standing efforts to foster discussions on verification of a Middle East Nuclear Free Zone but still might prove acceptable to Israel in the context of progress towards regional peace.

3. Interim Restraints

The United States and Russia in June, 1994 signed a bilateral agreement to shut-down former plutonium production reactors in Russia no later than the year 2000 and to cease use of newly-produced plutonium for nuclear weapons. Successful implementation of this agreement would be a step toward a global convention. In turn, it could provide a means to assess eventual verification concepts and techniques for a wider convention.

Public information suggests that none of the five acknowledged nuclear powers may now be producing either plutonium or highly-enriched uranium for weapons. (Russia's reluctance to shut-down its still operating reactors is said to stem from the lack of alternatives to the energy provided by these reactors, not from their use in Russia's weapons program.) As an interim step to a cutoff, therefore, each of these countries could be urged to declare unilaterally, as the United States has already done, that its policy is no longer to produce either plutonium or highly-enriched uranium for nuclear weapons or explosives.

IV - An Idea Whose Time Has Come

Proposals for an international agreement to ban the production of nuclear-weapons materials have a long history, dating first from the intense Cold War period of the 1950s. Fundamental changes in the US-Russian relationship and in world politics have occurred since then. As a result, there is skepticism in some quarters about a cutoff as a Cold War idea whose time has passed.

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By contrast, a global cutoff convention would usefully reinforce ongoing changes in the US-Russian nuclear relationship, making those changes more irreversible. It also would be a valuable vehicle to bring China and the other medium nuclear powers into a longer-term process of global nuclear arms controls and reductions. Not least, despite its limitations, a cutoff agreement would provide a useful interim measure for capping proliferation in South Asia and the Middle East and helping to head off potentially dangerous nuclear-arms racing in the decade ahead. Cutoff is an idea whose time has come.

Chapter 3

Some Aspects of a Cut-Off Convention

David Fischer¹

I - The Scope of This Paper

President Clinton has revived a forty-year old proposal to put an end to the production of fissile material for nuclear weapons, the so-called "cut-off".² This paper addresses some issues raised by such a cut-off. It examines the way in which a cut-off convention might change the status within the non-proliferation regime of the three remaining threshold states, India, Israel, and Pakistan, and the problems that this might raise for the regime as well as some ways of minimising them. It examines the scope of IAEA safeguards in the eight states likely to be most affected by a cut-off (the five declared nuclear-weapon states (NWS) and the three threshold states). An annex to the paper provides a more detailed analysis of the impacts of a cut-off on the eight states concerned.

II - A "Cut-Off" as Part of a Broader Strategy

Provided that it were ratified by the eight states concerned, a cut-off coupled with a comprehensive test ban treaty (CTBT) and an indefinitely extended NPT, would be an effective brake on further "vertical" as well as "horizontal"

¹ Director and later Assistant Director General for External Relations, IAEA 1957-80.

² On 28 September 1993 President Clinton outlined his Administration's non-proliferation policy. A White House "fact sheet" listed seven proposals. The second was "... a multilateral convention prohibiting the production of highly-enriched uranium or plutonium, and to ensure that where these materials already exist they are subject to the highest standards of safety, security and international accountability" (but the White House made it clear that Western Europe and Japan would not be required to stop the production or use of plutonium originating from US nuclear supplies).

The US does not envisage that the convention would "prohibit the production of tritium or the use of HEU for non explosive military uses such as naval reactors" (Statement by Ambassador Rich of the US to the IAEA Symposium on International Safeguards, 14-18 March 1994).

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III - The Impact of a Cut-Off on the NWS and Threshold States

A cut-off would have few if any strategic implications for the US or Russia. Neither plans to manufacture new designs of nuclear warheads. Each has plenty of spare fissile material (separated plutonium and highly enriched uranium or HEU) for the warheads that either will retain. However, a cut-off is high on the list of the arms control measures sought by the non-nuclear-weapon states (NNWS). The conclusion of such a treaty would help to substantiate US and Russian contentions that they are carrying out their obligations under Article VI of the NPT, and, since it would apply to NWS and NNWS alike, and should bring the entire civilian nuclear programmes of the NWS under IAEA safeguards, it would, in this sense, diminish the discriminatory aspects of the non-proliferation regime. On both counts it would improve the prospects for a successful NPT review and extension conference in 1995.

At the end of 1990 the fissile material held by Britain and France in their nuclear warheads and in storage outside them was a small fraction of US or CIS stocks.⁵ The British stock was nonetheless sufficient to arm 650-700 warheads (in 1993 Britain had approximately 200 warheads) and the French stock enough for 1000-1500 warheads compared with 520 warheads in her 1993 arsenal (for the calculation of these estimates see the Annex).⁶ In short, if the Western Europeans had to replace or wanted to add to their nuclear warheads, the limiting factor is not likely to be a general shortage of fissile material, though there might be shortage of particular types of material. In the final analysis both nations are likely to accept a cut-off though without marked enthusiasm.

⁵ The best researched estimates of the fissile material stocks of the five NWS and of the threshold states are given in David Albright, Frans Berkhout and William Walker, *World Inventory of Plutonium and Highly Enriched Uranium*, SIPRI, Oxford: Oxford University Press, 1993, total "military" stocks are given in a table on p.200 (reproduced in the Annex to this paper). It should be noted that Britain, apparently alone amongst the NWS, has a large stock of fuel-grade or reactor-grade plutonium in her military stockpile, namely 7.6 tonnes and only about 2.8 (+0.7) tonnes of weapon-grade plutonium (*ibid.* p.43). Only the weapon-grade plutonium is assumed to be usable for making warheads.

