



IPFM
INTERNATIONAL PANEL
ON FISSILE MATERIALS

Banning the Production of
Fissile Materials for Nuclear Weapons:

Country Perspectives on the Challenges to a Fissile Material (Cutoff) Treaty

Companion Volume to Global Fissile Material Report 2008

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On the cover: the map shows existing and planned uranium enrichment and plutonium separation (reprocessing) facilities around the world.

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About the IPFM

The International Panel on Fissile Materials (IPFM) was founded in January 2006. It is an independent group of arms-control and nonproliferation experts from both nuclear weapon and non-nuclear weapon states.

The mission of IPFM is to analyze the technical basis for practical and achievable policy initiatives to secure, consolidate, and reduce stockpiles of highly enriched uranium and plutonium. These fissile materials are the key ingredients in nuclear weapons, and their control is critical to nuclear weapons disarmament, to halting the proliferation of nuclear weapons, and to ensuring that terrorists do not acquire nuclear weapons. IPFM research and reports are shared with international organizations, national governments and nongovernmental groups.

The Panel is co-chaired by Professor R. Rajaraman of the Jawaharlal Nehru University of New Delhi, India, and Professor Frank von Hippel of Princeton University. Its members include nuclear experts from sixteen countries: Brazil, China, France, Germany, India, Japan, the Netherlands, Mexico, Norway, Pakistan, South Korea, Russia, South Africa, Sweden, the United Kingdom, and the United States.

Princeton University's Program on Science and Global Security provides administrative and research support for IPFM.

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Foreword

Nuclear weapons—whether in the hands of governments or terrorist groups—pose one of the greatest dangers to humankind today. The need for achieving stable global nuclear disarmament is urgent and compelling. Clearly, an essential pre-requisite for reaching this goal is ending the production of fissile materials for weapons and disposing of their vast accumulated stocks. The importance of this step has been realized from the beginning of the nuclear era but actual progress in carrying it out has been remarkably slow.

As far back as 1946, the United Nations Atomic Energy Agency's report to the Security Council recommended prohibiting national manufacture and possession of fissile materials. A decade later, in 1957, the General Assembly adopted a resolution to ban their production for weapons. In 1993, the UN General Assembly called for the negotiation of a treaty. The Conference on Disarmament in Geneva (CD) then agreed on a negotiating mandate. These negotiations have not yet begun.

Meanwhile the number of countries with nuclear weapons has grown to nine. If progress was impeded by disagreements between just the United States and the USSR in the early years, one can imagine the complexity of the problem today. The issues that worry different nations vary from the adequacy of their existing nuclear arsenals to the intrusiveness and cost of verifying a production ban.

This report provides a country-by-country analysis of the concerns of individual nations to different aspects of a prospective Fissile Material (Cutoff) Treaty, or FM(C)T. The word "cutoff" is put in brackets here because some countries would like the treaty also to assure that pre-existing civilian fissile materials and weapons materials that have been declared excess are not converted to weapon use.

The report covers 11 countries: China, France, Germany, India, Israel, Japan, Pakistan, Russia, South Africa, United Kingdom and the United States, i.e., all the weapon states other than North Korea and three key non-weapon states. The analyses are based on government statements as well as personal interviews on the security concerns of the country in question. While the report seeks to describe the positions or likely positions of the individual nations, the authors of the country studies are independent scholars and their summaries do not constitute the official positions of the respective governments.

There are some reasons to hope that negotiations may finally get under way at the CD in the next year or two. It is hoped that the studies presented here will clarify some of the issues involved and help speed the progress towards a treaty banning the production of fissile materials for nuclear weapons.

R. Rajaraman, Co-Chair, International Panel on Fissile Materials

Summary

The proposal for a binding international treaty banning the production of fissile materials for nuclear weapons has attracted attention and support for over fifty years. Today, a universal and effectively verified fissile material cutoff treaty could strengthen the nonproliferation regime, reduce the risk of nuclear terrorism, and help lay the basis for nuclear disarmament by:

- Making binding the moratoria of the Nonproliferation Treaty (NPT) weapon states on their production of fissile material for weapons;
- Ending production of fissile material for weapons in Israel, India, and Pakistan;
- Meeting the demands of the United Nations General Assembly and the Nuclear Nonproliferation Treaty;
- Extending to all states the NPT ban on production of fissile material for weapons and associated International Atomic Energy Agency (IAEA) safeguards that currently apply only to non-nuclear weapon states;
- Improving national monitoring and regulation of fissile material;
- Helping make nuclear-weapon reductions irreversible; and
- Creating institutions and practices necessary for a nuclear weapons free world.

In light of these potential benefits, the Conference on Disarmament (CD) in 1995 adopted the so-called Shannon Mandate (named after Canadian Ambassador Gerald Shannon) “to negotiate a non-discriminatory, multilateral and internationally and effectively verifiable treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices.”

Despite this initiative, negotiations have never gotten off the ground for a number of reasons. As the critical assessments of the various national perspectives described in this report make clear, both the nuclear weapon states and the non-weapon states have concerns that will have to be addressed.

For the nuclear weapon states, these concerns range from questions in China, India and Pakistan about whether they have enough nuclear-weapon materials to doubts in Russia, the United States and other countries about the intrusiveness and cost of inspections. Some of the NPT weapon states also question the point of an FM(C)/T if

India and Pakistan, which are still producing unsafeguarded fissile material (there is uncertainty about Israel), refuse to join the treaty. The weapon states for the most part want a treaty that simply cuts off further production of fissile material for weapons and does not cover pre-existing stockpiles of weapons-usable material.

The non-weapon states, in contrast, want an FM(C)T to serve as a significant step toward the eventual elimination of nuclear weapons. They therefore want a cutoff treaty that includes deep cuts in the existing weapons stockpiles—at least in those of Russia and the United States—and constraints that would prevent the conversion to nuclear weapons of pre-existing stockpiles of civilian and other fissile material declared excess to military needs.

Pakistan too is in the camp of countries that want to include reductions in existing stocks because it fears a cutoff treaty could lock it into a position of disadvantage relative to India. Whether Pakistan actually has a smaller stockpile than India, however, depends upon whether India's reactor-grade plutonium is considered civilian or weapon material.

Finally, there is Israel, which fears that an FM(C)T would require it to accept intrusive verification and place pressures on it to disarm. Israel also strongly objects to a treaty that does not block Iran's on-going uranium enrichment program. In the absence of additional constraints on Iran, Israel sees an FM(C)T as irrelevant to its current security concerns.

A Way Forward

If it is possible to break the impasse over the negotiating agenda of the Conference on Disarmament, FM(C)T the parties will have to be make compromises on a number of very difficult issues.

The United States will have to deal with China's concerns about the U.S. ballistic-missile-defense program, the potential weaponization of space and an emerging U.S. conventional threat against its strategic forces. This could include U.S. agreement to begin talks among key concerned countries on a Treaty on the Prevention of an Arms Race in Outer Space.

India and Pakistan each will have to decide that it is in their interest to agree to a verified halt in their buildups of nuclear-weapon materials.

Israel and its neighbors will have to come to an accommodation on their nuclear programs. This may require, for instance, that the FM(C)T become coupled with a regional agreement, such as a fuel-cycle-facility-free zone that would give Israel increased assurance that its neighbors will not acquire nuclear weapons. Israel's neighbors on their part would require increased assurance that Israel will eliminate its nuclear weapons as part of a broader Middle East peace agreement and settlement with the Palestinians.

At a minimum, a verified FM(C)T should require the IAEA to verify that any HEU produced and plutonium separated by an FM(C)T Party after the treaty comes into force is not diverted to weapons use. This would involve IAEA monitoring of all enrichment and reprocessing plants and any fissile material that they produce after the Treaty comes into force.

Some verifiable arrangement will have to be reached to assure that pre-existing stocks of civilian fissile materials and materials declared excess for weapons purposes can never be returned to weapons and are placed irreversibly under IAEA safeguards.

Finally, early entry into force would be desirable for many reasons. This would be facilitated by an entry-into-force requirement that does not specify ratification by particular states but only by a subset of NPT weapon states and non-NPT states.

Country Perspectives

China

During the past decade, several arms control negotiations have been proposed at the Conference on Disarmament (CD), including most prominently a Fissile Material (Cut-off) Treaty, or FM(C)T, banning the production of fissile materials for weapons; a treaty for the Prevention of an Arms Race in Outer Space (PAROS); a treaty on “negative security assurances” against threats or use of nuclear weapons against non-weapon-state Parties to the NPT; and a treaty on nuclear disarmament. Different groups of countries have very different preferences concerning these negotiations and no consensus has been reached on a mandate for any negotiation. China has pushed very hard for negotiations on PAROS, is very cautious about FM(C)T, and echoes other CD members on negotiations of negative security assurances and on nuclear disarmament. This paper discusses China’s position on an FM(C)T from the perspective of cost-benefit analysis.

How Much Is Enough?

A key question in the FM(C)T cost-benefit calculation is whether or not China’s current fissile-material stocks are sufficient to meet its future weapons needs. China’s fissile materials usable for weapons include both weapon-grade plutonium and weapon-grade highly enriched uranium. Recent non-governmental estimates of China’s stocks of weapon-grade uranium range from 17 to 26 tons and of its plutonium from 2.3 to 3.2 tons.¹ These estimates are based on very limited publicly available information about the capacities and histories of China’s fissile-material production facilities and the quoted uncertainties in the estimates appear smaller than the uncertainties in the input data would suggest.

China has reported very little on its fissile material production, and information on possible work stoppages, losses and inefficiency is not public. The non-governmental estimates may therefore be high.

China’s weapon-grade plutonium has only one use, the production of pits for nuclear warheads. Two tons of plutonium could be used to produce up to about 500 warhead pits. If the amount of China’s weapon grade plutonium is somewhat less, the number of nuclear warhead pits that could be produced would be correspondingly fewer.

Twenty tons of weapon-grade uranium could produce up to another one thousand warhead pits. However, China’s weapon-grade uranium has other potential uses: in the secondaries of thermonuclear warheads and in the fuel of nuclear-submarine and research reactors. These diverse uses of weapon-grade uranium reduce the maximum number of warhead pits China could potentially produce.

According to the most recent estimates published in the NRDC nuclear notebook, China has about 240 nuclear warheads with 176 deployed.² This number has been relatively stable in recent years although China could produce many more if it wished. This suggests that China feels comfortable with and confident with such a small nuclear force in today's security environment. Assuming that: (1) China has to reserve all its weapon-grade uranium for other purposes than producing nuclear warhead pits; (2) all China's weapon-grade plutonium stockpile is available for producing nuclear warhead pits; and (3) the real amount of China's weapon-grade plutonium is somewhat smaller than the publicly estimated 2–3 tons, we can conclude that China's weapon grade fissile stockpiles can support a nuclear force of a few hundred nuclear warheads. If, however, China's actual stockpile of weapon-grade plutonium is considerably less, its security experts may not be able to assure to China's decision makers that its weapon grade fissile stockpiles can meet all possible future weapon needs. This could explain China's cautious and reluctant positions on an FM(C)T during the past decade.

Three factors could affect China's perceived requirements for nuclear warheads and therefore weapon-grade fissile materials. These three factors are changes in: nuclear doctrine, the international security environment, and military technology.

China's leaders fully understand the constraints of the nuclear taboo against the use of nuclear weapons and therefore regard nuclear weapons as a "paper tiger." The purpose of Chinese nuclear weapons is to counter possible nuclear coercion by other nuclear weapon states. For this purpose, China does not need a large number of nuclear weapons or weapons that are kept launch ready.³

According to public reports, China's production of fissile material for weapons stopped in the early 1990s when its economy began to take off.⁴ This suggests that it was a political decision rather than economic constraints that led to a production halt, i.e., China's leaders felt that the Chinese did not need more than a relatively small nuclear force at the time.

