

***Fissile Materials Control in South Asia:
Regional Analyses and Potential
Confidence Building Measures***

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Fissile Materials Control in South Asia: Regional Analyses and Potential Confidence Building Measures

ABSTRACT

This paper surveys Indian and Pakistani academic and official statements on the control of fissile material production. As most published writings in India and Pakistan on this subject deal with the Fissile Material Cut-off Treaty (FMCT), the paper presents a review of the two countries' positions on the FMCT. Until its May 1998 nuclear weapon tests, India's position had been to oppose the FMCT negotiations in the Conference on Disarmament (CD). India now supports FMCT negotiations that are restricted to controlling future production, with no linkages to existing stocks. In contrast, Pakistan is concerned about the disparities of fissile material stocks between India and Pakistan and has argued in the CD that a future FMCT should include existing stockpiles. India and Pakistan face a quandary regarding the FMCT. On one hand, both countries have the expectation that participation in the ongoing FMCT negotiations and a successful conclusion of the negotiations in a binding treaty could lessen their nuclear isolation. On the other hand, domestic elements in India and Pakistan also view the FMCT as an attempt by the United States to cap their weapon capabilities in relation to the five states that are recognized as legitimately possessing nuclear weapons in the Treaty on the Nonproliferation of Nuclear Weapons. In 2004, India and Pakistan initiated direct bilateral negotiations in an array of security topics (including nuclear). An interim goal of the negotiations is to implement a series of nuclear confidence-building measures (CBMs). India and Pakistan might, therefore, consider regional approaches for fissile material production control. This paper presents concepts for regional CBMs related to fissile material production control. A discussion of the role that international institutions might play in facilitating India-Pakistan engagement is also presented.

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Abbreviations and Acronyms

BARC	Bhabha Atomic Research Centre (India)
CBM	confidence building measures
CD	Conference on Disarmament
CTBT	Comprehensive Nuclear Test Ban Treaty
FMCT	Fissile Material Cut-off Treaty
IAEA	International Atomic Energy Agency
MMS	Materials Monitoring System
NAIS	National Institute for Advanced Studies (India)
NPT	Treaty on the Nonproliferation of Nuclear Weapons
NRC	Nuclear Regulatory Commission (US)
PINSTECH	Pakistan Institute of Nuclear Science & Technology
UN	United Nations
UNGA	United Nations General Assembly

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EXECUTIVE SUMMARY

This paper surveys Indian and Pakistani academic and official statements on the control of fissile material production. As most published writings in India and Pakistan on this subject deal with the Fissile Material Cut-off Treaty (FMCT), the paper presents a review of the two countries' positions on the FMCT, as expressed in official statements and writings by regional analysts. Against this backdrop, various options for regional progress in fissile material production control are discussed.

India and Pakistan face a quandary related to the future Fissile Material Cut-off Treaty (FMCT) being negotiated in the Conference on Disarmament (CD). On the one hand, both countries have the expectations that participation in the ongoing FMCT negotiations and a successful conclusion of the negotiations in a binding treaty could lessen their nuclear isolation. On the other hand, elements in India and Pakistan also view the FMCT as an attempt by the United States (US) to cap their weapon capabilities in relation to the five states that are recognized as legitimately possessing nuclear weapons in the Treaty on the Nonproliferation of Nuclear Weapons (NPT). Pakistan also fears that the FMCT might solidify India's current lead in quantities of fissile material stocks.

Key aspects of Pakistan's official position on the FMCT in the CD negotiations are:

- Existing stocks of fissile materials must be "progressively reduced" and eventually eliminated.
- There should be a schedule for the transfer of stockpiles into civilian use with verification (transfers must first be made by the states with the largest stockpiles).
- All caps on future stocks must be accompanied by a reduction in asymmetries of existing stocks.

A key aspect of India's official position and where the Indian position differs most markedly from Pakistan's is that existing stocks must be excluded from the scope of the FMCT.

A summary of key Indian analysts' views on the FMCT is:

- The FMCT is a ploy by the US and others to bring under safeguards many of India's un-safeguarded facilities.
- The FMCT will forever restrict India to second-class power status by freezing disparities with the five nuclear weapons states.
- The FMCT will never confer any "special" nuclear weapon power status and never legitimize India's possession of weapons.
- If India does sign, it should use its leverage to wrest benefits.

A summary of key Pakistani analysts' views on the FMCT is:

- The FMCT (if stocks are excluded) would freeze disparities with India.
- The US is attempting to use economic pressure to force Pakistan to give up fissile materials production (even voluntarily).
- The FMCT does not serve the strategic interests of Pakistan.

- Pakistan should only consider signing after its own stocks are sufficient.

As current multilateral negotiations on the FMCT are stalled, India and Pakistan may well be disposed towards a regional approach to fissile material control. In 2004, India and Pakistan initiated a process of exploring nuclear-related confidence building measures (CBM). This process provides a window of opportunity for the two countries to consider bilateral CBMs related to fissile materials production control.

The crux of creating a South Asian fissile materials control accord will be political. How should a political climate be created that might allow regional initiatives on fissile materials control to move forward? We believe that limited technology demonstrations through short-term experiments might be a factor in influencing political, policy, and decision-makers in India and Pakistan to understand that fissile materials control can be effectively and verifiably monitored.