⁶ The estimates of the numbers of nuclear warheads possessed by the five NWS are taken from "Nuclear Pursuits", *The Bulletin of the Atomic Scientists*, May 1993, pp.48-49.

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India and, in terms of nuclear explosive potential, much larger than Pakistan's.¹² Finally Israel, unlike the other two threshold states, has at present no real or potential nuclear armed adversary.

A cut-off, would leave India with rather ample stocks of fissile material (weapon-grade plutonium), but if the cut-off were combined with a CTBT, India would be left with few nuclear warheads,¹³ with little prospect of developing a nuclear-armed ballistic missile (since this would probably require a series of nuclear tests). For the foreseeable future India would be condemned to remain greatly inferior to China in nuclear punch (this might well be the case even without a cut-off and a CTBT). It is argued below that a cut-off convention would probably require the threshold states to place their entire civilian nuclear industries under IAEA safeguards. This would be relatively easy for Israel and Pakistan; all their civilian nuclear plants are already under safeguards (in Israel's case a single small research reactor at Nahel Soreq) Such a requirement would be much harder for India to swallow. Since the mid-1950s when the safeguards clauses of the IAEA's Statute were being negotiated India has consistently resisted IAEA safeguards and most of her quite extensive civilian industry is still unsafeguarded.¹⁴

¹² There have been widely differing estimates of the size of Israel's nuclear arsenal. Spector puts the figure at 60-100 devices (Leonard S. Spector with Jacqueline R. Smith, *Nuclear Ambitions*, Boulder, Colorado: Westview Press, 1990, p.149). Albright et al., 28 to 118, according to various estimates of Dimona's power (Albright, et al., *World Inventory*, p.156). The ISS *The Military Balance 1993-1994* "up to 100".

¹³ Indian officials deny any deployment of nuclear warheads and this claim is widely accepted but senior members of the Atomic Energy Authority also maintain that India could make nuclear explosive devices within a matter of weeks (Albright et al, *World Inventory*, p.158). India's sole nuclear test took place nearly twenty years ago, and the "device" tested was not a warhead. To progress from a single test to a missile-mounted nuclear warhead would be likely to require a series of tests.

¹⁴ The only Indian plants continuously under IAEA safeguards are four power reactors acquired in the 1960s two from Canada and two from the US. The Prefer reprocessing plant and certain fuel fabrication facilities at Hyderabad, come under IAEA safeguards when they are handling safeguarded fuel. All ten nuclear power plants that India has built since the 1960s or is building are unsafeguarded replicas of the Canadian plants. For safeguarded plants in India see *The Annual Report for 1992*, IAEA, pp.153, 160 and 161.

There is likely to be support for linking the duration of the convention to that of the NPT and the CTBT. It is hardly likely that the NWS would accept an indefinite cut-off if the renunciation of nuclear weapons by the NNWS were of a more limited duration. If, as seems likely, the cut-off convention required comprehensive safeguards on the civilian nuclear programmes of all its parties the NNWS party to the NPT are also not likely to accept such safeguards for a period that is longer than that prescribed by the NPT.

The fervent proponents of a CTBT and of a cut-off in the NWS should therefore know that neither of their goals is likely to be achievable unless it is accompanied by a concurrent NPT; in other words the three treaties should run in tandem. Since they would be mutually reinforcing they should logically have the same duration - preferably indefinite.

Safeguards Agreements with the IAEA

To verify compliance with the cut-off it is assumed that each party will conclude an agreement for the eventual application of the IAEA's safeguards to all its civilian nuclear activities.

The existing "full-scope" safeguards agreements between the IAEA and the NNWS party to the NPT should meet the requirements of a cut-off convention provided that the duration of the convention was the same as that of the NPT.

Each NWS has a safeguards agreement with the IAEA requiring it to inform the IAEA of the plants on which it will accept safeguards (all wholly civilian plants in the case of the US and UK, a more restricted list in the other cases). From these lists the IAEA selects a handful of plants for the full application of safeguards (in the case of Britain and France, EURATOM applies safeguards to all plants and material on the lists).

Clearly all agreements with NWS under a cut-off convention should be essentially identical in coverage and approach. Each NWS should supply a list of all civilian and former military plants and nuclear material that will be subject to safeguards and the IAEA should be required to apply its safeguards (together with those of EURATOM in the British and French cases) to all items on the list. With modifications on these lines and harmonization of the US agreement with those

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of the other four NWS the existing agreements with the NWS would serve the purposes of a cut-off

Each threshold state must also be required to conclude a safeguards agreement similar in scope to those with the NWS.

The question whether the NWS and the threshold states should be required to declare all nuclear material and any plants that will not be subject to safeguards will be examined later.

V - Pitfalls to be Avoided

Pitfall 1: The Threshold States are Recognized as Quasi-Nuclear-Weapon States

It is assumed that the proposed cut-off convention will not impose any requirements (other than - possibly - an inventory declaration) in respect of fissile material produced by a state party to the convention before it brings the convention into force. To use the American expression, such fissile material will be "grand-fathered" and it is assumed that the state concerned, whether or not it is a declared NWS, will be free to use such "grand-fathered" material as it pleases - to make warheads or for civilian purposes.¹⁸ However, NNWS party to the NPT that join the cut-off convention would not be able to take advantage of this facility since all their fissile material will remain under IAEA safeguards and none may be used to make nuclear warheads.¹⁹ The states that will have exempted material will be the five NWS and potentially the three threshold states, as well as any other NNWS that is not party to the NPT and is able to produce unsafeguarded fissile material.