There is no evidence that China's emphasis on nuclear weapons has increased since. China has repeatedly reconfirmed its no-first-use commitment.⁵ China's nuclear weapons are reportedly still off alert and its single ballistic-missile submarine has reportedly never conducted a deterrent patrol.⁶ Although China is developing land-based mobile missiles and perhaps new submarines and submarine-launched ballistic missiles to raise the survivability of its nuclear weapons, it can recycle the fissile materials in old warheads on weapon systems being retired into the warheads for the replacement systems. At present, it appears that any net growth in China's stockpile of warheads is not large enough to require the production of more fissile material.

Also at present, China's overall international security environment remains favorable.⁷ China's relations with all other nuclear weapon states are much better than at the time when China first developed its nuclear weapons. Nuclear weapons are no longer a major factor in China's relations with the other four NPT nuclear weapon states: the United States, Russia, France and the United Kingdom; or with its new nuclear neighbors: India, Pakistan and North Korea. China does not need a large nuclear force to deal with these countries. A small nuclear retaliatory capability should be enough to counter any attempts at nuclear coercion.

Possible revolutions in military technology are the major sources of uncertainty in calculating China's future needs for nuclear weapons. If the technologies of missile defense and of conventional strategic offensive weapons become mature and effective,

China may need more nuclear weapons to offset the losses from a possible conventional first strike against its nuclear forces and then to be able to saturate the attacker's missile defense with its surviving force.

It seems that both conventional strategic offensive weapons and missile defenses still lack the capabilities to identify real targets among decoys and therefore their effectiveness remains a big question.

China's decision makers are unwilling to rule out the possibility, however, that, if the United States continues to invest heavily in these capabilities in the future, some technical breakthrough may fix the discrimination problems of conventional strategic offensive systems and missile defense. A safe strategy for China to hedge against unfavorable technical developments is therefore to reserve the option of expanding its nuclear force as a last resort. As its current fissile stockpiles might only marginally meet China's needs for its existing small nuclear force, it might then have to produce new fissile materials. This uncertainty about future needs is a central question in China's FM(C)T calculations.

Relative Security Gains

An arms control agreement brings security benefits to its state parties by putting constraints on the arms developments of the other state parties. This is why states are willing to accept some constraints on themselves. However, the FM(C)T would pose much stronger constraints on China's nuclear capability than on at least some other nuclear weapon states.

Relative to China, the United States and Russia have huge nuclear forces, huge numbers of warheads in reserve, and huge stockpiles of fissile-material. They would not need new fissile materials to build up their warhead stockpiles again. An FM(C)T therefore would place negligible constraints on their nuclear capabilities. Thus, the relative security gain of FM(C)T for China would be much smaller than for other nuclear weapons states.

During the Cold War, China repeatedly complained about the unbalanced gains (or constraints) of arms control treaties. China believed that United States and Soviet Union promoted arms control agreements only when they felt that they no longer needed the options that were foreclosed. Some of these agreements targeted China. The Partial Test ban Treaty and the Threshold Test ban Treaty are two examples.

The end of the Cold War changed this perception in China. The Chemical Weapon Convention (CWC) did not target China as China did not have a chemical arsenal. The CWC was negotiated at the CD largely because the United States took the lead in giving up the option of keeping a retaliatory reserve of chemical weapons.⁸ In the early 1990s, therefore, China no longer felt that arms control agreements were targeting China or brought little relative gains to China. This new perception encouraged China to be very active in the negotiations of the Comprehensive Test Ban Treaty (CTBT). Although the timing of the negotiations was bad for China, China was very constructive and cooperative.

After the conclusion of the CTBT, however, the global arms control situation worsened. The United States has been opposing the negotiation of a treaty on Prevention of an Arms Race in Outer Space (PAROS). The United States also withdrew from the ABM treaty, which China believed to be important. The arms control dynamics at the CD and elsewhere revived China's concern over the imbalance of relative gains of arms

control agreements. It is quite obvious that an FM(C)T would pose a stricter constraint on China's nuclear capability than on those of Russia and the United States. China's efforts to launch a PAROS negotiation were rejected by the United States repeatedly, which confirmed China's perception that an FM(C)T might be a relative loss for China among the five nuclear weapon states.

In principle, an FM(C)T would play a role in preventing emerging nuclear states from acquiring more fissile materials. In an FM(C)T negotiation, China would push for its new nuclear neighbors to join the treaty in the same way as it pushed in the CTBT negotiations for the ratifications of these countries as conditions for the Treaty to enter into force. The experience of CTBT raised a big question about the roles of arms control agreements for China, however, as three of its neighbors, India, Pakistan and North Korea, all conducted nuclear explosion tests after the conclusion of the CTBT.

It is not clear how these countries will respond to an FM(C)T. They might simply reject the treaty as they did the CTBT. Or, they might ask for additional rewards in separate deals. For example, North Korea is asking for energy compensation and benefits in the Six Party Talks in exchange for disablement of its plutonium-production complex. China has been paying economically and politically to encourage North Korea to freeze and dismantle its nuclear program. India and the United States are considering a nuclear deal that may help India increase its rate of production of fissile material for weapons. If China encouraged India and Pakistan to stop their fissile material production for weapons, China could pay the price of damaging its political relationships with these countries. Alternatively, if India and Pakistan delayed their accession to the FM(C)T—as currently seems quite possible—its security benefit to China would diminish.

At the same time, an FM(C)T may encourage nuclear weapon states to take more active steps to dispose of excess fissile materials, which would contribute to efforts to combat nuclear terrorism. If the FM(C)T can play this role, it would be a net security gain for all nuclear weapon states, including China.

On-Site Inspections

The abuse of on-site inspections has long been a concern for China. China worries that other state parties might ask for challenge inspections in China that could reveal sensitive information. This concern is more serious for an FM(C)T than a CTBT. A reasonable on-site inspection under a CTBT would be conducted in a desolate area that would not necessarily have great military significance. An on-site inspection under the FM(C)T would most likely be conducted in industrial facilities that might have military or commercial significance.

To analyze China's attitudes toward FM(C)T on-site inspections, a scenario of verification is assumed here. After the entry into force of the FM(C)T, the state parties would be required to declare their shutdown military fissile production facilities and operational civilian production facilities. The International Atomic Energy Agency (IAEA) would then deploy sensors at both the shutdown military fissile production facilities and at operating civilian production facilities. Routine inspections would be conducted at both categories of sites.

At operational civilian production facilities, routine inspections are to ensure that no civilian fissile material is redirected to weapons production. At shut-down military fissile production facilities, routine inspections are to make sure that there is no new production activity. Besides routine inspections, some challenge inspections may also

be allowed by the treaty to clarify concerns about possible undeclared production of fissile material. State parties or the IAEA could propose a challenge inspection if they suspected undeclared production by another state party. The IAEA would need certain procedures to approve (green light) or to deny (red light) a proposal for such an inspection.

Routine inspections at operational civilian production facilities under an FM(C)T would be similar to the safeguards measures implemented by the IAEA in non-weapon states. Some Chinese civilian nuclear facilities are now under IAEA safeguards, and China has become used to this kind of routine inspection including visits by inspectors and continuous monitoring by on-site sensors. China would feel comfortable with this kind of routine inspection at its civilian production sites if it was part of an FM(C)T verification system.

China does not want the FM(C)T to include declarations of the sizes of existing fissile stockpiles. This may also be the position of the other nuclear weapon states. Even routine inspections at shutdown military fissile-material production facilities therefore might be worrisome to China if it believed that the inspections could reveal sensitive information about the quantity or isotopic composition of the fissile materials in China's nuclear weapons.

Technically, sensors deployed at the shutdown military fissile-material production facilities could be designed not to reveal such information. For example, the sensors could be limited only to optical cameras, seismic sensors and electrical meters. Optical cameras would be used to detect human activities, seismic sensors to detect movements of heavy trucks, and electrical meters to detect the supply of power to key items of equipment. None of these sensors could detect nuclear radiation and provide information about the quantity and isotopic composition of fissile materials produced there in the past. Similar limits could be put on the equipment carried by the inspection team on routine visits. But the inspectors could easily take dust samples by wiping facility surfaces at the inspected site, even if they did not carry any complicated equipment. It would be difficult to stop them from taking dust samples and bringing them back for analysis. The dust samples could possibly contain information about the production history and the composition of the fissile materials, which China would not want revealed. This could become a difficult problem in the FM(C)T negotiations.

China also will be concerned with the procedures to be adopted in connection with challenge inspections under an FM(C)T. These procedures would cover: (1) the kinds of information that could be used as a basis for an accusation of a clandestine violation; (2) the basis for accepting or rejecting a challenge inspection; and (3) how sensitive information irrelevant to the treaty would be protected.

China always feels uncomfortable if human intelligence is used as the basis of an accusation of a clandestine violation. Unlike information gained by most remote-sensing technologies, state parties that make accusation on the basis of human intelligence are unwilling to provide the sources of their information. This creates an opportunity for the abuse of on-site inspections. If the information gained by human intelligence cannot be excluded from the basis for a decision to trigger a challenge inspection, China would want a high threshold, for example, a large majority vote of the treaty parties for authorizing an inspection. China would also like additional measures that would help protect sensitive information irrelevant to the treaty, for example, managed access during the inspection.⁹

The recent history of on-site inspections in arms control verification may encourage China to be more receptive to such inspections. To date, there has not been a single challenge inspection conducted under the Chemical Weapon Convention (CWC), even though the threshold of triggering an inspection under CWC is very low. This suggests that the international community is developing a serious and cautious culture with regard to on-site inspections, and that abuses of challenge inspection are not likely. China's chemical industry has become accustomed to CWC routine inspections. This experience may make China's security experts more willing to accept on-site inspections.

Beyond Costs and Benefits

We have discussed the direct security costs and benefits an FM(C)T could bring to China. But the debates over an FM(C)T in China would certainly go beyond such direct calculations. One reason is that the uncertainties in direct cost-benefit calculations affect the reliability of the conclusions. Another is that China's leaders will certainly take the larger political and economic context into account.

The uncertainties on some FM(C)T considerations are so large that they may lead to very different conclusions. One example is the abuse of on-site inspections. In the negotiation of the Chemical Weapon Convention, the United States pushed very hard for an easy trigger for challenge on-site inspections. In the event, however, things went in the opposite direction.

When the United States Senate ratified the Chemical Weapon Convention, it added reservations that would constrain challenge inspections, although reservations are not technically allowed by the treaty.¹⁰ This suggests that the United States may not after all like the easy trigger for on-site inspections that it appeared to support initially. Also, the relatively easy trigger in the CWC has not encouraged the abuse of on-site inspection in CWC implementation. China now feels quite comfortable with CWC verification.

Some uncertainties about FM(C)T on-site inspections are technical in nature and therefore could be clarified by technical approaches. For example, dust samples collected at old military fissile production sites may not be able to provide more accurate information about the amount and composition of fissile materials produced at the sites in the past than other technical approaches. Or it may be concluded that the information provided by dust samples is not so sensitive after all. A careful study could help clarify this question.

Some uncertainties lie in the dynamics of interactions among countries about arms control and are difficult to predict. For example, other nuclear weapon states may or may not share China's worries about possible abuse of on-site inspections. If they do, they may support a strictly controlled mechanism for on-site inspections, for example, by adding well-designed access management to protect sensitive information irrelevant to the treaty. The CWC experience suggests that the United States and some other countries would not appreciate a culture of frequent and intrusive challenge inspections. China does not have confidence, however, in the stability of the U.S. position on this issue.

The answer to the question, "how much is enough," also has big uncertainties. If, in the future the U.S. Congress limits the budgets for missile defense and strategic conventional offensive weapons as strictly as it has limited programs for designing new nuclear weapons for new missions in recent years, China's concerns about the chance

of technical surprises in these areas will be reduced. Under such circumstances, China would continue to feel comfortable with a small nuclear force and there would be no need to reserve an option for resuming fissile-material production.

