Paper published in the Journal of Nuclear Materials Management, Summer 2002, and presented to the Annual Meeting of the Institute of Nuclear Materials Management, Orlando, Florida, 23-27 June 2002

NUCLEAR NON-PROLIFERATION: THE ROLE OF COMPLEMENTARY REGIMES

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Abstract

The NPT is commonly perceived as dealing primarily with horizontal proliferation: this is where it has the most detailed provisions, and is the area of greatest achievement—the IAEA's comprehensive safeguards system. However, the NPT also deals with vertical proliferation—all Parties are to pursue effective measures relating to cessation of the nuclear arms race and to nuclear disarmament.

Nuclear disarmament will not be possible without supporting regimes and confidence building measures. This is recognized by the NPT—Parties commit not only to nuclear disarmament, but to pursue "a treaty on general and complete disarmament under strict and effective international control". The form the latter treaty or treaties might take, though clearly relevant to the achievement of NPT objectives, however is beyond the scope of this paper, which focuses on nuclear-related regimes.

One important complementary regime is the proposed Fissile Material Cut-off Treaty (FMCT). The FMCT would be a major step in containing vertical proliferation, and would bring the three "threshold States" into the nuclear arms control process. Another important complementary regime is the Comprehensive Nuclear-Test-Ban Treaty (CTBT), which has benefits in terms of both vertical and horizontal non-proliferation.

Horizontal and vertical proliferation are two sides of the same coin: effective containment of horizontal proliferation is an essential pre-condition for nuclear disarmament—but lack of real progress on disarmament could over time erode the norm against horizontal proliferation. Hence, furthering the conditions needed for nuclear arms reductions and eventual disarmament must be a priority—including resolving the considerable verification challenges involved.

This paper reflects the views of the authors and does not necessarily represent Australian Government policy.

1. INTRODUCTION

From the advent of the nuclear age, political and institutional arrangements against the proliferation of nuclear weapons have been an essential element of national and international security. Initially non-proliferation relied on national measures—export controls and safeguards inspections by nuclear suppliers. Following the IAEA's establishment in 1957, the application of safeguards became an Agency responsibility. Since its conclusion in 1968, the centrepiece of the non-proliferation regime has been the NPT, and the IAEA safeguards system which underpins it.

The success of the NPT should not distract our attention from the fact that there are other regimes, existing and prospective, important to the achievement of non-proliferation objectives. Export controls continue to make a major contribution. Regimes such as the CTBT and the FMCT have a vital role to play. Also important are the various regional and bilateral regimes dealing with nuclear issues, and verification arrangements underpinning reductions in nuclear arsenals and release of fissile material from weapons programs. As discussed in the next section, a whole range of security and arms control agreements outside the nuclear area—with associated verification and confidence building measures—are essential to complement nuclear non-proliferation.

2. THE NPT AND THE BROADER SECURITY ENVIRONMENT

The NPT is commonly described as a two-way bargain, between the non-nuclear-weapon States (NNWS) to forego the acquisition of nuclear weapons, and the nuclear-weapon States (NWS) to divest themselves of nuclear weapons. In fact, the NPT is a good deal more complex than this.

First, this simplistic dichotomous view overlooks that the NPT also comprises a bargain amongst the NNWS themselves not to acquire nuclear weapons—observance of this commitment is just as important to fellow NNWS, arguably even more so, as it is to the NWS. Second, Article VI of the NPT links the nuclear disarmament commitment of the NWS to a commitment on all Parties, NWS and NNWS alike, to pursue general disarmament. In this respect, the negotiators of the NPT recognised that a major motivation behind the acquisition of nuclear weapons has been concern about imbalances in non-nuclear forces—underscored by current concerns about chemical and biological weapons (CBW) programs. It is unrealistic to expect the eventual elimination of nuclear arsenals without effective steps to address these other concerns.

It is a feature of NPT Review Conferences that many NNWS routinely berate NWS for insufficient progress in the fulfillment of the disarmament commitment in Article VI of the Treaty. While some impatience is understandable, the NNWS would do well to reflect that this is not a matter for the NWS alone—appropriate action by the NNWS themselves will be essential in establishing the conditions under which nuclear disarmament can progress.