The Materials Monitoring System (MMS) developed at Sandia National Laboratories is one of the possible technological systems that could be demonstrated at select sites (mock or real) in India and Pakistan. The MMS is capable of supporting a variety of sensors and video equipment, and of operating in a multitude of configurations and modes. Example monitoring and verification technologies to be demonstrated could involve seals and tags, video cameras, etc. The MMS uses a flexible hierarchical architecture to allow near real-time, secure data acquisition and display at any location worldwide.

In many cases, cooperation with Indian and Pakistani nuclear scientists is restricted for US agencies by law and existing sanctions. However, interactions between US, Indian and Pakistani professional societies might be a way to start dialogue, as long as the interactions comply with all applicable laws. For example, the Institute of Nuclear Materials Management could work with the Pakistani Nuclear Society and the Indian Nuclear Society to arrange workshops that could promote discussions of fissile material production control issues.

India and Pakistan have fairly divergent views on the scope of a future FMCT. Pakistan wants existing stocks included, while India is for the capping of future production. The two countries do, however, have an ongoing bilateral dialogue on creating nuclear-related CBMs. The nuclear CBM dialogue provides a framework in which to discuss bilateral verification-related experiments or test beds. Third parties could help facilitate such projects.

Fissile Materials Control in South Asia: Regional Analyses and Potential Confidence Building Measures

1. INTRODUCTION

This paper surveys Indian and Pakistani academic and official statements on the control of fissile material production. As most published writings in India and Pakistan on this subject deal with the Fissile Material Cut-off Treaty (FMCT), the paper presents a review of the two countries' positions on the FMCT, as expressed in official statements and writings by regional analysts. Against this backdrop, various options for regional progress in fissile material production control are discussed.

India and Pakistan face a quandary related to the future Fissile Material Cut-off Treaty (FMCT) being negotiated in the Conference on Disarmament (CD). On the one hand, both countries have the expectation that participation in the ongoing FMCT negotiations and a successful conclusion of the negotiations in a binding treaty could lessen their nuclear isolation. On the other hand, domestic elements in both India and Pakistan also view the FMCT as an attempt by the United States to cap their weapon capabilities in relation to the five nuclear weapon states that are recognized in the NPT. Pakistan also fears that the FMCT might solidify India's current lead in quantities of fissile material stocks.

Current quantities of fissile material stocks in these two countries are not very well known. The Institute for Science and International Security has made some detailed estimates.^[1] It is clear from this study that India has larger stocks of plutonium that are probably in the hundreds of kilograms. Pakistan is suspected to have smaller stocks of plutonium, but larger stocks than India of highly enriched uranium. What is clear is that both countries have an extensive infrastructure for fissile materials production. They have well-developed nuclear energy programs, including power and research reactors.

2. FISSILE MATERIAL CUT-OFF TREATY ISSUES: A CRITIQUE

The scope of the FMCT regarding existing stocks of fissile materials is unclear. Possible outcomes include the following:

- The treaty will deal completely with all existing stocks.
- The treaty will deal only partially with some kinds of existing stocks.
- The treaty will only provide guidance on eliminating stocks, such as in its preamble.
- The treaty will exclude existing stocks and only cap future production.

The definition of what should be considered a fissile material is also unclear. Appendix A presents various definitions of "fissile" materials used in international law and by India

^[1] Institute for Science and International Security, *Global Fissile Material Inventories*, Chapter IX, "Estimates of Unirradiated Fissile Material in De Facto Nuclear Weapon States," June 2004 available at http://www.isis-online.org/global_stocks/de_facto_states.html

and Pakistan. These definitions are not synonymous, and will need to be reconciled in a future FMCT. Another key issue is how much transparency countries will be expected to provide. Monitoring and verification procedures will therefore need to be negotiated. All of these issues will concern India and Pakistan considerably, given the fact that many of their nuclear facilities are outside the scope of International Atomic Energy Agency (IAEA) safeguards.

Kathleen Bailey of the Lawrence Livermore National Laboratories in the US has provided a critique of any proposed FMCT.^[2] She writes: “A key issue is that current technologies do not allow for effective verification of a fissile materials cutoff. Equally important, the cutoff has the potential to damage the [Non-proliferation Treaty] by creating a new, less restrictive arms control accord that other nations may eventually prefer. There are other costs as well. International diplomatic energies will be sapped. The costs of inspections and other verification activities – activities that will offer little assurance that cheating is not under way – will be high. In summary, the costs of the fissile materials cutoff appear to outweigh the benefits.”

Both India and Pakistan are acutely aware of the difficulties inherent in implementing any proposed FMCT. There is little trust between these two countries. They will demand stringent verification procedures if either is to ever acquiesce to a cutoff. Both countries will likely continue to maintain civilian uranium enrichment and plutonium reprocessing facilities.^[3] Therefore, they will be faced with the risk that production of fissile materials for civilian fuel cycle purposes might be used to mask production of fissile materials for weapons manufacture.

The FMCT might also serve to legitimize existing stocks of fissile materials that India and Pakistan possess. If existing stockpiles are not covered, both countries would therefore legitimately possess fissile materials stocks that are applicable to building nuclear weapons. However, a verifiable cutoff would effectively cap their nuclear weapons programs.