These uncertainties do not necessarily suggest that China would oppose an FM(C)T. Instead, the uncertainties add difficulties to FM(C)T decision-making in China and would make every step forward very difficult. Facing large uncertainties in the direct cost-benefit calculations, the decision would have to rely more on the judgment of the Chinese government about the overall arms-control situation and its assessment of its overall national political and economic interests.

If China feels that the overall arms control situation is good and can constrain the future competition in strategic weapons at a low level, it will put more emphasis on the benefits of the FM(C)T and therefore become more supportive of the treaty.

One indicator for China to judge the overall arms control situation would be arms control in space. Even if the FM(C)T negotiations are mandated at the CD without parallel negotiations on other topics, the space issue will continue to be China's central concern. How this is dealt with could change China's confidence in the role of arms control and therefore impact China's approach to the FM(C)T negotiations.

In China, arms control decisions are made on the basis of broader considerations than those of traditional military security.¹¹ Political, economic, social, and environmental factors also contribute to the comprehensive security of a country. Therefore, arms-control debates in China are always put into the big picture of China's overall political and economic interests. In China today, economic and social development is central and the integration of China's economy into the world is still a general trend. The big picture of national interests suggests that, although it is a difficult topic for China, China would be flexible on the FM(C)T.

Conclusion

The calculation of direct security costs and benefits an FM(C)T could bring to China suggests that it is a difficult topic for China. China worries that an FM(C)T would rule out China's option to respond to unfavorable strategic developments by simply increasing the size of its nuclear force. It also worries about abuse of on-site inspections under an FM(C)T. The direct security calculations have very large error bars so the conclusions may not be very reliable. If the overall arms control situation improves in the future, China will have much higher confidence in its small nuclear force and will become much more supportive of an FM(C)T. One important indicator of the overall arms control situation will be U.S. attitudes toward space arms control. If the United States gives some positive feedback to China's proposals on PAROS, this would significantly affect China's concern over the imbalance of security gains of arms control. China's grand calculation about its total national interests is in favor of arms control in general. This suggests that China could be flexible on the FM(C)T, even though it is a difficult topic for China. If PAROS negotiations go forward together with the FM(C)T negotiations at the CD, China would regain faith in the cooperative nature of arms control and be willing to be flexible in the FM(C)T negotiations.

Li Bin

France

France has called for all nuclear weapon states to support the negotiation of a fissile material cutoff treaty, to establish an immediate moratorium on the production of fissile materials for weapons, and seeks transparency measures agreed between the five Nuclear Nonproliferation Treaty (NPT) nuclear weapon states.

France seeks an early start to FM(C)T negotiations, without preconditions. It supports a verifiable treaty, but one that will only end production of fissile materials for weapons purposes. It would not support limits on fissile material stocks held before the entry into force of the treaty, or limits on the production of fissile materials for peaceful purposes or non-explosive military uses.

France recently has taken initiatives to reduce its nuclear arsenal and increase its transparency.¹² Its arsenal is now about half of its Cold War peak. France also has shut down and is dismantling its Pierrelatte and Marcoule facilities for the production respectively of HEU and plutonium for nuclear weapons. It has invited international observers to confirm this.

Reductions in the French Nuclear Arsenal

The French nuclear arsenal has two components: the Strategic Oceanic Force (Force Océanique Stratégique) and the Strategic Air force (Force Aérienne Stratégique). In 2005, independent analysts believed the arsenal included 348 deployed nuclear weapons, comprising 288 submarine-launched ballistic missile warheads (3 submarines with 16 missiles each, with 6 warheads per missile), 50 air-launched cruise missiles and 10 airborne bombs.¹³ On March 21, 2008, President Sarkozy announced a reduction by a third “of nuclear weapons, missiles and planes” for the airborne component, with the result that “the French arsenal will include less than 300 nuclear warheads,” and declared for the first time that France has “no other weapons than those in its operational stocks.”¹⁴ This announcement also confirmed a 2006 official statement that some submarine-based M-45 ballistic missiles would carry less than six nuclear warheads.¹⁵

The announced reductions mean that the strategic air force will likely consist of forty planes each carrying a nuclear-armed cruise missile, and that the submarine force has decreased from 288 to 259 warheads. Taken together, this would give France a total of 299 operational warheads. The reduction in France’s arsenal from about the Cold War peak would free up about 1200 kg of plutonium and 7,500 kg of highly enriched uranium from dismantled weapons.¹⁶ France has, as yet, however, not declared any fissile material as excess to its military requirements.

The dismantling of the excess nuclear weapons will be done at the Valduc center of the Commissariat à l’Energie Atomique (CEA).¹⁷ Previously, fissile materials from disman-

tled weapons were recovered, treated and re-used in new nuclear warheads.¹⁸ According to Charles Million, Minister of Defense during 1995–1996, “France has a fissile material stock sufficient for the next fifty years,” and “beyond these fifty years, we will know how to recycle materials currently employed in our weapons.”¹⁹

The French nuclear arsenal continues to be modernized. At the beginning of 2009, the air force will receive the first squadron of the new Rafale F3 nuclear fighter-bomber to be equipped with a new cruise missile, the ASMP-A with a new warhead, the Tête Nucléaire Aéroportée (TNA).²⁰ The development of a new ballistic missile, M-51 also continues, and is expected to be operational in 2010, with a new warhead expected in 2015, Tête Nucléaire Océanique (TNO).

In his March 2008 speech, President Sarkozy stated that nuclear deterrence remains the principal element of French defense policy, and that the French nuclear arsenal is essential for the security of all European countries against all threats.²¹ The most recent Defense Ministry White Paper (“le Livre Blanc”) detailing French military strategy was presented on June 17, 2008. It states that “France’s nuclear deterrent must remain as France’s ultimate strategic guarantor in all potential situations, even as the doctrines accompanying it are modified to correct emerging gaps.” The White Paper proposes several concrete goals for European defense, including “dialogue with its European partners, who would wish, on the role of (French) deterrence and its contribution to common security.”²²

Marcoule, Pierrelatte and Fissile Material Production

France has decided to close and dismantle the facilities that produced the fissile materials for its nuclear arsenal.²³ The total cost of producing the highly enriched uranium, plutonium and tritium for French nuclear weapons and to fuel its nuclear submarines was estimated at nearly 32 billion euros.²⁴

Marcoule: After 40 years of activity, plutonium production was stopped in November 1992. The Marcoule reprocessing plant was converted to civil purposes and then shut down at the end of 1996. Dismantling began in 1998 and is expected to finish by 2035–2040.²⁵ The CEA is carrying out the first phase of dismantling, involving the conditioning of certain wastes, removal of waste stored in storage pools, etc. The overall cost of these operations is estimated at 5.6 billion euros.²⁶

Pierrelatte: Final shutdown of this HEU-production facility was decided in 1996.²⁷ Dismantlement began the same year and is expected to cost on the order of 500 million euros.²⁸

President Sarkozy has invited “international experts to come to note the dismantling of our installations at Pierrelatte and Marcoule.”²⁹ A Foreign Ministry official has argued that “[t]his invitation shows the willingness of France to promote the transparency of its efforts at disarmament in an unequalled way.”³⁰ IAEA inspectors and independent experts could be among those invited.³¹ Members of the CD were officially invited to send representatives to visit the sites on September 16, 2008.³²

France continues to reprocess spent nuclear fuel at its La Hague site.³³ Construction of the Georges Besse II centrifuge enrichment plant continues. Enrichment is due to start in 2009 and the facility is to be fully operational in 2014. Georges Besse II will ultimately replace EURODIF’s gaseous diffusion enrichment plant (Georges Besse I), which has operated at the same location since 1978.³⁴ In France, all civilian nuclear facilities, including enrichment and reprocessing plants, are subject to Euratom safeguards. On September 10, 2007, the French government sent the IAEA statements on its holdings

of civil separated plutonium, the estimated amounts of plutonium contained in spent civil reactor fuel, and holdings of civil highly enriched uranium as of December 31, 2006.³⁵

The French Position on the FM(C)T

The FM(C)T is for France an important instrument of nuclear disarmament. At meetings of the First Committee of the UN General Assembly, French diplomats have supported all resolutions relevant to the matter.³⁶ According to a French official at the CD “France wants to make progress in stopping the production of fissile materials for the weapons, which is in our eyes a priority”. France is however clear that “for this year [progress on the FM(C)T] is compromised because of waiting for the result of the American election and the blocking of some countries.”³⁷

President Sarkozy’s eight-point action plan of 2008 laid out at the CD included three items directly concerned with the FM(C)T: First, support the negotiation of a fissile material cutoff treaty; Second, establish an immediate moratorium on the production of fissile materials for nuclear weapons; Third, develop transparency measures between the five NPT nuclear weapon states.³⁸ France wants rapid and strong action by other members of the international community, in particular by the nuclear weapon states, on these steps.

For France, the FM(C)T is the next step in multilateral negotiation as regards nuclear disarmament. France seeks a cutoff that is a total ban on future production of fissile materials for nuclear weapons, but that does not constrain stocks held before the entry into force of the treaty, nor limits production of fissile materials for peaceful purposes or non-explosive military uses.

France does not wish to see constraints on naval fuel to be included in a future treaty, although it appears that the latest French nuclear submarines (the *Triomphant* and the *Rubis* classes) do not employ highly enriched uranium fuel but rather low enriched uranium (below 20%).³⁹

France is ready to start negotiations immediately on the basis of the 2007 proposal by the six presidents of the CD. This is a position supported by many delegations and calls for negotiations without pre-conditions on the FM(C)T in parallel with discussions of a number of other arms control measures. It has been supported by France for many years—both as an individual state and within the European Union.⁴⁰

It appears for France that negotiations with pre-conditions would risk preventing discussion on the delicate questions of verification and stocks. Consequently, France thinks that there should be no pre-conditions and the issue of verification should be solved during the negotiation itself. France continues to accept the 1995 Shannon Mandate for “a non-discriminatory, multilateral and internationally and effectively verifiable treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices.” It understands “verifiable” to mean that significant cheating is likely to be detected. No verification arrangements could provide perfect assurance regarding compliance with the treaty.

France is opposed to creating an FM(C)T negotiating process outside the United Nations Conference on Disarmament.⁴¹ France affirmed the importance of the structure of negotiation for an FM(C)T by abstaining from an October 2007 Japanese resolution at the First Committee of the United Nations General Assembly that did not specifically mention the CD as the negotiating body for a cutoff.

Jean-Marie Collin

Germany

Germany has always attached a high priority to an FM(C)T. It welcomed the proposal when it was first put forward and actively participated in the Conference on Disarmament (CD) in working out the 1995 compromise Shannon Mandate from which it has never deviated.⁴²

In April 2008, Germany submitted a working paper to the 2008 Prepcom for the 2010 NPT Review Conference on “Creating a New Momentum for a Fissile Material Cut-Off Treaty (FMCT).”⁴³ This paper urges the immediate start of an incremental and phased process, without prejudice to the continuing differences regarding some key treaty issues: scope and verification. In a first step, commitments to enter negotiations and to implement security measures for fissile material would be declared. In a next step, a framework treaty would set up a gradual implementation process involving voluntary and binding measures such as information exchanges, threat-reduction measures, or accountancy procedures. In parallel, a Group of Scientific Experts could be established in Geneva to examine technical aspects. Furthermore, this could be complemented by an additional Fissile Material Control Initiative (FMCI). This paper suggests that Germany will show initiative and commitment along with a willingness to compromise during the negotiations.

The Debate in Germany

The general background of Germany’s position on the FM(C)T can be found in its security policy and its policy with regard to civilian nuclear energy. Germany sees its security and foreign policy best served in multilateral frameworks and regimes. This is the starting point for shaping positions on arms control, including the FM(C)T. Germany considers the NPT to be a cornerstone of the nonproliferation regime. Implementation of Article VI, i.e., progress in nuclear disarmament, is a goal of German nuclear arms control policy for two reasons: First, Germany shares the belief that it is a prerequisite for credibility of the NPT. Second, in the opinion of a large majority of the population, nuclear arsenals should be reduced. Opinions on whether or not this should end in a nuclear-weapon-free world are divided. Less ambitious goals are uncontested, however, among them the reduction of the number of nuclear weapons, securing fissile materials, implementing the CTBT, and beginning negotiations of an FM(C)T. A high priority has been attached to the CTBT and FM(C)T since the NPT Review and Extension Conference in 1995, when they were explicitly named as near-term nuclear arms-control objectives.