In the context of the NPT itself, an essential step for all NNWS is to conclude Additional Protocols (INFCIRC/540) accepting the application of strengthened safeguards. The IAEA safeguards system which all NNWS NPT Parties are committed to accept is not static, fixed for all time as safeguards were in 1970 when the NPT came into force. The basic comprehensive safeguards agreement, INFCIRC/153, did not even exist then. In the three decades since INFCIRC/153 was introduced, safeguards have undergone considerable evolution. Today, the most developed and most effective form of comprehensive safeguards is *strengthened safeguards*, the combination of INFCIRC/153 and INFCIRC/540—this represents the contemporary NPT safeguards standard. For a NNWS NPT Party to remain outside strengthened safeguards will raise concern about its commitment to non-proliferation—this is not conducive to establishing the level of confidence required to encourage nuclear disarmament.

Outside the scope of the NPT, it is clear that a wide range of political agreements and associated confidence building measures will be an essential part of establishing an international security environment in which nuclear non-proliferation can be sustained and nuclear disarmament progressed. Some of these will be global—eg. effective regimes against CBW and associated missile systems—and some will be regional or even bilateral (a comprehensive Middle East peace settlement is just one regional possibility that comes to mind).

The NPT's reference to "a treaty on general and complete disarmament under strict and effective international control" is not to be taken literally—rather than a single treaty, there is bound to be a series of agreements, advancing towards this objective incrementally, and today alas *complete* disarmament seems too utopian an ideal. While the meaning of "strict and effective international control" has yet to be elaborated, at the least this will require effective verification, which has been such a hallmark of the NPT.

Consistent with the pragmatic principle of "trust, but verify", the NPT has derived great strength from the IAEA safeguards system. What verification might look like in other regimes will be determined by a range of factors, including: the level of assurance required politically, what is practical, what is acceptable, and what is affordable.

The verification regime under the Chemical Weapons Convention, for example, is a good deal less rigorous than IAEA safeguards, reflecting practicalities as to the scale and diversity of the chemical industry, and perhaps a political judgment that use of chemical weapons might not have the same devastating consequences as use of nuclear weapons. Failure to reach agreement on what would constitute an effective regime for the Biological Weapons Convention would have serious implications for the broader non-proliferation environment, since undoubtedly the "general and complete disarmament under strict and effective international control" referred to by the NPT will have to encompass biological weapons, and concern about BW programs will influence national decisions regarding nuclear weapons. What combination of verification and other confidence building measures can convincingly address the BW issue remains to be seen. This, and a whole range of other political and arms control matters, however, are beyond the scope of this paper.

3. REGIMES COMPLEMENTING THE NPT

3.1 CONTAINING THE SPREAD OF PROLIFERATION-SENSITIVE TECHNOLOGIES

As already mentioned, national controls on the export of proliferation-sensitive technologies—particularly enrichment and reprocessing—were the earliest non-proliferation measures, and they continue to have a vital role. National controls have been given multilateral frameworks, through the NSG (Nuclear Suppliers Group) and the Zangger Committee.

The NPT itself makes no provision for limiting the spread of proliferation-sensitive technologies. While some States have argued that acceptance of safeguards—full scope or otherwise—should be sufficient qualification to acquire any nuclear technology for "peaceful" purposes, it is generally recognised that restraint both in supply *and acquisition* of sensitive technologies is an essential complement to the NPT. Safeguards in themselves will not provide the assurance required by the international community if there are suspicions about a State's future intentions.

In this regard, an important concept was introduced by INFCE (International Nuclear Fuel Cycle Evaluation) in 1980, when it recommended that sensitive facilities should be owned and operated, not by individual States, but on a multination basis, perhaps servicing the requirements of a region. Another example of the recognition that the spread of sensitive facilities should be limited—and particularly in regions of tension—is the 1992 Joint Declaration on the Denuclearisation of the Korean Peninsula, in which the ROK and the DPRK undertook not to possess enrichment or reprocessing facilities. This agreement should serve as a precedent for other countries in regions of tension, like Iran, seeking such fuel cycle capabilities.

Currently, an interesting development is the increasing attention being given to the establishment of proliferation-resistant fuel cycle technologies. "Proliferation-resistance" has yet to be defined—an illustration is, technologies that allow for plutonium recycle without the necessity for full separation of plutonium—but it is clear that technical barriers, making proliferation more difficult and increasing the warning time to the international community, can play a vital role in reinforcing the non-proliferation regime. Whether this approach will constitute a "regime" in itself, eg. by being formalised through agreements or international understandings, remains to be seen.