3. FISSILE MATERIAL PRODUCTION IN INDIA AND PAKISTAN

Pakistan and India have a long history of seeking to produce fissile materials. Table 1 presents a chronology of important events related to fissile materials production in both countries. Given the long history and extensive infrastructure existing in both countries related to fissile materials production, verification of any sort of a future fissile materials control accord (whether regional or global) will be problematic.

^[2] Kathleen Bailey, *A Critique of the Fissile Materials Cutoff Proposal*, Director’s Series on Proliferation, Lawrence Livermore National Laboratory, California, 1995, UCRL-LR-114070-8, pp 55-62.

^[3] India has a unique nuclear fuel cycle planned that will involve the reprocessing of spent fuel from fast breeder reactors and the production of considerable quantities of U-233 (a fissile material capable of being used in weapons). Currently, Pakistan’s research and power generation reactors use fuel supplied from foreign sources under IAEA safeguards. However, in the future, Pakistan could produce its own low-enrichment civilian reactor fuel.

Table 1: A Chronology of Fissile Materials Production Activities in Pakistan and India^[4]

Country	Activity	Year started or estimated completion
Pakistan	Uranium discovered at Dera Ghazi Khan	1963
	5 MWt research reactor at PINSTECH (PARR-1)	1965
	Nuclear weapons program begins	1972
	Uranium enrichment program begins	1974
	New Labs Reprocessing Plant for plutonium reprocessing	1982
India	Uranium discovered at Jadugoda	1951
	Criticality of CIRUS research reactor	1960
	Nuclear weapons program begins	1964
	Uranium enrichment program begins at Trombay (pilot-scale)	1985
	Plutonium reprocessing plant established at BARC	1964
	Plutonium reprocessing plant established at Tarapur	1977
	Plutonium reprocessing plants under construction at Indira Gandhi Center for Atomic Research, Kalpakkam	2008



Figure 1: The PARR-1 research reactor at PINSTECH

^[4] These dates are taken from a variety of sources, primarily from the web sites of the Indian and Pakistani Atomic Energy Commissions, and George Perkovich, *India's Nuclear Bomb: The Impact on Global Proliferation*, (University of California Press, Berkeley, USA: 1999). Information was also obtained from an article by Mansoor Ahmed, "Pakistan's Nuclear History – Separating Myth from Reality" published on PakDef Forums: <http://www.pakdef.info/forum/showthread.php?t=6278>.

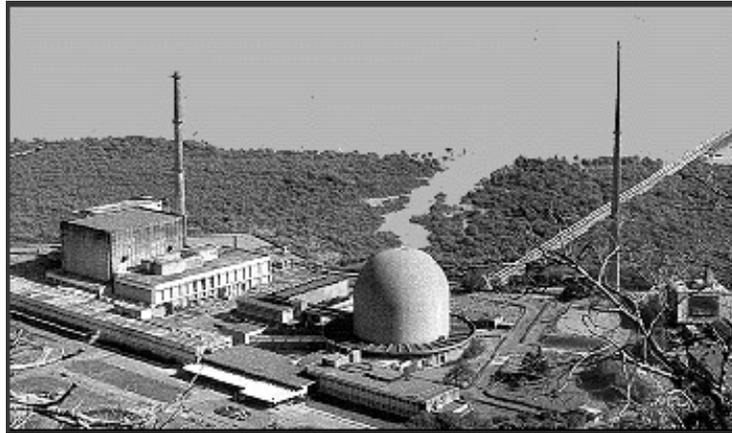


Figure 2: The CIRUS (right) and the DHRUVA (left) research reactors at BARC

4. OFFICIAL POSITIONS OF PAKISTAN AND INDIA ON THE FMCT

Pakistan's Ambassador to the CD, Munir Akram, stated on July 30, 1998, that there is a "wide disparity in fissile stockpiles of India and Pakistan," and that the FMCT should not freeze this disparity.

Key aspects of Pakistan's position are:

- Existing stocks of fissile materials must be "progressively reduced" and eventually eliminated.
- There should be a schedule for the transfer of stockpiles into civilian use with verification (transfers must first be made by the states with the largest stockpiles).
- All caps on future stocks must be accompanied by a reduction in asymmetries of existing stocks.

Originally, India had linked the FMCT to time-bound global nuclear disarmament. Prime Minister I.K. Gujral, answering a question in the Indian Parliament in 1997, said, "India believes that any FMCT can be a useful and necessary step but as part and parcel of a negotiated phased program for the elimination of nuclear weapons."