Germany is constrained, however, with regard to the initiative it can take towards reaching these goals. The sources of its constraints are Germany’s NATO-nuclear-planning-group membership, and the continuing deployment of U.S. nuclear warheads on

German soil. While an increasing number of voices demand the end of this deployment, decision-making within NATO on the future of these weapons has not yet taken place. Sometimes, fears are voiced that an end of the nuclear deployment would damage transatlantic ties, which are regarded as an important factor for security and peace in Europe. The German Government tries to avoid too deep frictions with the United States. It is also argued, however, that removal of the weapons would not seriously affect the relationship with the United States.

A second restraint against strong German policy initiatives towards nuclear disarmament is EU integration. Germany does not want to deviate from common EU positions, which are shaped in part by the nuclear weapon states, France and Britain, which do not endorse too far-reaching positions and that are very active in advancing their views.

Third, Germany's domestic lobby promoting nuclear disarmament has become very small. Since the end of the Cold War, the majority of the population does not worry about nuclear weapons. Many journalists find the topic boring.

Germany has a large nuclear industry with deep expertise relating to the nuclear fuel cycle. Currently, the official policy is to phase out nuclear power in Germany over roughly two decades. This phase-out policy does not affect Germany's positions on nuclear arms control.

Germany's nuclear-energy industry does not oppose nuclear arms control. On the contrary, its representatives believe that FM(C)T-related verification measures in the nuclear weapon states would reduce the inherent discrimination of the NPT which requires IAEA safeguards only in the non-weapon states. The industry opposes new initiatives that would increase this discrimination. Thus, when the Additional Protocol was negotiated, the German nuclear industry initially voiced opposition because it was concerned about additional safeguards burdens on the non-weapon states.⁴⁴

Even though Germany ended its own reprocessing program in 1991, it does not oppose reprocessing by other countries. Germany is a member of the Urenco multinational uranium-enrichment consortium and recently launched an initiative to promote multinational enrichment centers as an alternative to national enrichment facilities.⁴⁵

There is no official German position on many key aspects of the FM(C)T beyond a rather short but clear statement of the desirability of negotiations and verification. More details have been often discussed by German stakeholders from various backgrounds that make up Germany's FM(C)T community.⁴⁶ Although, in the past, some of its members would meet in a working group organized by the Foreign Office, this community is unofficial and informal. Nevertheless, a range of views, including the importance of verification, may be regarded as a consensus within this community. This chapter summarizes some of their views on: verification, treaty constraints on the uses of pre-existing stocks of fissile materials, production of HEU for naval-reactor fuel, minimization of civilian use of HEU and the number of countries that would have to ratify the FM(C)T for it to enter into force.

Verification

The German Government sees verification as a major benefit of an FM(C)T. This is in clear disagreement with the official U.S. position that, since 2004, has rejected verification. After the U.S. refusal to consider verification at all, many delegations seem to have become rather cautious about their positions on verification. Germany's official prior-

ity is to start negotiations, including on verification. In this context, a detailed official statement on verification would probably be counterproductive at this time. There is the hope in the cutoff community that by the time the negotiations get going, the U.S. position will have changed again.

Prior to the U.S. shift against verification, there were bilateral U.S.-Germany consultations on verification. The German cutoff community prefers more comprehensive verification than the so-called “focused approach” that has been advocated especially by Australia.⁴⁷ The reason is that the probability of detection of illegal diversion is high only when there is verification of material accountancy throughout the fuel cycle. Otherwise, there would be too many risks of undetected noncompliance.

Thus far, there has been no detailed German estimate of the costs of the various verification scenarios that could be considered. A 1995 cost assessment by the IAEA of several verification scenarios was rough and is now outdated, but provided a practical estimate of the relative costs of various scenarios.⁴⁸ With this background, many German experts view claims by nuclear weapon states that intrusive verification is “far too costly” as an excuse—especially given the sizes of their security-related budgets.

Its status as a non-nuclear weapon state and its commitment to the NPT are central to Germany’s view of its role in the international community. Germany sees possession of fissile materials as implying duties and responsibilities towards the international community. The security and accountancy of its own fissile materials are seen as one of these international responsibilities. In contrast, in non-EU nuclear weapon states, fissile materials—be they for military or for civilian use—are regarded as a matter of only national concern. Germany’s hope is that verification of an FM(C)T would promote a change of this attitude with consequent benefits for the overall security of fissile materials.

On various occasions, Germany has joined calls to promote the transparency of fissile materials and putting excess fissile materials under IAEA safeguards.⁴⁹ This view is supported not only by nuclear disarmament experts, but also by the nuclear industry, which perceives the lack of IAEA safeguards in nuclear weapon states as undermining Germany’s international competitiveness.

Pre-existing Stocks of Fissile Materials

The goal of reducing the quantities of excess fissile materials worldwide is shared by most members of the international community. Germany has taken part in studies of disposition options for plutonium recovered from excess nuclear weapons.⁵⁰ The U.S.-Russian agreement towards this goal⁵¹ was welcomed in Germany and the German nuclear industry bid for contracts in support of the U.S. project to dispose of its excess plutonium in MOX (mixed uranium-plutonium oxide) fuel. Germany has industrial experience with MOX production but has stopped its own domestic activities due to its nuclear-energy phase-out policy. Currently, MOX for German light water reactors is still being produced in France and Britain but the contracts will not be renewed.

Given the huge stocks of fissile materials formerly or still dedicated to military use, the disarmament effect of an FM(C)T will be marginal if the reduction of existing stocks of fissile material available for nuclear-weapon manufacture is not part of the Treaty. There is therefore no opposition in Germany to the Treaty including constraints on the weapons use of previously produced fissile materials. There is broad agreement that nuclear materials released from weapons use as a result of the reduction of weapon stocks must be put under IAEA safeguards as soon as possible, and never withdrawn

again. This would make nuclear disarmament an irreversible one-way street. There is also a great deal of support for an obligation to declare all stocks of fissile material including that in military use.

During the negotiations over what became the 1995 Shannon mandate, however, German diplomats became aware of the strong opposition of the nuclear weapon states to inclusion of pre-existing materials in an FM(C)T. As the FM(C)T would be desirable even without the reduction of pre-existing stocks, they have refrained from taking a firm official position on existing stocks for the moment. Starting negotiations is perceived as the first priority.

Production of HEU for Naval Reactor Fuel

With regard to future production of HEU for naval reactors, while there is no official position at this time, there is a strong sentiment within the German cutoff community that a ban be included in the treaty, for at least the following three reasons:

1. Such production would constitute a loophole that could undermine the treaty;
2. There are already such huge quantities of excess HEU, that any need for the production of even more by the NPT nuclear weapon states will not materialize for many decades. In this context, suggesting that military HEU would still be necessary suggests that a nuclear-weapon-free world will never come, in contradiction to Article VI of the NPT; and
3. A ban on the production of HEU for naval reactors would be compatible with and reinforce the goal of phasing out the use of HEU in civilian research reactors.

Minimization of Civilian Use of HEU

The goal of minimizing civilian use of HEU is official German policy, not least because Germany has experienced a great deal of international criticism for constructing a new HEU-fueled research reactor, the FRM-II and ignoring the consequences for nuclear non-proliferation. The explanation about why HEU instead of LEU fuel was chosen for FRM-II is complex.⁵² A regrettable outcome is the consequence that Germany insists on the right to use HEU for civilian fuel. At the 1995 Review and Extension Conference of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), Germany blocked language that would have banned “new civil reactors requiring highly-enriched uranium.”⁵³ The current official position favors minimizing the civilian use of HEU and a phase out as soon as suitable research reactor fuels are available. This position is controversial within the German community interested in the matter.

Entry into Force

In Germany the prevailing view is that the experience with the entry-into-force clause of the CTBT should not be repeated for the FM(C)T. Germany was willing to bring the CTBT into force without some weapon states, in the hope that they would join later, as had happened with the NPT. With regard to an FM(C)T, Germany will certainly try to avoid the treaty falling hostage to the non-ratification of one or two countries. At the same time, Germany will insist that most of the nuclear weapon states, including India, Pakistan, and Israel must be part of it. As it is clear that some countries will only accede if certain other countries do, Germany probably will encourage their simultaneous ratification.

Germany could endorse an FM(C)T without Israel’s membership. The prevailing assumption is that Israel has probably produced enough fissile materials for its needs. As long as Dimona is running, it is assumed that Israel will have problems accepting

verification. But there is the hope that, after a shut down, it could be cleaned up in a way that would allow verification of its closure without revealing sensitive information. It is believed unlikely that Israel will construct a new plutonium-production reactor.

Conclusion

In sum, Germany's interest in FM(C)T negotiations is strong. It believes that nuclear arms control, nuclear disarmament, and the nonproliferation regime need to be strengthened. Its positions are shaped by a group of stakeholders of various backgrounds who generally agree on most issues. This group is small, however, as is the number of activists generating public pressure for more progress in arms control. The goals of nuclear arms control—although hardly contested—are therefore in danger being given a lower priority than other unrelated foreign policy goals, especially when other countries oppose German arms control positions. Other foreign policy goals, such as the economy, EU decision-making, good relations with other countries, have a much higher ranking in Germany's list of priorities. German diplomats who negotiate on arms control therefore sometimes do not have much leverage in promoting their positions in comparison to diplomats from countries in which these issues rank high. This is the case especially with regard to the nuclear weapon states that have less progressive positions.

Germany can be expected to make constructive and progressive proposals and at the same time to be open to some compromises. Germany also has a great deal of experience in nuclear safeguards and monitoring, and at the same time a strong interest in promoting verification and transparency. It therefore may be expected that there will be specific German input in this regard.

Annette Schaper

India

India's official position is that it supports the development of a Fissile Material (Cutoff) Treaty, or FM(C)T. Notwithstanding statements of in-principle support, however, if India were asked to sign such a treaty today it would not be ready to do so. That is true of some other nuclear weapon states too. But India and Pakistan are also unwilling, as of now, to join the voluntary moratorium of the NPT weapon states against producing more fissile materials for weapon purposes.

India's posture is dictated by its perception of its strategic requirements. Before signing on to an FM(C)T, India has to persuade itself that its security interests will not be jeopardized by doing so.

India and the FM(C)T

India has for many years supported the evolution of some form of a fissile-material-control regime—actively during certain periods. India co-sponsored United Nations General Assembly resolution 48/75L, in 1993, which contained the mandate to negotiate an FM(C)T. This support was reiterated by India after the Conference on Disarmament (CD) adopted a negotiating mandate in 1995,⁵⁴ and in 1998, following the establishment of a negotiating committee.⁵⁵ As part of the Indo-U.S. Agreement (known commonly as the Indo-U.S. nuclear deal) announced in July 2005, India also agreed on “working with the United States for the conclusion of a multilateral Fissile Material Cut-off Treaty.”⁵⁶

India's position on a fissile material production moratorium prior to an FM(C)T was stated quite categorically, however, by the Prime Minister on May 17, 2006, when he said, “India has made it clear that it is not prepared to accept a voluntary moratorium on production of fissile material for nuclear weapons or other nuclear explosive devices. India is only committed to negotiate a Fissile Material Cut-off Treaty in the Conference on Disarmament in Geneva. India is willing to join only a non-discriminatory, multilaterally negotiated and internationally verifiable FMCT, as and when it is concluded in the Conference on Disarmament, again provided our security interests are fully addressed.”⁵⁷

The difference between the Indian position and that of the NPT nuclear weapon states on a fissile-material moratorium is not hard to explain. The United States, Russia, the United Kingdom, and France have already built nuclear arsenals as large as they expect to need in the foreseeable future. These countries also have adequate stocks of fissile material to significantly expand their nuclear arsenals. They have all declared a moratorium on further production. China's case falls somewhere between that of these four nuclear weapon states and India and Pakistan. China seems to have stopped

production of fissile materials, but has not made an official declaration of a unilateral moratorium. A plausible explanation is that it wants to keep open its options of producing more fissile material should its security environment change in the future. The most frequently cited concern is a U.S. ballistic-missile defense system that brings into question China's deterrent.