If these assumptions are correct and if care is not taken, an unintended consequence of the cut-off convention could be to grant treaty recognition to the

¹⁸ This was the understanding of US officials taking part in the Carnegie Endowment non-proliferation meeting in Washington, 15-17 November 1993.
¹⁹ Except fissile material withdrawn from safeguards in accordance with paragraph 14 of the NPT safeguards system (IAEA document INFCIRC/153) for non-explosive military use. Since 1970, when the NPT came into force, there has been no such withdrawal.

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three threshold states (and others of that may join this group) as de facto, perhaps even de jure NWS, having the right to maintain unsafeguarded stocks of fissile material, and, implicitly, having the right to make and retain a limited number of nuclear warheads.

It may be argued that every state inherently has such right unless it has voluntarily renounced it, by, for instance, joining the NPT. But the cut-off convention could be the first affirmation by international treaty of those rights. This would run counter not only to the fundamental aim of the NPT which is to prevent "the wider dissemination of nuclear weapons".²⁰ It would, in effect, give preferential treatment to the states that have "proliferated" sub rosa since 1970 (and to other non-parties to the NPT that might do so in the future). It would also clearly set the three threshold states aside from the NPT NNWS to whom the right of maintaining unsafeguarded stocks of fissile material and doing as they please with them, is explicitly denied. In fact, under the cut-off convention the three threshold states (and any other state that might join them) might be subject to a regime that was, in some ways, less restrictive than that under which the five NWS now operate. The threshold states are and would remain free from the obligations that the NPT imposes on the NWS under Articles I, III.2 and VI²¹ of that treaty. Obviously too, the IAEA could not require special inspections of the "grandfathered" material.

Of course, the obligations that the NPT imposes on the NWS could be built into the cut-off convention. However, unless the obligations imposed by Articles I and VI were formulated in such a way as to apply to all states (including NPT NNWS) incorporation of those articles might enhance the impression that the threshold states were henceforth recognized, by treaty, as NWS. Some circles in India have long pressed that their country should be so regarded. This would be contrary to the intention of Article IX.3 of the NPT.²² The cut-off convention should not become a means of circumventing that article.

²⁰ NPT, fourth preambular paragraph.
²¹ Article I of the NPT imposes an obligation on "Each nuclear-weapon State Party to the Treaty not to transfer to any recipient whatsoever nuclear weapons... [emphasis added]. Article III.2 requires all parties to ensure the application of IAEA safeguards on certain nuclear exports. For Article VI see footnote 2.
²² "... For the purposes of this Treaty, a nuclear-weapon State is one which has manufactured and exploded a nuclear weapon or other nuclear explosive device prior to 1 January 1967...".

Despite any such disclaimers the fact would remain that the convention implicitly recognized the right of certain NNWS party to it to keep unsafeguarded stocks of fissile material and to make nuclear warheads. The NNWS party to the NPT and abiding by its provisions are likely to be unhappy about any provision in the convention that appeared to confer special privileges on NNWS not party to the NPT. The best way to avoid this impression would be to make it clear that in the case of the threshold states the convention was only an intermediate step to the establishment of nuclear-weapon-free zones, and, in the case of the NWS, to nuclear disarmament .

Another issue is whether the NWS and the threshold states will have to declare the amount, composition and location of "grandfathered" nuclear material and of relevant plants and stores when they join a cut-off convention. Unless such declarations are made, the risk arises that if the IAEA discovered some undeclared material, the state concerned will simply claim that it was produced before the cut-off, and that it was under no obligation to declare it.

**Pitfall 2: Safeguards under the Convention are Regarded
as the Equivalent of Full-Scope Safeguards (FSS)**

The second pitfall is more easily avoided. It may be contended that if the convention implicitly recognizes the right of the threshold states to be regarded as NWS, then nuclear exports to them should be subject to the same regime as that applying to exports to the five recognized NWS under Article III.2. of the NPT (the NPT does not require any safeguards on nuclear exports to the five NWS). It should be made clear that the safeguards applied to nuclear material that has not been "grandfathered" do not equate with the comprehensive or "full-scope" safeguards that the Nuclear Suppliers' Guidelines (NSG) now require as a condition for nuclear supplies. In other words, the ban on nuclear exports must remain in place in the case of NNWS not party to the NPT or to an equivalent non-proliferation regime. If this ban were lifted, the basis of the NSG would be undermined and the two decades spent in establishing full-scope safeguards as the cardinal condition of supply, would have been largely wasted.

Is a Cut-Off Verifiable?

One of the first questions that will be asked is whether a cut-off can be effectively verified by the organization that will be given this task; in the first place

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the IAEA. Verification would indeed entail a very substantial expansion of IAEA safeguards, but the types of nuclear plant that the IAEA would safeguard would generally be the same as those already under safeguards in NNWS and in several cases, also in the NWS. Even today, nearly all reprocessing plants in both the NWS and NNWS of the EU are under EURATOM safeguards, and in some cases, partly under IAEA safeguards. All operating and planned reprocessing plants in Japan are or will be under IAEA safeguards.²⁴ The task ahead would be to bring reprocessing plants in the US, Russia, Israel and India under safeguards or to verify that they had been and remained shut down. Similarly all enrichment plants in the EU are under the safeguards of EURATOM²⁵ or of both agencies, and in Japan under IAEA safeguards. Under a cut-off it would be necessary to extend safeguards to US, Russian and Pakistani plants or to verify closure. The problem would be one of resources rather than devising new additions to the safeguards system though a good deal of ingenuity may be needed in designing effective safeguards for plants producing tritium, HEU for non-explosive military purposes and reprocessing plants that produced military plutonium and were not planned with international safeguards in mind.