3.2 FISSILE MATERIAL CUT-OFF TREATY (FMCT)

The intention underlying the proposed FMCT—set out in the negotiating mandate agreed by the UN Committee for Disarmament (CD)—is for "a non-discriminatory, multilateral and internationally and effectively verifiable treaty banning the production of fissile material for nuclear weapons and other nuclear explosive devices". Production of fissile material for peaceful purposes and for non-proscribed military purposes (such as propulsion) would continue, but under multilateral verification to ensure there is no diversion to proscribed (ie. explosive) purposes. The FMCT would be a major step in containing vertical proliferation, placing a quantitative cap on fissile material for weapons programs, and bringing the three "threshold States" (India, Israel and Pakistan) into the nuclear arms control process.

While the objective of the FMCT is agreed, commencement of negotiations in the CD have been delayed for some years over other, unrelated, issues, and the final form the FMCT may take is as yet uncertain. Some States have said it should not be pre-judged that IAEA safeguards will constitute the FMCT verification mechanism. Nonetheless, two points are clear:

- the verification issues involved with the FMCT are very similar to those dealt with by the IAEA, and the IAEA's substantial experience should be used to advantage in ensuring that the FMCT is implemented effectively;
- in the case of NNWS Parties to the NPT, comprehensive safeguards already fully meet the FMCT objective. In principle therefore the FMCT should not involve any additional commitments from States that have in place both an NPT safeguards agreement and an Additional Protocol.

For the five NWS and the States outside the NPT (principally India, Israel and Pakistan), the FMCT would involve substantial new commitments—to produce fissile material only under verification to assure the material is not used for weapons. This will bring new verification challenges. Perhaps it is in this sense that some States have queried the role of IAEA safeguards—if they are thinking of *comprehensive* safeguards they may have a point: truly comprehensive safeguards covering all nuclear material cannot apply in the NWS (and threshold States) while they retain, outside verification, nuclear material (including weapons) existing when the FMCT enters into force; and the cost of verification on the comprehensive safeguards model in the NWS would be prohibitive.

It can be argued that the verification objectives of comprehensive safeguards and the FMCT are qualitatively different. Comprehensive safeguards have a degree of rigor which reflects that, in countering *horizontal* proliferation, the acquisition of one nuclear weapon will defeat the verification objective. FMCT verification on the other hand will be aimed at *vertical* proliferation—for States that already have nuclear arsenals, the same degree of rigor would not be essential.

The authors advocate what has become known as the "focused" approach: verification focused on the most sensitive facilities and materials will be both appropriate and credible, provided the regime

includes an effective counter to the possibility of undeclared production (ie. after entry-into-force (EIF)). Under this approach, verification would be concentrated on the facilities which produce fissile material, ie. enrichment and reprocessing plants, and on separated plutonium and HEU produced after EIF. It is envisaged that the FMCT regime would include, *inter alia*, routine and non-routine verification activities, managed access, verification measures against possible undeclared production activities, and mechanisms for special and/or challenge inspections.

3.3 COMPREHENSIVE NUCLEAR-TEST-BAN TREATY (CTBT)

The CTBT has both vertical and horizontal non-proliferation benefits—it would place a qualitative cap on nuclear weapons programs and present a substantial barrier to would-be proliferators (*ab initio* States).

The commitment not to conduct nuclear tests, embodied in the CTBT, is assuming the status of an international norm, having been signed by 165 States and ratified by 90—and a *de facto* moratorium on testing has been observed for three years (or 6 years if one excludes the Indian and Pakistani tests of 1998). Although the CTBT is not in force—it has yet to receive the necessary ratifications, including by the US—the Treaty expressly provides that its verification system (the International Monitoring System—IMS) is to be capable of meeting the requirements of the Treaty at entry-into-force. The Preparatory Commission for the CTBT Organization is therefore engaged in a major program in preparation for EIF, including the establishment/upgrading of 337 monitoring facilities around the world, and the provisional operation of these facilities.

It is surprising, and disappointing, that one of the reasons cited by the US for deciding against ratification is that the CTBT is "unverifiable". Effective verification is key to the credibility of the Treaty, and a great deal of effort has been expended over the last 20 years to develop and implement an effective IMS. A basic design parameter for the IMS is that it should be able to detect and identify a one kiloton explosion in any terrestrial environment. In many cases however the level of sensitivity will be considerably greater. Calibration tests of the IMS have shown good results for 100 ton explosions. A number of IMS stations also detected the (relatively) quite small explosions that resulted in the sinking of the Kursk submarine in August 2000.