In 1998, after a change of government and nuclear tests, India relaxed this condition and reached consensus to allow the FMCT negotiations to begin. In December 1998, speaking to India's Upper House of Parliament, the Minister of External Affairs, Jaswant Singh, stated, "India's stand on the FMCT has remained consistent. We had supported multilateral negotiations on this subject leading to a non-discriminatory treaty which will prohibit the production of fissile material for weapons purposes. What we are advocating is a treaty which will control future production and not stockpiles. There is no question of

bringing the stockpiles within the scope of FMCT. As far as a unilateral moratorium on fissile material production is concerned, it is not possible for India to agree to it.”^[5]

Brahma Chellaney, a noted Indian strategic affairs analyst, has discussed this change in India’s official position regarding the FMCT.^[6] He quotes the official Indian government statement issued after the May 1998 nuclear tests: "India remains committed to a speedy process of nuclear disarmament leading to total and global elimination of nuclear weapons. Our adherence to the Chemical Weapons Convention and the Biological Weapons Convention is evidence of our commitment to any global disarmament regime which is non-discriminatory and verifiable. We shall also be happy to participate in the negotiations for the conclusion of a fissile material cut-off treaty in the Geneva-based Conference on Disarmament". As described by Chellaney, “The (May 1998) statement signified a major shift in the Indian position on the much-despised CTBT [Comprehensive Nuclear Test Ban Treaty] as well as the FMCT. India abruptly changed its position on these two arms-control measures at the center of U.S. non-proliferation diplomacy.” Chellaney goes on to state, “It is remarkable that in a very short time India – the principal opponent of the U.S.-led non-proliferation regime – has jettisoned its unyielding opposition to the FMCT and CTBT. ... India also opposed the FMCT, leading the group of non-aligned nations to successfully block the start of negotiations because of the refusal of the great powers to discuss nuclear disarmament. But after its tests, India, without consulting its non-aligned partners, announced it would participate in the FMCT negotiations, forcing Pakistan and Israel to fall in line and opening the way for negotiations to start. India was in the group of 28 non-aligned member-states at the CD that had linked the start of FMCT talks to the ‘immediate and concurrent commencement of negotiations and early conclusion of’, among other things, a binding non-use convention and a treaty to eliminate all nuclear weapons. India reckons that by the time an FMCT is negotiated and takes effect, it would have produced enough fissile material for a minimum deterrent against its two closely aligned nuclear neighbors, China and Pakistan.”

Although both India and Pakistan are now committed to participating in FMCT negotiations, a key aspect of India’s position (and where the Indian position differs most markedly from Pakistan’s) is that existing stocks must be excluded from the scope of the FMCT.

5. THE VIEWS OF REGIONAL ANALYSTS ON THE FMCT

This study found that there are fewer Pakistani publications on fissile material control than Indian.

^[5] Elements of External Affairs Minister Jaswant Singh's speech in Rajya Sabha on bilateral discussions with United States, December 16, 1998, [http://www.indianembassy.org/new/js\(rajyasabha\).htm](http://www.indianembassy.org/new/js(rajyasabha).htm)

^[6] Brahma Chellaney, “India’s Nuclear Planning Force Structure, Doctrine and Arms-Control Posture,” presented at the Forum of the UNESCO International School of Science for Peace on Nuclear Disarmament, Safe Disposal of Nuclear Materials, or New Weapons Development: Where are the National Laboratories Going?, Landau Network-Centro Volta, Villa Erba, Cernobbio-Como, Italy, July 1998. <http://www.mi.infn.it/~landnet/brahma.html>

5.1 Survey of Indian Analysts

In a detailed study entitled *Fissile Material Cut-off Treaty and Options for India*, S. Rajagopal of the National Institute for Advanced Studies (NIAS) has explored six options for India, including signing a future FMCT with no conditions, not signing at all, and some options within this range that offer incentives to India.^[7] The six options considered are:

Option One: Sign the FMCT as is

- Benefits:
 - possible slackening of technology controls and embargoes
 - prospects of better India-US bilateral relations and cooperation in the areas relating to security, economic development and South Asia stability
 - possible projection of a better image of India by P-5 (the five permanent members of the UN Security Council)

Option Two: Conditionally sign the FMCT (these conditions are listed below)

- Benefits:
 - If the treaty is prospective, it would restrict the availability of fissile material for weapons
 - India would be capped above Pakistan
 - India would be in a position to retain stockpiled fissile material, however small, which will ensure conditions of minimum deterrence policy are met to an extent

Option Three: Sign the FMCT with quid pro quo

- Benefits:
 - Removal of embargoes and controls would strengthen Indian economic development and help India attain global stature
 - Nuclear cooperation with the P-5 would increase transparency and confidence

Option Four: Declare a moratorium on fissile material production

- Benefits:
 - Increase pressure for global disarmament
 - Compel Pakistan to emulate; and, thus, maintain India's lead in stocks
 - Allow easy withdrawal and renewed production of fissile material
 - The moratorium might be viewed by other countries as a concession by India deserving some rewards

Option Five: Sign the CTBT and declare moratorium on fissile material production

- Benefits:
 - Improve environment for India-US cooperation
 - Increase pressure on US to ratify CTBT

^[7] S. Rajagopal, *Fissile Material Cut-off Treaty and Options for India*, NIAS Working Paper WP1-99, National Institute of Advanced Studies, Indian Institute of Science, Bangalore, India, 1999.