The five NWS would have a strong incentive to demonstrate that the cut-off was effective and, in most cases, having ample stocks of fissile material they would also have little if any incentive to divert safeguarded nuclear material (though the UK might have difficulty in obtaining sufficient HEU for her nuclear warships and both Chinese and British stocks of weapon-grade plutonium are limited). The same cannot be said of all three threshold states. The incentive to divert would be roughly in inverse proportion to the size and composition of the state's stock of usable fissile material at the time that its entire civilian programme came under safeguards - the smaller the stock in relation to perceived military needs, the larger is likely to be the incentive to divert. This might point to Pakistan as having the strongest incentive, but the possibility of diversion, in this case, is very limited.²⁶

²⁴ Other examples are the gaseous diffusion enrichment plant at Pilcaniyeu in Argentina, the "helikon" process enrichment plant at Valindaba in South Africa.
²⁵ Except, apparently, the high enrichment cascades at Tricastin in France.
²⁶ Pakistan will have two power reactors and a single research reactor under safeguards, one of power reactors and the research reactor have been under safeguards for nearly thirty years, the second power reactor is of the most common type and relatively easy to safeguard Pakistan has no significant reprocessing capability, her unsafeguarded HEU derives from the her centrifuge enrichment plant (Kahuta) which would be shut down or re-configured to produce low enriched

Annex

In July 1992 President Bush announced that the US had permanently stopped the production of fissile material for nuclear warheads. With the end of the Cold War it has become clear that the US has large and growing surpluses of plutonium and probably of HEU. Russian stocks of plutonium and HEU recovered from dismantled warheads are likely to be even larger.

The HEU that the US extracts from her own warheads, or is buying from Russia, will be "blended down" (diluted with natural or depleted uranium) to about 3% enrichment and will provide a substantial amount of fuel for the 109 nuclear power reactors that were in operation in the US at the beginning of 1993.²⁸

Dealing with surplus plutonium is less simple and much more controversial. Should it be re-integrated into and treated as nuclear waste? Or used as fuel for power reactors in the form of mixed oxides of plutonium and uranium (MOX), or in fast breeder reactors? Or should it simply be kept in storage until a final decision about its fate can be taken? Whatever course is chosen, most of the recovered plutonium will have to be safely and securely stored for many years to come. The same questions may have to be answered in regard to civilian plutonium of which there is a substantial and growing stock

The production of fresh HEU in Russia has stopped, and it is reported that Russia has agreed to close down her three remaining plutonium production reactors.²⁹

However, the ultimate fate of Russian and American fissile material surpluses need not concern us further here. For the purpose of this paper the relevant and obvious conclusion is that a cut-off of fissile material production for military purposes would have few, if any, strategic implications for either nation.³⁰ Unless, of course, the Cold War and the nuclear arms race were to revive, which seems most improbable.

²⁸ *Nuclear Power Reactors in the World*, April 1993 Edition Reference Data Series No 2.

²⁹ "La Russie met fin à sa production de plutonium militaire", *Le Monde*, 19 March 1994.

³⁰ However, the effect of the cut-off convention, coupled with the application of safeguards to plutonium retrieved from warheads, could be to reduce US and Russian stocks of fissile material available for nuclear warheads.

The impact of a cut-off on the other three recognized nuclear-weapon states is less clear. The following table shows their estimated stocks of fissile material in all five NWS at the end of 1990.

Estimated plutonium in military stockpiles at the end of 1990³¹

CIS	125.0
USA	112.0*
UK	11.0
France	6.0
China	2.5

* Information recently released by the US Department of Energy puts this figure at 89 tonnes.

Central estimates of HEU at the end of 1990

CIS	720
USA	550
UK	10
France	15
China	15

Britain, France and China also tend to be more secretive in these matters than the US or Russia and there is thus greater uncertainty about these estimates of their military stocks. If they are roughly correct, however, it is clear that China has less "military" plutonium to spare than either Britain³² or France, and about the same amount of HEU as France.

³¹ Albright, et al, *World Inventory*, pp.198 and 200.

³² See, however, footnote 4 above on British stocks of weapon-grade plutonium.

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Assuming that the amounts of fissile material in stock today are not significantly different from the above estimates and that, on average, about 4 kg of plutonium and about 15 kg of HEU are needed per warhead, the British stock of 2.8 tonnes of weapon-grade plutonium and 10 tonnes of HEU would be enough to arm approximately 650 to 700 warheads and the French stock (6 tonnes of plutonium and 15 tonnes of HEU) enough for 1000 to 1500 warheads. China's stock should suffice for about 600 warheads.³³

Britain is acquiring Trident missiles from the US for deployment in four Valiant class submarines. After the commissioning of the fourth Valiant Britain has no plans for the production of any new types of nuclear warhead and would not need to produce any more fissile material for military purposes except possibly HEU for submarine fuel. The fissile material for the Trident warheads is produced in Britain; the fuel for all Britain's nuclear powered submarines is partially enriched at Capenhurst, the final (high) enrichment taking place in the US.³⁴ Should any difficulties arise there is nothing in the NPT that would debar the US from providing Britain with HEU from the US' ample stores. Whether the US will be prepared to do so may depend on how compliant the UK is with US plans for nuclear disarmament

Unlike Britain, France has plans for developing new nuclear warheads and expanding her nuclear powered navy, and the current French Minister of Defence, M. Leotard, is insistent on resuming nuclear tests after M. Mitterrand retires from the Elysée in the spring of 1995. In December 1992 the Minister of Defence approved the design of a new strategic nuclear missile (the M5-S5) which will be deployed from about 2000 on French nuclear-fuelled ballistic missile submarines (SSBNs). The first of three new Triomphant class submarines was "rolled out" in July 1993 and the third has been ordered.³⁵ In theory, the US could also provide France with fissile material and nuclear fuel for her navy but French pride in the independence of her force de dissuasion makes this unlikely, or would have done

³³ On the basis of a UN report published in the 1960s the IAEA safeguards operation assumes that a nation would need about 8 kg of plutonium and 25 kg of HEU for its first nuclear explosive. According to Albright, Berkhout and Walker (p.6) "modern weapons are typically estimated to contain on average 3-4 kg of plutonium and 15 kg of weapon-grade plutonium".