The "unverifiability" assertion may relate to the fact that there are some practical limits to the IMS detection capabilities—some very small-scale super-critical testing might proceed with a low risk of detection. Such testing however would be very difficult for an *ab initio* State, and would not add greatly to the knowledge of a State with full-scale test experience. Obviously the NWS are in a position to refine existing designs, and to a certain extent develop new designs, based on activities not proscribed by the Treaty, eg. using simulation programs and data from previous tests, as well as conducting sub-critical tests—whether for weapon development or stockpile stewardship. However, major changes to existing designs and development of substantially new designs are likely to require full-scale testing. Thus the Treaty will impose substantial qualitative limits on what the NWS (and threshold States) can do. While there are some in the NWS who are concerned about this limitation, clearly it is consistent with the NPT commitment to the eventual elimination of nuclear weapons.

While *ab initio* States could develop a simple nuclear weapon without testing (eg. a "gun-type" HEU weapon), such a weapon would require a relatively large amount of fissile material—a disadvantage when a clandestine enrichment program is relied on—and its size and weight could limit delivery options. A basic implosion design could be developed with sub-critical testing, but without the benefit of full-scale testing an *ab initio* State could not be confident how well such a design would work in practice—and small-scale tests, if not well conducted (and without testing experience that would be

problematic), will risk detection. Development of more advanced designs requiring boosting would require full-scale testing. Thus the CTBT, while not a complete barrier to an *ab initio* State, will increase the risks and substantially limit the options available to such a State.

3.4 Regional and Bilateral Regimes

There are two broad categories of regional arrangements relevant to nuclear non-proliferation: those establishing political non-proliferation commitments; and those establishing international organisations responsible for applying regional safeguards.

In the first category are the nuclear weapon-free zone (NWFZ) treaties—and the right to conclude such treaties is expressly recognised in the NPT (Article VII). Currently there are four: the Treaty of Tlatelolco, the Treaty of Rarotonga, the Treaty of Pelindaba (yet to enter into force), and the Bangkok Treaty. Mention might also be made of the Antarctic Treaty, which proscribes military activities, nuclear explosions and disposal of radioactive waste in Antarctica. A fifth NWFZ—covering Central Asia—is currently under development. Although the NWFZ treaties contain verification provisions, it is notable that they do not establish separate safeguards systems but adopt IAEA safeguards.

In the second category are the Euratom Treaty, establishing the European Atomic Energy Community, and the Bilateral Agreement between Brazil and Argentina establishing ABACC, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials.

Both the NWFZ treaties and the regional/bilateral safeguards arrangements serve an important confidence-building/transparency function. This can be seen particularly in the case of the ABACC agreement, which enabled the introduction of comprehensive safeguards in Argentina and Brazil ahead of the time when the conditions were right for both States to be prepared to join the NPT. Both States continue to appreciate the mutual transparency in nuclear activities provided through ABACC.

The ABACC model—safeguards inspections undertaken by the IAEA and the parties jointly—establishes a valuable precedent for other States—States such as India and Pakistan, outside comprehensive safeguards, where mutual confidence building measures could be an important element in winding back nuclear weapon programs, and NNWS that find themselves in circumstances where confidence building measures additional to IAEA safeguards could play a useful role, eg. perhaps the ROK and the DPRK, and (when conditions are more favourable) Iran and Iraq.

3.5 Nuclear Weapon Dismantlement, Irreversibility

Effective verification will be an essential component in establishing the confidence necessary for nuclear disarmament to progress. A range of verification objectives will be involved, including: that no undeclared weapons are retained; there is no undeclared fissile material production (the object of the FMCT); that weapons submitted for dismantlement are in fact dismantled; and that fissile material released from military programs for peaceful use remains in peaceful use (“irreversibility”).

The Trilateral Initiative between the US, Russia and the IAEA, under which agreed quantities of plutonium and HEU are to be released from weapons programs under verification to ensure irreversibility, sets an important precedent. US and Russian experts have developed verification instruments that can be used by IAEA inspectors to confirm that fissile material in canisters presented for verification meets required quality and quantity parameters, without revealing sensitive information (such as the precise isotopics or the mass and shape of weapons components). A verification approach has been developed to cover storage of canisters under surveillance, processing under “black box” arrangements to remove sensitive characteristics (shape, mass, isotopic composition), and submission

of the resultant unclassified fissile material to IAEA safeguards. This work serves as a foundation for the further verification methodologies that will be required as disarmament proceeds.

Irreversibility—ensuring that fissile material committed to peaceful uses does not return to weapons programs—involves issues that are as much political as technical. Pragmatically, it could be argued that released fissile material needs to remain under verification only until it is degraded into a form that would require nuclear upgrading (enrichment or reprocessing) to return it to weapons use. This would be achieved: (a) in the case of HEU, once it is downblended to LEU; and (b) in the case of plutonium, once it is fabricated as MOX fuel and irradiated (incidentally, degrading the isotopics). In circumstances where the US and Russia still have substantial excess weapons material, and are reducing weapons numbers, it is highly unlikely they would re-enrich or reprocess released material for weapons use (though this argument might not be as persuasive in the case of States with much smaller nuclear arsenals).