- Increase credibility of India's stated intentions to maintain a minimum nuclear deterrence
- Domestic political advantages in removing friction regarding signing of the CTBT
- Removal of sanctions
- Compel Pakistan to emulate and increase US pressure on China to also follow suit
- Moratorium easy to reverse if needed

Option Six: Reject FMCT

- Benefits:
 - Allow increases in weapons stockpiles
 - India will be viewed as a strong nation with an independent security policy

As a part of the NIAS study, a conference of experts from academia, science, and research convened and voted for the option they preferred. Option Two - that India should sign with conditions - received the most votes. These conditions include:

- Cut-off only prospective
- Time-bound global nuclear disarmament
- Limited scope
- Discharged spent fuel to be treated as stockpile
- Tritium to be included
- Use for military purposes to be banned
- Non-discriminatory verification and safeguards regime

Other analysts based in India are more strongly opposed to fissile material controls. In a series of three papers, S. Chandrasekharan, with the South Asia Analysis Group, argues that the FMCT could constrain India's weapons programs and could involve intrusive verification programs.^[8] He writes that if un-safeguarded pre-existing stocks are available for weapons production, then this, by implication, would legitimize India's nuclear weapons. However, he also feels that the US and other states would not permit giving India any "special" nuclear status. A summary of the views of Indian analysts surveyed follows:

- The FMCT is a ploy by the US and others to bring under safeguards many of India's un-safeguarded facilities.
- The FMCT will forever restrict India to second-class power status by freezing disparities with the five nuclear weapons states.
- The FMCT will never confer any "special" nuclear weapon power status and never legitimize India's possession of weapons.
- If India does sign, it should use its leverage to wrest benefits in return.

^[8]Chandrasekharan, S., Fissile Material Cut-off Treaty and India, Parts I, II, and III, 1999
<http://www.saag.org/papers/paper38.html>

5.2 Survey of Pakistani Analysts

Shireen Mazari, a noted Pakistani strategic analyst has written, “[A] compromise on the FMCT, in terms of the issue of stockpiles would damage Pakistan permanently.”^[9] Zafar Jaspal in an article entitled “FMCT: Policy Option for Pakistan” states: “In fact one objective of the current US nonproliferation policy is to cap and eventually reverse the nuclear-weapon program of Pakistan. Significantly, the FMCT although considered to be a non-discriminatory disarmament measure, global in its reach and universal in its application, is so only in intent. In real terms, it does not change the status quo nor does it in any way reduce the gap between the haves and the have-nots. There is a big gap between India’s and Pakistan’s fissile material stockpiles.”^[10] Retired Wing Commander Muhammad Irshad has also discussed Pakistan’s apprehensions regarding fissile material control.^[11] He writes: “When Pakistan agrees to sign [the] FMCT, agreeing to stop fissile material production at levels many hundred times less than that of India, it would amount to deliberately giving the Indians a perpetual edge, an edge which our generations might repent.”

These themes occur frequently in the writings of Pakistani analysts. A summary of the views of Pakistani analysts surveyed follows:

- The FMCT (if stocks are excluded) would freeze disparities with India.
- The US is attempting to use economic pressure to force Pakistan to give up fissile materials production (even voluntarily).
- The FMCT does not serve the strategic interests of Pakistan.
- Pakistan should only consider signing after its own stocks are sufficient.

6. PROSPECTS FOR REGIONAL INITIATIVES IN FISSILE MATERIAL CONTROL

Despite Indian and Pakistani differences on the future scope of a FMCT, at various times there have been proposals made for regional South Asian initiatives on fissile material control. The US, as well, has proposed regional fissile material control as an option for India and Pakistan to consider. As described by Peter Lavoy, “Several confidence-building measures have been proposed for India and Pakistan: a regional cutoff of fissile material production, a regional nuclear test ban, safeguards on new and existing nuclear facilities, extension of the nuclear no-attack pledge to cover population centers, enhanced international security assurances, regional risk reduction centers, upgraded hotlines between military and political officials, and regular exchanges of military personnel. However, even the best ideas cannot succeed in the absence of a stable arms control culture.”^[12]

^[9] Shireen Mazari, “Has Pakistan Fallen in the US Tactical Trap?”

<http://www.defencejournal.com/dec98/us-tactical.htm>

^[10] Zafar Nawaz Jaspal, “FMCT: Policy Option for Pakistan”, *National Development and Security*, Vol. 9, No. 4, Serial No. 36 (Summer 2001).

^[11] Muhammad Irshad, “Fissile Material: Fears and Compulsions”,

<http://www.defencejournal.com/jan99/fissile.htm>

^[12] Peter Lavoy, “Nuclear Arms Control in South Asia”, p. 273, in *Arms Control: Toward the 21st Century*, edited by Jeffrey Larsen, and Gregory Rattray, (Lynne Rienner Publishers, Inc. Boulder CO) 1996.

The Indian government has had a long-standing interest in negotiating a global ban on fissile material production. As reported by George Perkovich from his interviews with more than a dozen former high-ranking Indian officials and strategic analysts, the Indian government had in 1992 begun to see “the merit and perhaps the international political necessity of cooperating to negotiate global bans on nuclear weapons testing and production of fissile material for weapons”.^[13] At this time, as also reported by Perkovich, experts such as Raja Ramanna (a former head of India’s Atomic Energy Commission) “believed that India could afford to place all its power reactors under IAEA safeguards, a move that would demonstrate India’s nuclear responsibility to the international community”. The recent India-US agreement on nuclear cooperation formalizes this approach. India has made a commitment as a part of this agreement to voluntarily place all of its civilian nuclear facilities under IAEA safeguards. A joint statement issued on July 18, 2005 at the end of a meeting between the Indian Prime Minister Dr. Manmohan Singh and US President George W. Bush says that India agrees to “...working with the United States for the conclusion of a multilateral Fissile Material Cutoff Treaty.”^[14] As current multilateral negotiations on the FMCT are stalled, India might accept a regional approach to fissile material control with Pakistan and possibly China.