³⁴ Norman Dombey, David Fischer and William Walker, "Becoming a Non-Nuclear-Weapon State: Britain the NPT and Safeguards", *International Affairs*, Spring 1987, p.198.

³⁵ *The Military Balance 1993-1994*, International Institute of Strategic Studies (IISS), London: Brassey's, October 1993, p.32.

so in the past. Nonetheless the author has been told that France could accept a cut-off within two or three years when she will have satisfied her HEU needs.

China has more powerful security incentives than any other NWS for expanding her nuclear forces. She has no nuclear disarmament agreement with Russia or the US, the number of warheads in her nuclear arsenal (estimates vary from 300 to 450 warheads) is today a small fraction of the Russian (about 21 000 as of January 1992³⁶) and will still be so when START I and START II are fully implemented, the nuclear environment of North East Asia is markedly less stable than that of the other NWS. Although Sino-Indian relations have greatly improved, there has been no formal settlement of their frontier dispute. It is not surprising, therefore, that China has extensive plans for expanding her nuclear forces. At the same time Chinese stocks of fissile material, although not inconsiderable, are smaller than those of any other NWS except Britain. For security concerns and, to a certain extent, because of her plans for expanding her nuclear forces, it seems likely that China would today be the most reluctant amongst the five NWS to accept a cut-off, just as she was the last NWS to accede to the NPT and seems to be the most reluctant to accept a moratorium on nuclear testing.

The area of uncertainty becomes even greater when one turns to the three other states, India, Israel and Pakistan that are believed to have nuclear weapons or to be able to assemble them at short notice. Estimates of the total quantities of separated plutonium in the case of Israel are 240-415 kg at the end of 1991 and 275-475 kg at the end of 1995 (enough for about 55-95 warheads at the later date assuming 5 rather than 4 kg per warhead).³⁷ The corresponding figures for India are 290 kg and 425 kg separated plutonium, or enough for about 85 warheads at the later date (also at an average of 5 kg per warhead). Neither Israel nor India is thought to have a noteworthy stock of HEU.

Amongst these three states it seems that Israel with no nuclear adversaries (at present) and a nuclear arsenal that is probably substantial and sophisticated, is best placed to accept a cut-off. India's estimated stock of separated plutonium is not far short of Israel's. But India has other concerns. She has two potential nuclear adversaries, China and Pakistan, and she is unlikely to accept a cut-off unless

³⁶ *Arms Control Today*, January-February 1992, p.25. The estimate for the CIS as a whole was 27,000.

³⁷ These and the following estimates are taken from Albright, et al, *World Inventory*, pp.156-166 and in the case of India and Pakistan are stated to be subject to a 25% margin of uncertainty.

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China does so first. While in the case of Israel a cut-off would only mean shutting down one ageing reactor and its associated reprocessing facilities, and, as noted, in Pakistan it would affect only the Kahuta enrichment plant, in India's case a large and variegated civilian nuclear power and research programme would eventually have to come under safeguards, a prospect that is unlikely to be welcome in New Delhi.

Without a cut-off Israeli stocks of plutonium would expand by some 14% between 1991 and 1995, Indian stocks would expand by some 40%, in other words Indian production would be more severely affected than Israel's by a cut-off.

By the end of 1991 Pakistan may have had enough HEU in stock (130-220 kg) for 6 to 10 warheads (assuming 20 rather than 15 kg of HEU per warhead) By 1995 these figures might reach 430-520 kg or enough for about 20-25 warheads compared with about 85 warheads in India, or 4 warheads a year compared with India's 25 or more.

Pakistan is thus likely to have mixed feelings about a cut-off. The incentive to produce as much fissile material before the axe falls might be stronger here than in any other threshold state but it might be difficult significantly to expand production at Kahuta. If she accepted a cut-off Pakistan would be left with a stock of fissile material far smaller than India's. But cut-off or no cut-off, any she has little or no hope of catching up with India. Pakistan has had to pay more dearly than India in recent years for her nuclear programme, she is less industrially self-sufficient than India, and the prospect of restoring relations with the US and perhaps reopening the flow of conventional weapons must be attractive. Indeed there have been reports that the US is prepared to sell F-16s fighter planes to Pakistan in return for acceptance of a cut-off.³⁸ There have been no clear indications of the reward that might be offered to India. Except for rumours about concessions in regard to the supply of fuel for the Tarapur reactors, but these would be difficult to reconcile with the Nuclear Suppliers' Guidelines and the US Nuclear Non-Proliferation Act of 1978.

³⁸ Peter Grier, "As World's Nuclear Fireman, the US Aims at the India-Pakistani Arms Race", *Christian Science Monitor*, 28 March 1994.