The alternative view is that it might be unacceptable to the international community to have "incomplete" safeguards in place, that once the material is submitted to safeguards it should remain under safeguards until it becomes practicably irrecoverable. This argument would be very neatly resolved by proceeding with the FMCT without further delay—a verified peaceful use commitment would then apply to all new fissile material production (defined, in the case of the "focused" approach, as production of HEU and separation of plutonium), thus effectively ensuring irreversibility for released material once it has been downblended or irradiated.

3.6 Some Other Verification Issues

The "classical" safeguards system, which developed with a focus on verifying declared nuclear material inventories in the context of horizontal proliferation, is not necessarily the most appropriate model for all verification requirements. While some argue for a "universal" system as a matter of policy, practical considerations are likely to dictate otherwise.

For new verification regimes, addressing new situations and new objectives, a greater emphasis on qualitative approaches may be more appropriate—for example, as discussed earlier, FMCT objectives can be seen as being quite different to those of comprehensive safeguards, and less rigorous verification measures may well be acceptable. Indeed, as comprehensive safeguards are developed further to better address a *qualitative* objective—assurance of the absence of undeclared nuclear activities—comprehensive safeguards themselves, at least in the form of *integrated safeguards*, are placing less emphasis on routine verification activities.

This qualitative difference between regimes might well be reflected in different verification standards—again, looking at the FMCT, if in the case of NWS undetected fissile material production sufficient for a low number of weapons is an acceptable risk, different detection parameters might be acceptable compared with classical safeguards, where the objective is to detect diversion of just one *significant quantity* (an amount sufficient for one weapon). Of course, such differences raise important policy issues and need to be considered very carefully.

Examples of wholly qualitative mechanisms which are likely to become increasingly important in nuclear verification include: surveillance through use of satellite imagery and instruments such as the Open Skies Treaty; and measures to promote greater transparency between States. While objective verification by a competent multilateral agency—the IAEA—will be essential to maintain credibility, bilateral and regional confidence building measures to complement multilateral verification—as exemplified for example by ABACC—can also be expected to play an important role in particular situations.

While the theme of this discussion is the need to tailor verification mechanisms to suit specific circumstances—rather than pursue a "one size fits all" approach—clearly there will be substantial areas of commonality, and the differences between NNWS and NWS will reduce as nuclear arsenals run down. Thus over time the trend is likely to be towards *convergence* between different systems—eg. between comprehensive safeguards and FMCT verification—though it is too early to say in which direction this will occur. As the capability of safeguards to provide assurance about undeclared activities strengthens, a substantial simplification of safeguards can be expected for material other than unirradiated *direct-use material* (HEU and separated plutonium)—thus comprehensive safeguards may well evolve towards FMCT verification rather than *vice versa*.

4. CONCLUSIONS

When the NPT was concluded, in 1968, the negotiators demonstrated considerable far-sightedness, and realism. They recognised that the division of States into two groups—the five NWS existing at that time, and the NNWS—could not be sustained permanently. While containment of horizontal proliferation was the immediate priority, nuclear disarmament was also an essential objective, since otherwise the norm against horizontal proliferation could erode over time.

Hence the NPT sets out a framework for dealing with vertical as well as horizontal proliferation. Since the elimination of nuclear weapons must be seen as a *long term* objective, the NPT recognises the need for further agreements elaborating the Treaty framework. Of particular importance, the NPT recognises the direct relationship between nuclear disarmament and effective arms control and disarmament in non-nuclear areas. This is especially pertinent today with heightened concern about the development of chemical and biological weapons. Progress in nuclear disarmament will be closely linked to progress in addressing these concerns.

In the nuclear area, near-term steps to advance NPT objectives include:

- further action against horizontal proliferation—particularly the general adoption of the Additional Protocol and continued development of strengthened safeguards capabilities;
- action against vertical proliferation—particularly consolidation of the moratorium on nuclear testing through bringing the CTBT into force, and agreement on an FMCT.

Effective verification will continue to be an essential element in curbing horizontal proliferation. Likewise, effective verification will be required to curb vertical proliferation and to progress nuclear disarmament. Here, there will be major challenges—but the Trilateral Initiative shows how novel situations can be met by ingenuity and innovation. The challenges are not entirely technical—policy makers too have to be receptive to new ways of achieving verification objectives.