7. INDIA-PAKISTAN DISCUSSIONS ON NUCLEAR-RELATED CONFIDENCE BUILDING MEASURES

In 2004, India and Pakistan initiated a process of exploring nuclear-related confidence building measures (CBM).^[15] This process provides a window of opportunity for the two countries to consider a bilateral CBM (such as increasing transparency regarding stocks) related to a future FMCT.

Despite their disparate positions on the scope of a future FMCT, there are motivations for both India and Pakistan to be interested in discussing FMCT-related CBMs. India wishes for the FMCT to provide indirect acceptance of India’s possession of weapons-usable fissile materials. It also wishes to freeze its existing advantage in stocks with Pakistan. Pakistan, in turn, wishes to reduce its disparity in stocks with India. However, many international analysts have argued that the two countries are being disingenuous in their support for the FMCT, and that they would never bring their sensitive facilities under international monitoring or IAEA safeguards. If the two countries participate in bilateral experiments related to possible verification measures of a future FMCT, this could increase their credibility at the CD in relation to the negotiations which would facilitate the overall process.

^[13] George Perkovich, *India’s Nuclear Bomb: The Impact on Global Proliferation*, (University of California Press, Berkeley and Los Angeles, USA: 1999) pg 332.

^[14] From the web site of India’s Atomic Energy Commission – <http://www.dae.gov.in/jtstmt.htm>

^[15] Joint Statement, Second Round of India-Pakistan Expert Level Talks on Nuclear CBMs, available on the web site of India’s Ministry of External Affairs, at <http://meaindia.nic.in/speech/2004/12/15js04.htm>

Currently, the two are engaged in a process of discussing nuclear-related CBMs. This process is being conducted through official expert-level talks. Two rounds of talks occurred in 2004.^[16] Key points listed in the Joint Statement issued at the end of the second round stated:

- Both sides agreed to establish “a dedicated and secure hotline between the two Foreign Secretaries...to prevent misunderstandings and reduce risks relevant to nuclear issues.”
- Both sides have reaffirmed their nuclear weapon test moratoria.
- Both sides have made a commitment to implement the nuclear CBMs they agreed to in principle when they signed the 1999 Lahore Memorandum of Understanding. These CBMs included early notification of accidents involving radiation releases, and the implementation of procedures to minimize the risks of accidental nuclear war.
- Both sides agreed to upgrade the existing hotline between Directors General of Military Operations in their respective Armies.

This process of creating nuclear CBMs offers a window of opportunity for India and Pakistan to consider implementing CBMs related to fissile materials monitoring and control. Such CBMs could enhance their credibility in future FMCT negotiations. Further, both countries want to be recognized internationally as responsible possessors of nuclear weapons. FMCT-related CBMs, therefore, could possibly serve their interests.

8. TRANSPARENCY, VERIFICATION AND POTENTIAL CONFIDENCE BUILDING MEASURES

The crux of creating a South Asian fissile materials control accord will be political. Jon Neuhoff and Clifford Singer examined these issues in “The Verification and Control of Fissile Material in South Asia”.^[17] This paper, although written before the 1998 nuclear weapon tests, defines the problems inherent in India and Pakistan implementing CBMs related to fissile materials. The paper presents a survey of “... the general gamut of arms control verification technologies to see what problems and opportunities might be relevant to the South Asian context. It is argued that a number of regionally applicable arms control technologies exist, but an excessive emphasis on technological issues in a predominantly political problem would be a mistake.”

The confidence-building measures discussed by Neuhoff and Singer cover a wide range of options from “one time perfunctory visits of facilities to total and complete disclosure of all potential weapons-related activities and stockpiles.” Potential agreements that lie between these two extremes are concerned with off-site monitoring, non-intrusive on-site monitoring, on-site monitoring with process stream sampling, and notification procedures and exchanges of data.

^[16] Ibid.

^[17] Jon Neuhoff and Clifford Singer, “The Verification and Control of Fissile Material in South Asia”, in *Nuclear Proliferation in South Asia: The Prospects for Arms Control*, Stephen P. Cohen (Ed.) (Westview Press, Boulder CO, 1991) pp 207-224.

In their paper, Neuhoff and Singer define three groups of nuclear weapons related materials: (1) plutonium, uranium and heavy water, (2) tritium and lithium, and (3) other materials used with natural isotopic concentrations, such as beryllium, heavy metal tampers, centrifuge materials (including maraging steel and light-weight high-strength materials), and manufactured weapons components. For each class of materials, they consider what is technically feasible for confidence building measures within the South Asian context, control of material production, and control of existing materials. Controls on nuclear materials production will involve more systematic monitoring measures than those employed for confidence-building.