Chapter 4

Halting Fissile Material Production for Nuclear Weapons: A Sept Towards Nuclear Disarmament

*Rakesh Sood*¹

I - The 1993 UN General Assembly Session

The 1993 session of the UN General Assembly witnessed a consensus on a subject that had been on the multilateral disarmament agenda for many decades. For the first time, the UN General Assembly adopted a consensus resolution on "Prohibition of the Production of Fissile Material for Nuclear Weapons or other Nuclear Explosive Devices".² Thirty countries co-sponsored the resolution including Australia, Canada, Germany, India, Japan, Sweden and USA. The development of this consensus is a remarkable achievement as some of these countries had, in previous years, tabled their own resolutions on subjects related to the nuclear arms freeze and the fissile cut-off. In 1982, India presented a resolution "A Freeze on Nuclear Weapons" calling on all nuclear weapon states to stop production of nuclear weapons, accompanied by a cut-off in production of fissionable material for weapons purposes.³ The Indian resolution which was tabled annually, was merged in 1988 with a Mexican resolution on the same subject which also included in the "freeze" - a comprehensive test ban on nuclear weapons and on their delivery vehicles, coupled with a ban on all further deployment of nuclear weapons and their delivery vehicles.⁴ Canada too had a resolution on the same subject.⁵ However, the position of the nuclear weapon states made forward movement on the subject impossible, despite the fact that the UN General Assembly would adopt these resolutions by overwhelming majorities year after year.

¹ Director (Disarmament and International Security Affairs), Ministry of External Affairs, New Delhi, India.

² United Nations General Assembly, 48th Session, Resolution 48/75L.

³ United Nations General Assembly, 37th Session, Resolution 37/100A.

⁴ United Nations General Assembly, 44th Session, Resolution 44/117D.

⁵ United Nations General Assembly, 47th Session, Resolution 47/52C.

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civilian uses and non-explosive military purposes such as naval propulsion; and finally, recommends a non-discriminatory verification regime to provide requisite confidence in a cut-off treaty. A relevant point to be mentioned here is that existing stockpiles of fissile materials, whether in nuclear weapon states or in states that are not subject to IAEA full scope safeguards, will not be subject to any verification. These stockpiles will however be capped on the date that the cut-off treaty comes into force. This might be considered inadequate by some. However, India has always indicated readiness to move the process forward and accept full-scope safeguards simultaneously when the nuclear weapon states give up their arsenals and place their fissile materials, either in stockpile or in warheads, also under full-scope safeguards. Since January 94, the subject has been under consideration in the Conference on Disarmament in Geneva, though formal negotiations have yet to commence. It is hoped that the consultations during last three months will enable an ad hoc committee to be set up to undertake negotiations.

IV - Scope in Terms of Fissile Materials

Primarily, two fissile materials are considered in such a proposal. Uranium-235 is a fissile isotope that occurs naturally, but only to the extent of 0.7 percent in natural uranium. The larger percentage (99.3) consists of uranium-238, an isotope that is not capable of undergoing a chain reaction. For weapons purposes, the percentage of uranium-235 has to be enriched to over 90 percent. A number of techniques for enrichment have been developed. The most commonly used is gaseous diffusion which diffuses uranium hexafluoride gas through porous material in a series of cascades. The USA, UK, France and China have traditionally relied on this method. Centrifuge enrichment is a more energy efficient method but requires capability in metallurgy and high precision engineering for setting up and maintaining the high-speed centrifuges. Russia, Germany and the Netherlands have traditionally relied more on this technique. Electromagnetic separation was used first by USA and then discarded as being both energy and capital intensive. Iraq had made use of this technique. Laser enrichment is reportedly the future enrichment technology, though it has not yet been put into commercial application.

The second fissile material, plutonium, does not occur naturally, but has to be produced in a reactor. Uranium-238 is bombarded with neutrons, turning it into

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uranium-239 which decays naturally into neptunium-239 and yet again into plutonium-239. Plutonium-239 has a long half life of 24,000 years, but is readily induced into a chain reaction by thermal neutrons. Another isotope of plutonium, plutonium-241 is also susceptible to fissioning but is not considered suitable bomb material because of a short half life of 13.2 years. Plutonium production reactors are not very different from nuclear power reactors except that the operation is configured to yield plutonium with over 93 percent content of plutonium-239. Higher content of heavier isotopes of plutonium make it less attractive for weapons use.

A third material is tritium which is used in nuclear warheads as booster (to enhance yield), in fission devices and as a fission trigger in thermonuclear devices. Tritium, which is produced by bombarding lithium-6 with neutrons, has a short half life of 12.4 years and consequently needs to be replenished periodically in order to maintain operational readiness. Tritium production reactors can also be used to produce plutonium. According to one estimate, production of 6 kilograms of tritium would entail a reactor production capacity of the equivalent of 500 kilograms of plutonium capacity, which could provide up to 100 nuclear warheads.¹¹ As tritium production is likely to continue, it implies that tritium production reactors will need to be verified in some manner to ensure that these are not used to provide plutonium for weapons purposes.

V - Scope in Terms of Facilities

In nuclear weapon states, the nuclear material destined for weapons use is produced largely in military facilities. In fact, Western countries have often tried to separate civil and military fuel cycled as a means of curbing proliferation. With the collapse of the former USSR, it is apparent that this separation was not technical, but political. The agreement for the US to buy 500 tonnes of highly enriched uranium from Russia, in order to be used as fuel after blending down, suggests that the fuel cycle will be driven by both non-proliferation and economic imperatives in future. Other sources for fissile materials also exist. These are facilities that produce fissile materials for non-weapons purposes and civilian facilities which can be operated in a manner to produce weapons-usable materials.

¹¹ F. von Hippel and B.G. Levi, "Controlling Nuclear Weapons at the Source", in Tsipis et. al., *Arms Control Verification: The Technologies That Make it Possible*, Washington: Pergamon-Brassey's, 1986, p.368.

or one tonne of plutonium, quantities which can produce hundreds of weapons.¹³ Clearly, verification thresholds for a universal convention need to be much lower and any identification and detection of violations that undermine the cut-off convention should take place with enough lead-time to enable the international community to address the challenge posed to the treaty regime.