India's implicit view appears to be that it is a recent entrant to the group of nuclear powers, that its nuclear forces are still at the growing stage and that it needs more time before it can consider any constraints on its fissile-material production. It is unlikely that India will accept any restriction on its production till such time as it feels that it has an adequate nuclear arsenal to deter all foreseeable nuclear threats to its security. India's posture during any FM(C)T negotiations on the critical issues of existing stocks and verification also will be influenced by its estimate of its requirements.

Fissile Material Stocks and Production Capabilities

India's unwillingness to stop fissile-material production for weapons and other military purposes is clear from the civil separation plan negotiated between India and the United States as part of their nuclear deal, and from the bilateral discussions that preceded the plan's finalization.⁵⁸ This plan separates those of India's nuclear reactors that would be considered civilian and placed under IAEA safeguards from those which would be kept outside any safeguards or external inspection. In the Manmohan Singh-Bush Agreement in 2005, the identification of those facilities that would be deemed civilian was left to the Indians. But in practice, this separation had to be negotiated with the U.S. government, which then had to convince the U.S. Congress, on the strength of the separation plan, to pass the required legislation enabling the Deal,⁵⁹ and thereafter, convince the Nuclear Suppliers Group to lift its sanctions against India.

The most contentious item in the separation plan was India's Prototype Fast Breeder Reactor (PFBR). During the negotiations with the Americans, India kept insisting, in the face of considerable initial resistance from the U.S. side, that the PFBR and some Pressurized Heavy Water Reactors (PHWRs) needed to supply plutonium fuel for the PFBR be kept outside safeguards. In the event, not only the PFBR but 8 PHWRs were exempted from IAEA safeguards. The whole negotiating process was accompanied by extensive media coverage and public debate in India. Various public statements by Indian government officials explicitly invoked "national security" and strategic considerations as the primary reasons for wanting to keep the Breeder outside safeguards.

Translating what the phrase "national security" means in the context of reactors capable of producing weapon-grade plutonium, the Indian government had in essence publicly stated that, in its judgment its current stocks of fissile materials plus the future output of its existing two research reactors (CIRUS and Dhruva) that produce weapon-grade plutonium were not sufficient for its strategic needs. Thus, far from declaring a moratorium India has done the opposite. It has declared its perceived need for a significant enhancement in its weapon-grade plutonium production capability.

We estimate India has currently about 550 kg of weapon-grade plutonium—most of it separated. It has produced approximately 13 tons of reactor-grade plutonium in the spent fuel of its unsafeguarded power reactors. There is no official information on how much of this reactor-grade plutonium has actually been separated so far. About 7.5 tons could have been separated if the reprocessing plants at Tarapur and Kalpakam had been operated on average at 50 percent of their design capacity or 3.7 tons if they have operated at only a 25-percent capacity factor. According to the U.S.-India nuclear agreement, the 13 tons of reactor-grade plutonium would not be safeguarded.

It is therefore not “civilian” plutonium and is available for strategic purposes such as conversion to weapon-grade plutonium by unsafeguarded breeder reactors. This is discussed further below. According to one interpretation of the draft FM(C)T tabled by the United States in May 2006, such conversion could take place even after the FM(C)T came into force.⁶⁰

India is generally believed to be producing highly enriched uranium (HEU) of 20–40% enrichment, primarily to fuel a naval reactor to power India’s first nuclear submarine, the Advanced Technology Vessel (ATV). In 2007, Albright and Basu estimated that the HEU enrichment facility, the Rare Materials Project, in Rattehalli, may have a capacity of 9600 kgSWU/y, sufficient to produce about 48 kg of weapon-grade uranium per year.⁶¹

How Much is Enough?

Unlike the NPT weapon states, India has not joined the moratorium on fissile-material production because it views its nuclear buildup as incomplete. There is also no public indication that the Indian government has set a specific target or ceiling on the desired size of its nuclear arsenal. That makes it difficult to give an objective and reliable estimate of when India may be ready to end its fissile-material production for weapons.

But some information is available about the general contours of India’s nuclear plans. Unlike China, Pakistan or Israel, India has made public a Nuclear Doctrine.⁶² It was first released in 1999 in the form of a draft document produced by an advisory committee and, in January 2003, the essence of the draft was confirmed as official policy by the Cabinet Committee on Security.⁶³ The vigorous public discussion of the terms of the Indo-U.S. deal provided some additional insights into the thinking of the government’s nuclear establishment. These indications give some room for optimism that, in a few years, by the time other nations are ready to sign an FM(C)T, India may also be ready to do so.

This optimism stems from India’s own stated policy on its nuclear forces. The Nuclear Doctrine document clearly states, in Section 2.3, that “India shall pursue a doctrine of credible minimum nuclear deterrence.” Furthermore, in Section 2.4, is stated that “[t]he fundamental purpose of Indian nuclear weapons is to deter the use and threat of use of nuclear weapons by any State or entity against India” and in Section 8.2 that “no-first use of nuclear weapons is India’s basic commitment.”

The general consensus among independent Indian experts on the subject is that these clauses in the doctrine are credible and genuinely reflect the government’s policy of developing only a credible minimal deterrence rather than a major offensive capability. Therefore, once the government is convinced that it has enough warheads for minimum deterrence, and a corresponding back-up stockpile of fissile material, one can hope that it will be willing—like the NPT nuclear weapon states—to stop further production. It may also be willing to declare a part of its existing stockpile of reactor-grade plutonium “excess” to its military needs.

The problem lies in deciding how much is enough? That requires translating the qualitative requirement of minimum deterrence into some concrete number of warheads. Minimum deterrence does not require that you should match the arsenals of your perceived adversaries. It only requires that you have enough surviving weapons after a first strike by the enemy, to inflict “unacceptable damage” to the other side.

That in turn requires estimating how much damage would be “unacceptable” to the adversary—partly a matter of subjective judgment. In my view, an arsenal of a dozen or so

weapons should suffice, since even a half a dozen “modest” Hiroshima-level weapons, if dropped on a couple of major cities, could kill a million people in minutes. That is more than enough to be unacceptable to even a remotely rational government of any modern state. If the adversary is controlled by irrational and suicidal leadership (as can conceivably happen) no arsenal of any size could deter them anyway.⁶⁴

As against this requirement of a dozen warheads, India already possesses a stock of over a half a ton of weapon-grade plutonium in separated form or in its spent fuel—enough to make a hundred warheads. This provides a substantial safety margin to compensate for possible losses due to survivability, reliability and interception and still leave several dozen delivered weapons, quite sufficient for creating unacceptable damage and thus acting as a deterrent.

Even if it is felt that a hundred weapons is not quite enough, there is still the large stock of reactor grade plutonium separated in the reprocessing plants. Some of this will no doubt be used to fuel India’s Prototype Fast Breeder Reactor (PFBR) and other similar reactors in the future. The PFBR is designed to generate about 1250 MW(th), with an initial inventory of 1910 kg of reactor grade Pu (to be obtained from the spent fuel of power reactors), and to have an equilibrium breeding ratio of 1.05. A detailed study by Glaser and Ramana concludes that the PFBR can produce more than 140 kg per year of weapon-grade plutonium in its radial and axial blankets, while using just the radial blanket’s output for military purposes would yield about 90 kg per year of weapon-grade plutonium.⁶⁵ Under the Indo-U.S. nuclear deal, this PFBR would remain un-safeguarded.

Reactor-grade plutonium can also be used directly to make weapons, albeit with more technical difficulties due to its higher heat and radiation output, and, for first-generation designs, an uncertain yield. India has not made any public statements restricting its options on how it will use its stock of unsafeguarded reactor-grade plutonium.

Given the large stock of weapon-usable plutonium that already exists, some have argued from the early stages of the Indo-U.S. nuclear negotiations that India can, after retaining its current stocks of plutonium, afford to open all its pressurized heavy-water power reactors to safeguards.⁶⁶ In the event, however, as the Separation Plan revealed, the Indian government did not do that and decided instead to enhance its production capabilities further by keeping the PFBR and 8 heavy-water power reactors outside safeguards.

But that does not necessarily mean that India has changed its policy of minimal deterrence. National security decisions of countries are not always based on precisely tailored requirements. It is not unusual for planners to play safe and stock up with more weaponry than is needed, rather than be guilty of “compromising national security.” Besides, less than 10 years have passed since India became overtly nuclear and it takes some “turn-around time”—both politically and psychologically—before it can cap its nuclear program. Recall that the United States took over 40 years, from 1945 to 1988 before it stopped production of plutonium for weapons and China too started its arsenal build-up thirty years before it is believed to have stopped producing fissile material for weapons in the early 1990s.

The best way to accelerate this process in the case of India is to continue to persuade it that its current stock of fissile material, small though it may be compared to those of the NPT nuclear weapon states, is still sufficient for the stated goal of minimal deterrence.

The response of many nations, including India, to new nuclear regimes like the FM(C)T will also be favorably influenced by faster progress in worldwide disarmament. If the United States and Russia could proceed more rapidly with their disarmament programs and bring the sizes of their arsenals down closer to those of the other nuclear weapon states, then a joint effort by all nuclear weapon states towards further arms reduction could be initiated. With the major nuclear powers still possessing nearly 10,000 warheads each, it is difficult to convince newer nuclear weapon states to see the wisdom in capping their arsenals and associated fissile-material stocks at less than a few percent of that level.

R. Rajaraman

Israel

Israel has always viewed an FM(C)T as a “slippery slope” towards premature nuclear disarmament, mainly because it would undermine its long-standing commitment to a policy of “nuclear opacity,” under which it neither confirms nor denies possession of nuclear weapons. For this reason, Israel offered only token support to the FM(C)T proposals put forward by the United States during the administrations of G. H. W. Bush and Bill Clinton. With its growing concern about possible Iranian acquisition of nuclear weapons and the conviction that an FM(C)T cannot deal with this perceived threat, Israel’s attitude towards an FM(C)T has now evolved into strong opposition. At the same time, Israel is attempting to “balance” this opposition and its purely rhetorical support for the establishment of a Middle East Nuclear Weapons Free Zone (NWFZ) by emphasizing various actions it has taken in recent years in support of the global non-proliferation regime such as its active participation in the Comprehensive Test Ban Organization and its adherence to international norms with regard to the export of nuclear and other military technology. In this manner, it seeks to make the case that Israel is a “responsible” albeit opaque nuclear state in contrast to “rogue” states such as Iran.

In the following, we discuss Israel’s evolving attitude towards the FM(C)T, and, given its opposition to such a treaty, what other initiatives might be undertaken to lessen the danger of further proliferation and possible use of nuclear weapons in the Middle East. To provide a context for this discussion, we begin with a summary of Israel’s nuclear history, with an emphasis on the key role of nuclear opacity.

Israel and the Bomb

Recently, at various international meetings, the leaders of the Israeli nuclear establishment have emphasized “Israel’s long standing commitment to norms of security, responsibility, accountability and restraint in the nuclear domain.”⁶⁷ This new terminology, with its strong resemblance to the language the United States now uses to refer to India, allows Israel to hint at but not explicitly acknowledge its nuclear weapons capability, while promoting its credentials as a supporter of the international non-proliferation regime.⁶⁸ Thus, while fully consistent with Israel’s long-standing policy of nuclear opacity, this “face lift” represents a tacit but significant departure from Israel’s past nuclear policy that was characterized by a determined effort to be a “free agent” outside the obligations and constraints of the nonproliferation regime.⁶⁹

Israel’s nuclear-weapon program began in earnest in the late 1950s, roughly in parallel with the early attempts by the international community to deal with the risk of the spread of nuclear weapons. A decade later, around 1967–68, Israel completed its weapons R&D and produced its first nuclear devices just as the Non-Proliferation Treaty

(NPT) was being finalized. By the time the NPT was opened for signature in the summer of 1968, Israel already had the bomb and was not willing to give it up, making it impossible for Israel to join the treaty as a non-nuclear weapon state.