8.1 Controls on Fissile Material Production

Neuhoff and Singer assume that India and Pakistan will remain “disinterested for the foreseeable future in simply applying for extension of IAEA monitoring”. The authors suggest that, in the South Asian context, it would be more feasible to set an upper limit on the amount of fissile material which might be diverted over a specified time without detection rather than use the “significant quantity” defined by the IAEA. This would simplify the technological requirements and lessen the intrusive nature of monitoring. Further, they suggest monitoring plutonium production and recycling by defining a limit on possible plutonium production based on the total thermal power output of all known reactors. This suggestion has also been made in a report of a South Asia-related task force of the Carnegie Endowment for International Peace.^[18] Neuhoff and Singer conclude that ground-based monitoring stations measuring thermal emissions would be more practical than remote sensing of infrared radiation from satellites. For assaying the isotopic concentrations of plutonium in spent fuel, they suggest non-destructive techniques relying on estimating the “overall burnup from the radiation spectrum emitted by the irradiated fuel”, in combination with “fairly extensive monitoring by scales, sealed cameras, inspection and record keeping.” For monitoring uranium enrichment in gas centrifuge facilities, the degree of access granted will determine the technical approaches utilized. Although problematic, access would have to be granted for the nondestructive assay of inputs and/or outputs, sampling and access to centrifuge rooms for visual inspections.

8.2 Transparency in Existing Fissile Material Stocks

A key measure for any future bilateral agreement between India and Pakistan or a global FMCT will be increased transparency in fissile material stocks. India and Pakistan could, therefore, consider increasing the transparency related to their current holdings. Although declaring all stocks is unlikely, bilateral confidence could be increased by declaring the quantity of civilian reactor spent fuel being produced and/or stockpiled - the fraction reprocessed need not be shared. The issue of validating existing fissile materials stockpiles is recognized by Neuhoff and Singer to be one of the most vexing problems due to the need for and acceptance of some level of physical access to facilities and stocks. Technological solutions to problems of verification exist and many of these technologies have been developed and implemented for several decades. A review of

^[18] Report of the Carnegie Task Force on Nonproliferation and South Asian Security (Washington, D.C.: Carnegie Endowment for International Peace, 1988).

these technologies is available in reports prepared by the Pacific Northwest National Laboratory.^[19]

How could a political consensus be created that might facilitate regional initiatives on fissile materials control? Technology demonstrations through short-term experiments might be a factor in influencing political, policy, and decision-makers in India and Pakistan to understand that fissile materials control can be effectively and verifiably monitored.

The Materials Monitoring System (MMS) developed at Sandia National Laboratories is one of the possible technological systems that could be demonstrated at select sites (mock or real) in India and Pakistan. The MMS is capable of supporting a variety of sensors and video equipment, and of operating in a multitude of configurations and modes. The MMS logs, stores, and transmits sensor information from monitored items and facilities to users worldwide. The system supports various sensor types (e.g. sensors operating with radio frequency, or hard-wired), and video systems. The MMS provides users with the following capabilities: “1) selecting from a list of desired sensors and video, 2) installing the MMS system, 3) running the system without needing to develop additional software to meet unique monitoring requirements, and 4) using a site configurable interface for data review and analysis.”^[20] The MMS uses a flexible hierarchical architecture to allow near real-time, secure data acquisition and display at any location worldwide. Similar systems have been developed by other laboratories worldwide, and some have been implemented and/or demonstrated through various projects of the IAEA and other agencies. Projects using such monitoring systems could be implemented between India and Pakistan.

The two countries could also work with the IAEA (or within the context of their membership in other international and regional nuclear cooperation organizations^[21]) to share data and information on creating comprehensive tracking and accounting systems for fissile materials.

There are options to conduct joint experiments that demonstrate various monitoring technologies for materials that may be declared as excess and placed under monitoring in the future. These could be conducted first at universities or laboratories using mock set-ups of empty waste containers. Monitoring and verification technologies could involve seals and tags, video cameras, etc. Indian and Pakistani scientists could remotely monitor each other’s mock sites to demonstrate for policy makers that remote cooperative

^[19] R.W. Perkins and N.A. Wogman, *Current and Potential Technologies for the Detection of Radionuclide Signatures of Proliferation, (R&D Efforts)*, Pacific Northwest National Laboratory, Richland, WA, DOE Washington D.C. (USA) Department of Energy International Safeguards Meeting, 22-23 March, 1993.

^[20] Lawrence Desonier, “SNL Material Monitoring System: Sensor Configurations and Latest Applications,” (Sandia National Laboratories, Albuquerque, US: 2000), SAND 2000-0361C.

^[21] An example of one such organization is the Regional Cooperative Agreement for Research, Development and Training in Nuclear Science and Technology in Asia and the Pacific (RCA). The RCA is described in the IAEA Information Circular 167, and includes 17 Asia-Pacific countries, as well as the IAEA, as members. Other examples are the World Association of Nuclear Operators, and the International Nuclear Societies Council (the Indian Nuclear Society and the Pakistani Nuclear Society are members).

monitoring could be a very real possibility. Many such cooperative monitoring projects have been done in the US and Russia using both surrogate and actual fissile materials.