For a genuine multilateral treaty that seeks to attract universal adherence, verification has to be in a co-operative mode rather than in an adversarial mode, the latter relying more on national technical means and intelligence information. The experience of Iraq and North Korea in recent times indicates that the verification regime should also contain a politically effective mechanism for resolving ambiguous situations and disputes. Controversies over compliance are not limited to multilateral agreements only. Both the USA and USSR used to exchange allegations of violations on various bilateral arms control agreements, despite the existence of consultative mechanisms in the 70s and up to the mid-80s; since then, these controversies which presumably still come up, are now resolved at a technical level through appropriate institutional mechanisms. For an effectively implementable international treaty of this nature, it is therefore essential to have a representative and transparent institutional mechanism.

Unilateral measures in USA and Russian have been encouraging precursors for a cut-off convention. It is reported that the US stopped producing highly enriched uranium for its nuclear weapon stockpile in 1964 and in 1988, and also that it stopped production of plutonium for weapons purposes.¹⁴ In 1989, the USSR announced termination of production of highly enriched uranium and also the shut-down of seven plutonium production reactors. It was announced that three more plutonium production reactors would be shut down by 1996 and the remaining three by 2000.¹⁵ During discussions in March 1994, it has been announced that the shut-down could take place earlier, as soon as alternative energy sources are made available, for which the US will also provide financial assistance. In a related agreement, the US and Russia have agreed to permit

¹³ Note 11.
¹⁴ US Department of Energy, *Nuclear Weapons Complex Reconfiguration Study*, DoE/DP-0083, January 1991, p.49.
¹⁵ Statement by USSR Deputy Foreign Minister V. Petrovsky in the United Nations General Assembly, 25 October 1989.

negotiated by non-nuclear weapon states parties to the NPT fall within the latter format implying that the state accepts full-scope safeguards. This implies that all source and special nuclear materials and activities are covered by a comprehensive safeguards system. The objective of INFCIRC/153, which arises out of Article III of the NPT is to ensure that the nuclear material is not diverted for nuclear weapon explosive devices. In fact, paragraph 14 of the INFCIRC/153 provides for withdrawal of fissile material for use for non-proscribed military purposes although there have not been any requests to invoke this provision.

According to the IAEA Annual Report, 188 safeguards agreements were in force with 110 states in 1992.¹⁷ However, safeguards activities were carried out only in 59 countries, including the five nuclear weapon states. Voluntary offer agreements were in place with the five nuclear weapon states but inspection effort was minimised in 1992. Nearly a third of the NPT states (55) have not yet negotiated a safeguards agreement, primarily because according to IAEA, except for three states, the others do not have any nuclear activity of significance. In addition, non-NPT states have safeguards agreements under INFCIRC/66. Altogether, the IAEA safeguards agreements are estimated to account for 95 percent of nuclear material in peaceful use in all non-nuclear weapon states (the remaining accounted for by unsafeguarded material in non-nuclear weapon states) and some material from nuclear weapon states other than that declared voluntarily. This includes plutonium (35.3 tonnes), plutonium in spent fuel (366.2 tonnes); highly enriched uranium (10.9 tonnes); low enriched uranium (35,833 tonnes); natural and depleted uranium and thorium (77,958 tonnes).¹⁸

The kinds of facilities under IAEA safeguards include uranium chemical conversion facilities, enrichment facilities, fuel fabrication facilities, nuclear power and research reactors, fuel reprocessing facilities and spent fuel storage. The total number of such facilities under safeguards was 493, as of 31 December 1992. Of these, 423 facilities came under INFCIRC/153; 59 under INFCIRC/66 and the nuclear weapon-states have submitted only 11 facilities to IAEA safeguards.¹⁹

¹⁷ International Atomic Energy Agency, The Annual Report for 1992, Document Number GC (XXXVII)/1060, Vienna, 1993, pp.135-171.

¹⁸ *Ibid.*

¹⁹ *Ibid.*

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any event, if past experience is a relevant guide, the issue of organisational responsibility is bound to be a major subject for discussion among the negotiators. However, since the objective is to make use of IAEA's expertise, this can as easily be done by developing an institutional link by which the designated verification organisation can sub-contract work to the IAEA. This may be a better solution in the long run because over the years, it has become apparent that the IAEA has certain limitations, no doubt as a result of decisions taken by member states. Often, it is easier to start afresh than to bring about changes in established structures.

VIII - Conclusion

Nuclear technology is a dual-use technology with a global dimension. It has immense potential for peaceful application and we need to find ways and means to address proliferation concerns without trying to deprive others of the benefits of peaceful uses of this technology, or trying to stem the tides of expanding frontiers of knowledge. Technologically advanced countries are undertaking research and development to develop more efficient technologies for the production of fissile isotopes and would try to keep these outside the purview of the convention. The commercial motivation for such action is understandable, but in order to be broadly acceptable, it should not be couched in terms of non-proliferation. In fact, international nuclear co-operation for peaceful purposes needs to be expanded so that new proliferations are not generated. Fissile materials have legitimate civilian uses. Therefore any cut-off convention, in order to enjoy universal adherence, must rest squarely within the parameters of the consensus achieved last year. The many decades of the Cold War have inducted nuclearism into strategic thinking. Even though the Cold War is now over, it has not been possible to completely jettison the old mind-set. Yet, a gradual process does seem to be getting under way with unilateral steps, bilateral arms control and most significantly, in the forward movement in the multilateral framework on issues like a comprehensive test ban and a cut-off convention. These are process trends, and as long as these are managed in a framework based upon principles of equity, transparency and non-discrimination, the cut-off convention will be one more significant step towards the objective of nuclear disarmament.

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Confidence-Building Measures in Africa, by Augustine P. Mahiga and Fidelis Nji, 1987, 16p., United Nations publication, Sales No. GV.E.87.0.5.