A year later, in a one-on-one meeting at the White House in September 1969 between U.S. President Richard Nixon and Israeli Prime Minister Golda Meir, Israel's policy of nuclear opacity was born. As long as Israel did not advertise its possession of nuclear weapons by public declaration or testing, the United States would tolerate the capability that was for Israel essential to its national security.⁷⁰

From an Israeli perspective, the policy of opacity has been a great strategic and diplomatic success. On the one hand, both deliberate and inadvertent leaks over the years leave no doubt that Israel has a sophisticated nuclear arsenal.⁷¹ On the other hand, the fact that Israel has not flaunted its nuclear capability while taking actions in support of global efforts to limit the risks of nuclear proliferation and terrorism has persuaded other states to follow the United States lead and acquiesce to its existence.⁷²

Having now attained an advanced nuclear-weapon capability, however, Israel's priority is to burnish its credentials as a democratic, responsible nuclear state, and thus increase international support for retaining its capability while denying it to autocratic, "rogue" regimes such as the current government of Iran. The leaders of Israel's nuclear establishment point to a number of actions that it has taken in recent years in support of the norms of the global nonproliferation regime. First and foremost is its active support for the Comprehensive Test Ban Treaty (CTBT). Israel, like the United States signed the CTBT soon after it was open for signature but has not ratified it. Unlike the United States under the current Bush Administration, however, it participates actively in the work of the CTBT Organization (CTBO), and supports entry into force of the treaty.

In addition, Israel has: (1) completed a multi-year effort to harmonize its export-control legislation with the guidelines of various regimes such as the Nuclear Suppliers Group and the Wassenaar Arrangement; (2) endorsed and launched the ratification process of the amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM) and the Convention on the Suppression of Acts of Nuclear Terrorism; and (3) increased the security at its international border crossings against illicit trafficking of nuclear and radiological materials.⁷³

Israel has not threatened the existence of other states by nuclear weapons or any other means, and has reinforced its public actions in support of the nonproliferation regime by private assurances that it is a responsible custodian of its nuclear weapons with regard to both the doctrine and procedures governing their potential use.

By contrast, the strong evidence that Iran is seeking to acquire a nuclear weapons capability under the cover of a peaceful nuclear program, coupled with its rejection of Israel's legitimacy and the perceived threats to Israel's existence by Iran's leaders, have been used to support the argument that treating Israel and Iran differently with regard to their nuclear status—the so called "nuclear double standard"—is justified.⁷⁴

While basing non-proliferation policy toward a state on the character and actions of its government has a certain logic, however, it is also difficult to implement. Not only do governments change, but the judgment about whether a government fits into the "responsible or rogue" category is inevitably subjective. Moreover, the possession of nuclear weapons by any state in the name of national security, particularly one in a volatile region such as the Middle East, provides a strong incentive to its neighbors to

acquire them. This has motivated efforts to implement arms control initiatives that would “level the playing field” with regard to the obligations of weapons and non-weapons states and hence could be important stepping-stones along the road to nuclear disarmament.⁷⁵ Prominent among these suggested initiatives is a verifiable treaty to cap or cutoff the production of fissile materials for nuclear weapons, the FM(C)T.⁷⁶

The issue for the five NPT and the three non-NPT weapons states is whether the benefits of agreeing to such a treaty outweigh its costs. For Israel, there is a unique dimension that it must consider in weighing these costs and benefits: whether an FM(C)T is compatible with its long-standing commitment to the policy of opacity. And, if not, whether the benefits of an FM(C)T outweigh the costs of compromising or even abandoning this policy, which for decades has been the cornerstone of Israel’s nuclear policy and its nuclear relationship with the United States, and has withstood many challenges, including the decision by India and Pakistan to test their nuclear weapons in 1998.

In our view, Israel will maintain its current opposition to an FM(C)T. We explain why in the following, and then suggest what Israel might do instead to reduce the risk of further proliferation and possible nuclear use in the Middle East.

Israel and the FM(C)T: A Brief History

While the idea of capping fissile material stockpiles is as old as the nuclear age itself, its application to the Middle East is relatively new. It was proposed for the first time in June 1991 as part of a U.S. arms control initiative, which was an attempt in the wake of the American victory in the first Gulf War to “rethink” the Middle East. While no state was mentioned specifically in the U.S. FM(C)T proposal, its focus was clearly on Israel, the only Middle Eastern state that produces fissile material. This was a novelty: ever since the 1969 Nixon and Meir agreement on nuclear opacity, the Israeli nuclear program had not been on the U.S. political agenda. Israel, which had not been consulted in advance on the U.S. proposal, took a “wait and see” attitude, holding off its official response.

Internally, however, the U.S. proposal stimulated a heated debate within the Israeli national security establishment. While some thought that the American proposal could offer interesting opportunities for Israel (e.g., providing “seeds of legitimacy” for the Israeli nuclear program), the majority took the view that Israel should be wary of such a proposal because it could be a “slippery slope” towards premature nuclear disarmament. Ultimately the latter perspective prevailed and became the consensus within the Israeli national security establishment.

At the same time, Israel concluded that it would not be wise to openly reject the U.S. proposal. Conveniently, there was little pressure to do so: the Arab states were not endorsing it either and the administration of G. H. W. Bush had no appetite for a showdown with Israel on the nuclear issue. Formally, Israel never rejected the U.S. proposal. This was also an important lesson for Israel: there may be no need to reject nuclear proposals it does not like, let others do it or let it die naturally.

In any case, the U.S. Middle East Arms Control Initiative was short lived. A few months later, in the wake of the 1991 Madrid Peace Conference, the United States decided to take a different approach and let the parties negotiate their differences. Five working groups were established, including a Working Group on Arms Control and Regional Security (ACRS), co-chaired by the U.S and Russia. By now there is a great deal of literature that analyzes the history of the ACRS working group, in particular, how and why it failed to achieve any substantive results.⁷⁷ There is little doubt, however, that a

strong disagreement between the parties—Israel and Egypt in particular—on how to deal with the Israeli nuclear issue led to the collapse of the ACRS process in 1995.

Interestingly enough, an FM(C)T was never even seriously discussed during the ACRS process. Neither side, each for its own reasons, had any interest in it. Nevertheless, the FM(C)T remained a global arms control issue that Israel could not avoid. In September 1993, in a speech before the UN, President Clinton proposed a multilateral convention banning the production of fissile materials for nuclear explosives or outside international safeguards. Two months later the UN General Assembly adopted resolution 48/75L calling for the negotiation of a “non-discriminatory, multilateral and international effectively verifiable treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices.” In 1995, the Conference on Disarmament (CD) established an ad hoc committee to carry out this mandate.

Despite its reservations, Israel decided both to join the General Assembly consensus resolution, and to participate in the subsequent negotiations in the CD. Despite its high stakes in these negotiations, however, Israel kept a low profile, calculating that it would be wiser to let others impede the negotiating process, which indeed soon stalled. This strategy proved correct until the summer of 1998 when Israel’s joining of the consensus became essential.

By early August 1998, after the India and Pakistan nuclear weapons tests, China, India and Pakistan joined the consensus. Israel was left as the last holdout in the CD, and its position became critical for the entire process in the 61-nation body that makes decisions by consensus. For the first time in its history, Israel found itself in a unique position of being able to derail a global issue. It was in those days of mid August 1998 that the otherwise friendly Clinton administration exerted the harshest pressure it ever used against any Israeli government.

Even though no cutoff treaty was on the horizon, Israeli Prime Minister Benjamin Netanyahu recognized that an FM(C)T, might have profound long-term implications for the future of Israel’s nuclear policy, in particular on opacity. Under intense pressure from Washington, he announced that Israel was joining the consensus, but also let it be known that it would oppose the treaty. In two letters and several conversations with the president, he told Clinton, “We will never sign the treaty, and do not delude yourselves—no pressure will help. We will not sign the treaty because we will not commit suicide.”⁷⁸

Opacity and FM(C)T: The Unstated Opposition

Throughout the 1990s Israel was vague, even secretive, about explaining the sources of its reservations and concerns about the FM(C)T. In the wake of the showdown in August 1998, and in response to the strong letters that both Netanyahu and Israeli Defense Minister Moshe Arens sent to their American counterparts, however, the Clinton administration proposed that a quiet but open strategic dialogue on the cutoff issue be initiated between the United States and Israel in order for the United States to better understand the nature and scope of the Israeli reservations to the cutoff treaty. The American suggestions triggered a heated debate in Israel about whether such a dialogue would be in its best interests. Ultimately, the more conservative view won and Israel decided not to share its reservations, beyond stating laconically that the cutoff would be detrimental to the security of the state of Israel.⁷⁹

In the following, we offer our own interpretation of the underlying reasons behind the Israeli opposition to the FM(C)T. We believe that this opposition involves both political

and technical considerations, and, furthermore, that central to both is a perceived conflict between the FM(C)T and the policy of opacity.

On the political front, the main Israeli concern is that an FM(C)T would be a “slippery slope” to nuclear disarmament. It is likely that the Arab states would argue that an FM(C)T is not an acceptable substitute for a nuclear-weapon-free zone in the Middle East, as it would tend to legitimate Israel’s nuclear monopoly in the Middle East, which they could never accept. Hence they could be expected to “pocket” Israel’s agreement to an FM(C)T, and try to exert further pressure on Israel to disarm. This is consonant with the recent declaration by Arab foreign ministers that, if Israel admits to having nuclear weapons but doesn’t commit to destroy them, the Arab states will leave the NPT.⁸⁰

Technically, it would also be difficult for Israel to maintain its policy of opacity under an FM(C)T—especially if the treaty contained provisions for credible verification, a position currently supported by most of the international community, if not the United States. While the shutdown of Israel’s Dimona reactor, which is used to produce plutonium for its weapons program, could be verified remotely, it is known that the reactor is also used to produce tritium via neutron irradiation of lithium-6 targets.⁸¹ Because tritium has a relatively short half-life—12.3 years—shutting down the reactor would eventually lead to a degradation of the tritium boosted weapons in Israel’s arsenal. While Israel could continue to produce tritium as a party to the FM(C)T, it would have to agree to verification to ensure that the reactor was not also being used to produce plutonium. It is not clear that this could be accomplished without intrusive on-site inspections that would compromise opacity.⁸²

The FM(C)T and Iran

In recent years, Israel has become more open and explicit in its opposition to the FM(C)T. On November 11, 2004, on the last occasion in which the FM(C)T resolution was voted at the UN First Committee, Israel provided an official explanation of its decision to abstain. The text of the Israeli statement follows:

“Israel views the FMCT in both regional and global contexts, and its policy is governed by these two considerations:

1. In the regional context of the Middle East, issues related to nuclear disarmament can be dealt with only after achieving lasting relations of peace and reconciliation, and within the context of the overall regional security and stability. Israel’s approach on the way to move forward on these issues, inspired by the experience of other regions, is anchored in Israel’s long-term vision, and is elaborated in our delegation’s explanation of vote on the draft resolution entitled ‘The Establishment of a NWFZ in the region of the Middle East.’
2. In the global context, recent developments highlight the fact that, non-compliance of states with their international obligations, as well as the misuse and un-checked dissemination of nuclear fuel cycle capabilities, have become among the most pressing challenges in the nuclear non-proliferation field. *The FMCT does not address these challenges and can further complicate them.* [Emphasis added]

We therefore, believe that an overall priority in non-proliferation should be assigned to developing a new effective non-proliferation arrangement pertaining to the nuclear fuel cycle.”⁸³

Evidently, the Iranian nuclear issue creates a political context that reinforces and compounds Israel's objections to the FM(C)T. This opposition is both global and regional. Here are the main considerations:

- An FM(C)T allows the operation of both uranium enrichment and reprocessing facilities as long as the enriched uranium and plutonium are used for ostensibly peaceful purposes, not weapons. However, even if the safeguards to detect possible diversion of these fissile materials to weapons are credible, they cannot prevent breakout and they would provide a convenient rationale for the acquisition of expertise and technology that would facilitate the construction and operation of clandestine enrichment and reprocessing plants.
- On the regional level, Israel insists that the only avenue for nuclear disarmament in the Middle East is via the regional NWFZ route, not the FM(C)T, and such a route could be initiated only in the context of a comprehensive peace process, where the peace issue is the primary driver, not the nuclear issue.