The long-term storage of fissile materials is complicated by thermal and irradiation effects. Some of these effects involve irradiation softening, swelling, formation of volumetric defects, etc.^[22] It is conceivable that India and Pakistan may decide to share information of the safe and long-term storage of fissile materials resulting from civilian programs. The avoidance of accidents involving fissile materials is of great interest to each and information and data-sharing on the subject of safety could form the basis of a CBM.

The US has an interest in the safety and security of Pakistani and Indian nuclear sites to prevent unauthorized access and/or the leakage of materials and components to terrorist organizations. Both countries' nuclear regulatory bodies (India's Atomic Energy Regulatory Board and the Pakistan Nuclear Regulatory Agency) have held high-level meetings with the US Nuclear Regulatory Commission (NRC), and are now beginning discussions on future collaborative projects. Direct US involvement with national defense-related sites is not allowable either under US, Indian or Pakistani law. The US NRC and Department of Energy could, however, collaborate with India and Pakistan on improving the physical protection of fissile materials held at civilian nuclear facilities.

In some cases, cooperation with Indian and Pakistani nuclear scientists is restricted for US agencies by law and ongoing sanctions. However, interactions between US, Indian and Pakistani professional societies might be a way to start dialogue, as long as the interactions comply with all applicable laws. For example, the Institute of Nuclear Materials Management could work with the Pakistani Nuclear Society and the Indian Nuclear Society to arrange workshops that could promote discussions of fissile material security and production control issues.

9. CONCLUSIONS

Given that current multilateral negotiations on the FMCT are stalled, India and Pakistan may well be disposed towards a regional approach to fissile material control. In January 2004, India and Pakistan initiated a process of exploring nuclear-related confidence building measures. This process provides both a window of opportunity and a context for the two countries to consider bilateral measures related to fissile materials production control.

The two countries have fairly divergent views on the scope of a future FMCT. Pakistan wants existing stocks included, while India seeks the capping of future production. The crux of creating a South Asian fissile materials control accord will be political. This study concludes that limited technology demonstrations through short-term experiments can be a factor in helping decision-makers in India and Pakistan to understand that fissile

^[22] J. Leteurtre and Y. Quere, *Irradiation Effects in Fissile Materials*, (North-Holland Publishing Company – Amsterdam: 1972).

materials control can be effectively and verifiably monitored. Transparency measures could begin with declarations on commercial stocks. India and Pakistan might also collaborate on improving the physical protection of fissile materials held at commercial nuclear facilities.

Third parties can play a facilitating role such projects. Interactions between international, US, Indian and Pakistani professional societies might be a way to start the dialogue, as long as the interactions comply with applicable national laws. For example, the Institute of Nuclear Materials Management could work with the Pakistani Nuclear Society and the Indian Nuclear Society to arrange workshops that could promote discussions of fissile material production control issues.

APPENDIX A: RELEVANT DEFINITIONS OF FISSILE MATERIALS

The United Nations General Assembly (UNGA) has passed a resolution that does provide an indication of what should be considered a “fissile material” for purposes of a future FMCT. The UNGA resolution 48/75-L called for negotiations of a

“...non-discriminatory, multilateral and internationally and effectively verifiable treaty banning the production of *fissile material for nuclear weapons or other nuclear explosive devices.*” (emphasis added.)

The International Atomic Energy Agency (IAEA) does not specifically define fissile material. Rather, the IAEA statutes define “nuclear material”, “special fissionable material” and “source material”. These definitions are:

- Nuclear material... *any source or special fissionable material as defined in Article XX of the IAEA Statute.*
- Special fissionable material ...*plutonium-239; uranium-233; uranium enriched in the isotopes 235 or 233; any material containing any of the foregoing; and such other fissionable material as the Board of Governors shall from time to time determine.*
- Source material ...*uranium containing the mixture of isotopes occurring in nature; uranium depleted in the isotope 235; thorium; any of the foregoing in the form of metal, alloy, chemical compound, or concentrate; any other material containing one or more of the foregoing in such concentration as the Board of Governors shall from time to time determine; and such other material as the Board of Governors shall from time to time determine.*

The Indian Atomic Energy Act does define a “fissile” material as “uranium 233, uranium 235, plutonium or any material containing these substances or any other material that may be declared as such by notification by the Central Government.”

At the time of writing this paper, the author has been unable to access a copy of the Pakistani Atomic Energy Act to determine if it contains a definition of “fissile” material. However, the Pakistani Nuclear Regulatory Authority Ordinance of 2000 contains a definition of nuclear materials, nuclear fuels, and nuclear substances:

- Nuclear material...*Nuclear fuel, including natural uranium and depleted uranium, capable of producing energy by self-sustaining chain process of nuclear fission outside a nuclear reactor, either alone or in combination with some other material, and Radioactive products and waste.*
- Nuclear fuel...*any material which is capable of producing energy by self-sustaining chain process of nuclear fission, nuclear fusion, or other nuclear transmutation.*
- Nuclear substance... *any substance or nuclear material which the Authority determines as being a substance or material which may be used for production of or use in atomic energy or for research into matters connected therewith and includes all substances obtained or obtainable from the soil or water by underground or surface working or from the atmosphere.*

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