Disarmament: Problems Related to Outer Space, UNIDIR, 1987, 190p., United Nations publication, Sales No. GV.E.87.0.7.

* Existe également en français: ***Désarmement: problèmes relatifs à l'espace extra-atmosphérique***, UNIDIR, 1987, 200p., publication des Nations Unies, numéro de vente: GV.F.87.0.7.

Interrelationship of Bilateral and Multilateral Disarmament Negotiations / Les relations entre les négociations bilatérales et multilatérales sur le désarmement, Proceedings of the Baku Conference, 2-4 June 1987 / Actes

))

de la Conférence de Bakou, 2-4 juin 1987, 1988, 258p., United Nations publication, Sales No. GV.E/F.88.0.1, publication des Nations Unies, numéro de vente: GV.E/F.88.0.1.

Disarmament Research: Agenda for the 1990's / La recherche sur le désarmement: programme pour les années 90, Proceedings of the Sochi Conference, 22-24 March 1988 / Actes de la Conférence de Sotchi, 22-24 mars 1988, Geneva, 1988, 165p., United Nations publication, Sales No. GV.E./F.88.0.3, publication des Nations Unies: GV.E./F.88.0.3.

Conventional Disarmament in Europe, by André Brie (IIB), Andrzej Karkoszka (PISM), Manfred Müller (IIB), Helga Schirmeister (IIB), 1988, 66p., United Nations publication, Sales No. GV.E.88.0.6.

* Existe également en français: **Le désarmement classique en Europe**, par André Brie (IIB), Andrzej Karkoszka (PISM), Manfred Müller (IIB), Helga Schirmeister (IIB), 1989, 90p., publication des Nations Unies, numéro de vente: GV.E.89.0.6.

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* Also available in English: **Conventional Forces and Arms Limitation in Europe**, by Pierre Lellouche and Jérôme Paolini (eds) (IFRI), 1989, 88p., United Nations publication: GV.E.89.0.6.

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* Existe également en français: **Désarmement classique en Europe: problèmes et perspectives**, 1990, 226p., publié pour l'UNIDIR par Masson (Paris).

The Projected Chemical Weapons Convention: A Guide to the Negotiations in the Conference on Disarmament, by Thomas Bernauer, 1990, 328p., United Nations publication, Sales No. GV.E.90.0.3.

Verification: The Soviet Stance, its Past, Present and Future, by Mikhail Kokeev and Andrei Androsov, 1990, 131p., United Nations publication, Sales No. GV.E.90.0.6.

* Existe également en français: **Vérification: la position soviétique - Passé, présent et avenir**, 1990, 145p., publication des Nations Unies, numéro de vente: GV.F.90.0.6.

UNIDIR Repertory of Disarmament Research: 1990, by Chantal de Jonge Oudraat and Péricles Gasparini Alves (eds), 1990, 402p., United Nations publication, Sales No. GV.E.90.0.10.

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Africa, Disarmament and Security / Afrique, désarmement et sécurité, Proceedings of the Conference of African Research Institutes, 24-25 March 1990 / Actes de la Conférence des Instituts de recherche africains, 24-25 mars 1990, United Nations publication, Sales No. GV.E/F.91.0.1, publication des Nations Unies, numéro de vente: GV.E/F.91.0.1.

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In Pursuit of a Nuclear Test Ban Treaty: A Guide to the Debate in the Conference on Disarmament, by Thomas Schmalberger, 1991, 132p., United Nations publication, Sales No. GV.E.91.0.4.

Confidence-Building Measures and International Security: The Political and Military Aspect - A Soviet Approach, by Igor Scherbak, 1991, 179p., United Nations publication, Sales No. GV.E.91.0.7.

● **Verification of Current Disarmament and Arms Limitation Agreements: Ways, Means and Practices**, by Serge Sur (ed.), 1991, 396p., published for UNIDIR by Dartmouth (Aldershot).

* Existe également en français: **La vérification des accords sur le désarmement et la limitation des armements: moyens, méthodes et pratiques**, 1991, 406p., publication des Nations Unies, numéro de vente: GV.F.91.0.9.

))

- ***Nonmilitary Aspects of Security - A Systems Approach***, by Dietrich Fischer, 1993, 222p., published for UNIDIR by Dartmouth (Aldershot).
- Conference of Latin American and Caribbean Research Institutes***, Proceedings of the São Paulo Conference, 2-3 December 1991, by Péricles Gasparini Alves (ed.), 1993, 202p., United Nations publication, Sales No. GV.E.93.0.8.
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- Nuclear Deterrence: Problems and Perspectives in the 1990's***, by Serge Sur (ed.), 1993, 173p., United Nations publication, Sales No. GV.E.93.0.16.
* Existe également en français: ***La dissuasion nucléaire: problèmes et perspectives pour la décennie 1990***, sous la direction de Serge Sur, 1993, publication des Nations Unies (à paraître)
- Conference of Research Institutes in the Middle East***, Proceedings of the Cairo Conference, 18-19 April 1993, by Chantal de Jonge Oudraat (ed.), 1994, 132p., United Nations publication, Sales No. GV.E.94.0.13.
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Research Papers / Travaux de recherche

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))

* Also available in English: ***A Legal Approach to Verification in Disarmament or Arms Limitation***, 1988, 72p., United Nations publication, Sales No. GV.E.88.0.5.

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* Existe également en français: ***La prévention de la prolifération géographique des armes nucléaires: zones exemptes d'armes nucléaires et zones de paix dans l'hémisphère Sud***, par Edmundo Fujita, avril 1989, 61p., publication des Nations Unies, numéro de vente: GV.F.89.0.8.

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