Thus, Israel sees an FM(C)T as a net loss as it requires constraints on its nuclear activities that would lessen the benefits of opacity, while it gives virtually nothing in return.

Conclusion

While Israel has always had reservations about the FM(C)T, it now views any international attention to it as a dangerous distraction from the urgent need to focus on the threat of Iranian nuclearization. Beyond the actions that it has already taken in support of the global non-proliferation regime, however, is there anything else that Israel could do to lessen the dangers of further proliferation and the actual use of nuclear weapons in the region, both now and in the longer term?

We believe that there is, and offer a specific proposal below. While similar in spirit to an FM(C)T, it would offer more tangible benefits for Israel, though also raising similar problems. In any case, in considering such measures, it is important not to lose sight of the "big picture": nuclear weapons even in the hands of "responsible" states such as Israel pose significant dangers, and thus it is essential to work seriously towards ridding both the Middle East and the world of these weapons.⁸⁴

In the Middle East, this means keeping in focus the connection between the possession of nuclear weapons by Israel and the enduring conflict between Israel and its Arab neighbors. Indeed, it was the perception that Israel faced an existential threat from these states that motivated Israel's former Prime Minister, David Ben-Gurion, and his associates to acquire the bomb in the 1950s. Although the military balance in the region today is quite different than it was then, in the eyes of many Israelis and their supporters, particularly in the United States, Israel still faces an existential threat, today from Iran, and perhaps from other states in the region in the future, unless a just and durable peace is achieved. At the moment, such a peace seems a distant prospect, which in the minds of the Israeli Government justifies the retention and possible upgrading of Israel's nuclear deterrent.

While the view that Iran's ongoing nuclear activities pose a threat to Israel's existence is not universally accepted,⁸⁵ instead of debating this point, it makes more sense to accept the premise that a just and durable peace in the region is a necessary precondition for a nuclear free Middle East, and intensify efforts to achieve such a peace, particularly with regard to settling the long-standing dispute between Israel and the Palestinian people.⁸⁶

As to our specific proposal, we suggest making the Middle East a fuel cycle free zone, i.e., a region free of all enrichment and reprocessing plants.⁸⁷ Unlike the FM(C)T, this would eliminate the risk that Iran or another Middle Eastern country could obtain weapons-useable nuclear materials via misuse of declared and safeguarded enrichment or reprocessing plants. Additionally, credible means to verify that such plants have not been constructed clandestinely as well as strong measures to insure that if such plants are found that they be destroyed would also be required. However, in common with the FM(C)T, there would be significant problems in insuring credible and balanced verification while maintaining opacity with regard to Israel's nuclear program, and convincing both Iran and the Arab states that an arrangement that left Israel with a formidable nuclear arsenal while precluding their own acquisition of nuclear weapons was nevertheless a net benefit to them.⁸⁸

We recognize that the need to work seriously and synergistically towards the goals of a nuclear-weapon-free world and a nuclear weapons free Middle East would require a "sea change" in nuclear policy both in Israel and in its "partner in opacity," the United States. Opacity is viewed as a great success by Israel. The Arab states have not only learned to live with it, they seemingly can't live without it.⁸⁹ However, the recent differences in nuclear policy between the United States and Israel with regard to Israel's approach to the Nuclear Suppliers Group and its strong support of the CTBT suggest that Israel should reexamine whether opacity is a wasting asset in that it makes it difficult if not impossible to implement arms control measures that may be necessary to thwart the Iranian threat.⁹⁰

Avner Cohen and Marvin Miller

Japan

Japan has always been a strong advocate of nuclear disarmament and has attached special importance to a Fissile Material (Cutoff) Treaty as its priority at the Conference on Disarmament (CD). Japan has noted the significance of FM(C)T to the Non-Proliferation Treaty (NPT) Article VI and has stated that “quantity capping of nuclear weapons”⁹¹ should be achieved through early commencement and conclusion of FM(C)T negotiations.

Japan’s most recent Working Paper on an FM(C)T was submitted to the Conference on Disarmament in May 2006. The following information on scope, verification and entry into force is largely taken from a statement on this subject to the CD in May 2006,⁹² based on the aforementioned Working Paper, and earlier official statements and papers.⁹³

Scope of an FM(C)T

Japan believes that the ban on the production of fissile material should be limited to “material for nuclear weapons or nuclear explosive devices” as agreed in the 1995 Conference on Disarmament’s Shannon Mandate. Japan’s position is that fissile material for civil use should not be the subject to a production ban under an FM(C)T. Japan’s civilian nuclear program, which promotes reprocessing and recycling of the recovered plutonium, has today a stockpile of 43 tons of separated plutonium.⁹⁴ As a result, Japan opposes any restriction on civilian plutonium programs. Inclusion of a ban on the production of HEU for reactor fuel may not be a problem for Japan, since it is committed to ending the consumption of HEU in research-reactor fuel and is sending spent HEU fuel back to the United States.⁹⁵

Japan believes that, after an FM(C)T, fissile material production facilities for nuclear weapons “will inevitably be closed down, decommissioned or converted to non-nuclear-weapon use.” Confirmation that those facilities will never again be “operated” as production facilities for nuclear-weapon purposes “would be necessary and significant.” This implies a verifiable treaty.

Japan also argues that “diversion” of existing stocks of fissile material for non-nuclear weapon use to nuclear-weapon purposes would be “substantially the same as production,” and therefore “should be banned.”⁹⁶

Japan also views the enrichment of pre-existing fissile material as “production” and therefore would require it to be banned by the FM(C)T. That is, the FM(C)T should prohibit enrichment of plutonium to higher Pu-239 concentrations and of HEU to higher concentrations of U-235.⁹⁷ Japan also notes that receiving fissile materials for nuclear

weapons from another state should be subject to a ban under the FM(C)T, as it would be equivalent to “production.”

Although it considers the production or use of HEU for naval propulsion to be out of the scope of FM(C)T, Japan believes that diversion of naval HEU stocks to nuclear weapon purposes should also be banned. It might be difficult to verify such a ban, however, as HEU for nuclear submarines currently is not subject to international reporting requirements.

Japan thinks it is necessary for nuclear weapon states to “declare all past production of fissile materials” under an FM(C)T.⁹⁸ At the same time, Japan recognizes that such a declaration for some countries might be “unrealistic from the perspective of proliferation of sensitive information.” Japan also notes that “identifying production time and purpose of fissile materials would also be challenging and would require the active input of the states possessing such materials.”⁹⁹

Verification

There is no agreement so far about which organization should be responsible for FM(C)T verification.¹⁰⁰ But, in its 2003 Working Paper, Japan noted that “The FMCT requires a body to implement verification. There is an advantage to using existing expertise and knowledge of the IAEA, and its robust infrastructure, including administration and equipment of the IAEA. Best utilization of the already existing expertise and infrastructure will save administrative costs and reduce financial burdens on States parties.”¹⁰¹

In its 2006 Working Paper, Japan refers to the IAEA as the verification organization for the “Trilateral Initiative” for fissile materials voluntarily declared excess by the United States and Russia. And experts close to Japan’s government often mention the IAEA as an “appropriate” organization for FM(C)T verification.

Japan believes that verification should assure the following:

1. The stock of fissile materials for nuclear weapons or nuclear-explosive devices is not increased after the FM(C)T enters into force. Verification should assure that production reactors and other facilities formerly used for the production of fissile material for nuclear weapons or nuclear-explosive devices are closed down, decommissioned, or converted to non-nuclear-weapon use and remain so; and that,
2. Fissile materials in use for non-nuclear-weapon purposes and fissile materials that have voluntarily been declared as excess as a result of nuclear disarmament are not diverted to nuclear-weapon purposes.

It is difficult to detect “undeclared activities” such as production and recovery of plutonium in an undeclared facility. In this context, the Additional Protocol could be useful, and Japan’s 2003 FM(C)T working paper says “The IAEA Additional Protocol (INFCIRC/540) has already introduced verification arrangements (expanded declaration and complementary access) for the detection of undeclared activities, and such a set of measures should be considered as one of the pillars of verification.”¹⁰²

There is no official statement on how the verification costs of an FM(C)T should be financed. But it is Japan’s position that the FM(C)T is a nuclear disarmament treaty mainly targeted at nuclear-armed countries. The cost of verification of an FM(C)T should therefore be paid from a different account from that used to pay for IAEA

safeguards of civilian nuclear programs in non-weapon states. It is not clear how much of the verification cost Japan is willing to share, but it believes that the cost should primarily be borne by the nuclear weapon states.

Entry into force

There is no clear statement in Japan's 2006 Working Paper about specific countries that would have to ratify to bring the FM(C)T into force. But the 2003 Working Paper said "ratifications by the recognized five nuclear weapon States and those States non-party to the NPT are essential for the operation of the FMCT."¹⁰³

With regard to the non-NPT states, Japan's position has been that they should join the NPT as non-nuclear weapon states. Specifically, Japan would like Israel to join the NPT as a non-weapon state. For India and Pakistan, the situation might be different, as they officially claim that they have nuclear weapons. Japan has introduced official sanctions targeted on those states. If they join FM(C)T, it is essential that both countries also ratify the Additional Protocol, which would make it easier for the IAEA to find undeclared facilities.

Tatsujiro Suzuki

Pakistan

Pakistan has been an active participant in the debates on the proposed Fissile Material (Cutoff) Treaty for many years. In order to deal with what it sees as a significant asymmetry between its fissile material stocks and those held by India, Pakistan has insisted that any FM(C)T should do more than simply ban further production of fissile materials for weapons. It seeks a treaty that will cover existing stocks, require verified declarations and monitoring of such stocks, and a schedule for the transfer of existing military stockpiles to civilian use with a view to equalizing unsafeguarded stocks “at the lowest level possible.”

Pakistan and the FM(C)T

Pakistan has historically favored a possible Fissile Material (Cutoff) Treaty. It supported the December 1993 UN General Assembly Resolution calling for a negotiations on a “non-discriminatory multilateral and internationally and effectively verifiable treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices.”¹⁰⁴ However it played an important role in delaying the start of talks at the United Nations Conference on Disarmament by insisting on debating the scope of the treaty with a view to having it include constraints on existing stockpiles of fissile materials and declaring a simple cutoff treaty to be a “waste of time.”¹⁰⁵ The March 1995 Shannon mandate laying out the basis for talks at the CD on an FM(C)T finessed the issue by noting that the mandate did not preclude any state from raising the problem of existing stockpiles as part of the negotiations. This, however, was not enough to satisfy Pakistan.

After the nuclear tests by India and Pakistan in May 1998, Pakistan’s Ambassador Munir Akram sought to explain at the CD that Pakistan was only seeking nuclear balance in South Asia. He argued that “as regards the FMCT, for Pakistan this issue is now dependent on India’s nuclear status, its degree of weaponization and the *size and quality* of its fissile material stockpiles. Pakistan cannot allow India to once again destabilize the balance of deterrence in future through *asymmetry in the level of stockpiles.*”¹⁰⁶ [Emphasis added]

Responding to the tests, the United Nations Security Council unanimously called upon “India and Pakistan *immediately to stop* their nuclear weapon development programmes, to refrain from weaponization or from the deployment of nuclear weapons, to cease development of ballistic missiles capable of delivering nuclear weapons and *any further production of fissile material for nuclear weapons*, to confirm their policies not to export equipment, materials or technology that could contribute to weapons of mass destruction or missiles capable of delivering them and to undertake appropriate commitments in that regard.”¹⁰⁷ [Emphasis added]

Pakistan and India ignored the Security Council resolution. Under pressure from the United States, Pakistan acquiesced to the fissile material talks.¹⁰⁸ Pakistan made clear, however, that it would negotiate from the same position that it had taken earlier and “raise its concerns about and seek a solution to the problem of unequal stockpiles.”¹⁰⁹ The ambassador to the CD explained that “To maintain deterrence, Pakistan needs to ensure that it is not in a position of strategic vulnerability in certain areas—such as fissile materials and ballistic missiles.”¹¹⁰

The connection between stockpiles and stability was made explicit by Pakistan’s representative, who argued that “We believe that a wide disparity in fissile material stockpiles of India and Pakistan could erode the stability of nuclear deterrence.”¹¹¹ In particular, he explained two weeks later, Pakistan assumed “India will transform its large fissile material stocks into nuclear weapons” and thus needed to “take into account both India’s nuclear weapons and fissile material stockpiles” and that “We cannot therefore agree to freeze inequality.”¹¹² This position persists today and is the core of Pakistan’s position on the FM(C)T. This makes it very likely that Pakistan would neither sign nor ratify an FM(C)T unless India does so at the same time.

Current Stocks and Production

As of 2007, Pakistan may have accumulated a stock of about 1.4 tons of highly enriched uranium for its nuclear weapons (enough for perhaps 50–60 weapons assuming 25 kg per warhead). It may be producing perhaps 0.1 tons of HEU per year (i.e. about 4 weapons worth a year).¹¹³ Pakistan also has about 90 kg of weapon plutonium (enough for 15–20 warheads) from its reactor at Khushab, which yields about 10 kg (about 2 weapons worth) per year.¹¹⁴ This suggests that Pakistan may have fissile material sufficient for perhaps 65–80 weapons and may be increasing its stock by the equivalent of about 6 weapons worth per year.

Pakistan is expanding its fissile material production capacity. There are two additional production reactors under construction at Khushab.¹¹⁵ Each of these new reactors could produce about 10 kg of plutonium a year, if they are the same size as the existing reactor at the site. Imagery from late 2006 shows that Pakistan has also been working on a new reprocessing plant at Chashma, presumably to reprocess the spent fuel from the new production reactors.¹¹⁶

Pakistan also has about 1.2 tons of safeguarded reactor-grade plutonium in the spent fuel from its nuclear power reactors. This is not reprocessed.

FM(C)T, Stocks and Asymmetry

Pakistan refers to a Fissile Material Treaty (FMT) rather than a Fissile Material Cutoff Treaty as a way to emphasize the importance of stocks. Pakistan argues that “the proposed FMT should also deal with the issue of *past production of fissile material* and, through their *progressive and balanced reduction*, promote the goal of nuclear disarmament. The treaty must therefore address the question of *production—past, present and future*—in its entirety at both regional and global levels.”¹¹⁷ It has argued that “existing stockpiles, unless accounted for and monitored, could be used for the development of new and most sophisticated nuclear weapons.”¹¹⁸

It would seem that Pakistan wants an FM(C)T in which fissile-material stocks would be declared and these declarations would be properly verified. It is not clear how this could be done without verification of fissile materials in weapons, which would seem to undercut Pakistan’s traditional reliance on keeping secret the size of its fissile stocks and its arsenal. Pakistan may intend to consider these issues as they arise in possible CD discussions.

If accounting for and verifying stocks is to be discussed in FM(C)T talks, a key question will be what stocks are to be included. As noted earlier, Pakistan may have sufficient fissile materials for up to 80 weapons or so. It is estimated that India may have sufficient weapons plutonium for about 130 weapons.¹¹⁹ This would not seem to be a “wide disparity” in stocks. However, Pakistan is also concerned about India’s stock of unsafeguarded power-reactor plutonium.¹²⁰ There are reports that at least one Indian test in 1998 used plutonium that was less than weapon grade.¹²¹

India may have accumulated a total of almost 13 tons of plutonium in unsafeguarded spent power-reactor fuel discharged as of mid-2007. Considering only spent fuel that has had time to cool for three years and a 50% capacity factor at India’s reprocessing plants, India may have accumulated perhaps 7.5 tons of separated reactor-grade plutonium. Assuming that 8 kg of such plutonium may be sufficient for a weapon, this would be enough for over 900 weapons. This stockpile is likely to grow rapidly.¹²²

If Pakistan’s concerns about an asymmetry in fissile material stocks stem from India’s large and growing unsafeguarded power reactor plutonium then Pakistan is likely to seek to have it declared and verified.

A Production Moratorium and the U.S.-India Nuclear Deal

On 26 October 1998, Pakistan’s Foreign Minister, Sartaj Aziz, was quoted to the effect that “Nuclear scientists have advised the government that there was no harm in signing the CTBT and FMCT at this stage as we had enough enriched nuclear material to maintain the power equilibrium in the region.”¹²³ It was made clear, however, that there was no possibility of a unilateral or bilateral moratorium. The Foreign Minister later explained “They [the United States], of course want us to impose some kind of a multilateral or unilateral moratorium on the production of fissile material. But we feel that we will only abide by the Treaty once it is concluded because you can’t do anything unless there is a framework. There is asymmetry with India ... so I think our position is quite reasonable.”¹²⁴ This was reformulated to imply that Pakistan would not agree to halt its fissile material production, “we cannot do that unless the FMCT comes into force.”¹²⁵

There is now growing concern that India’s capacity for producing weapons grade plutonium may increase significantly in coming years, in part because of the 2005 U.S.-India deal.¹²⁶ It is estimated that India could produce about 40–50 weapon equivalents worth a year of weapon grade plutonium in its unsafeguarded ‘military’ facilities—up from perhaps seven weapons equivalents a year today. The major contributors to the increase would be from weapon-grade plutonium produced in the blanket of the prototype fast breeder reactor that is expected to be completed in 2010 and the diversion of freed up domestic uranium to produce weapon-grade plutonium in some of India’s unsafeguarded heavy-water power reactors.

Responding to the U.S.-India deal, Pakistan’s National Command Authority, which has responsibility for its nuclear weapons program, declared in August 2007 that “the US-India Nuclear Agreement would have implications on strategic stability as it would enable India to produce significant quantities of fissile material and nuclear weapons from un-safeguarded nuclear reactors ... [and] expressed firm resolve to meet the requirements of future credible minimum deterrence.”¹²⁷ This would seem to imply a Pakistani decision to increase its own fissile material production capacity. Citing its concerns about the U.S.-India deal, Pakistan has again emerged as perhaps the key obstacle to the start of talks towards a Fissile Material Cutoff Treaty at the United Nations Conference on Disarmament.¹²⁸

Reductions

Pakistan has made clear that it will resist an FM(C)T that only serves to freeze stocks at existing levels. It has proposed that “A cut-off in the manufacturing of fissile material must be accompanied by a *mandatory programme for the elimination of asymmetries* in the possession of fissile material stockpiles by various states. Such transfer of fissile material to safeguards should be made first by states with huge stockpiles, both in the global and regional context.”¹²⁹

Rather than leave such reductions in the largest stockpiles to arms control agreements arrived among nuclear weapon states, Pakistan has recently argued that “A fissile material treaty must provide a *schedule for a progressive transfer of existing stockpiles to civilian use and placing these stockpiles under safeguards so that the unsafeguarded stocks are equalized at the lowest level possible.*”¹³⁰

Pakistan has not offered any indication of what it considers to be “the lowest possible level” of fissile material stocks, how this is to be decided, or what it believes could be a schedule for reductions. It may be that Pakistan assumes that it would not have to reduce its stocks, since it has the smallest fissile material stocks of any of the weapon states (apart from North Korea, which, in any case, has already committed to giving up its nuclear weapons and plutonium stocks as part of a peace process with South Korea and the United States).

FM(C)T and Verification

Pakistan has consistently argued for a verifiable treaty. It argued in June 2007 at the CD that “we insist on the verification of current stocks.”¹³¹ It has indicated in the most general terms that the treaty should not be too intrusive or discriminatory, with all signatories subject to the same standards of verification.

If and when FM(C)T comes into being, Pakistan has indicated that it will use its existing military enrichment and reprocessing facilities for civilian purposes. Pakistan has not revealed all the facilities in its nuclear weapons complex. Under a 1988 agreement, however, Pakistan and India exchange annually a list of nuclear facilities that are not to be attacked.¹³² The list is not made public, but it has been reported that both states left at least one facility off their lists.¹³³

In determining its approach towards verification under an FM(C)T, Pakistan may not yet have considered whether, under what circumstances, and with what constraints it would be willing to allow inspectors into its enrichment and other nuclear facilities.

Pakistan is a signatory of the Chemical Weapons Convention, which does allow inspections at facilities suspected of producing or storing chemical weapons. But Pakistan may not have considered developing managed access protocols for, say, the Kahuta uranium-enrichment plant. In the statement accompanying its CWC ratification, Pakistan announced it “will exercise its rights ... to indicate its non-acceptance of inspectors and inspection assistants as it deems appropriate ... [and] Pakistan will at all times retain its sovereign right to take all necessary measure to protect its national security interests against disclosure of confidential and sensitive information unrelated to the CWC or intrusion into sensitive facilities unrelated to the convention or if the Convention is used to justify degrading Pakistan’s defense capabilities unrelated to the CWC. Pakistan regards these as matters of ‘supreme national interests’ as recognized under international law and provided for under Article XVI of the CWC.”¹³⁴ In other words, Pakistan would exercise its right to withdraw from the CWC if it felt its national security was jeopardized by an inspection it felt to be inappropriate. Pakistan may extend this perspective to verification under an FM(C)T.

Prospects

In June 2008, Pakistan again laid out its position on an FM(C)T at the CD. It continues to insist on negotiation of a non-discriminatory and verifiable treaty with “space for addressing the question of the existing and future stocks, as it was done in the Shannon report.”¹³⁵ It is concerned that, without these conditions being spelled out as part of the negotiations, “The dice is loaded from the start.”

If there were to be a decision by other countries, especially all the other nuclear weapon states, to proceed on FM(C)T talks at the CD, it is not clear that Pakistan would be willing or able to block progress by itself. Instead, Pakistan could choose to participate in the talks and continue to raise its concerns, with support from other countries who also want both verification and stocks to be included as part of the possible treaty. These countries include New Zealand,¹³⁶ Iran¹³⁷ and Brazil.¹³⁸ If the final treaty does not meet Pakistan’s concerns, it has the option to simply not become a party.

Zia Mian and A.H. Nayyar

Russia

Russia supports a verifiable ban on the production of fissile materials for weapon purposes and other explosive devices. In its view the conclusion of such treaty would prevent both the Nuclear Non-Proliferation Treaty and de facto nuclear weapon states from increasing the stocks of materials they have available for weapons purposes and would be a logical step in strengthening the nuclear nonproliferation and disarmament regime.¹³⁹

Russia's official position on an FM(C)T was formulated around 2000 and apparently has not changed significantly since then. Russia's proposed approach to the FM(C)T is that all Parties to the treaty should accept the following obligations:

- 1) Not to produce weapon-grade uranium and plutonium for use in nuclear weapons;
- 2) Not to assist or encourage other states in the production of these materials
- 3) Not to transfer fissile materials from civil to nuclear weapon use;¹⁴⁰
- 4) To accept international monitoring of nuclear materials and facilities for verification of compliance with obligations under the treaty.¹⁴¹

Russia's views on the scope of the treaty, associated verification measures and participation are given below.

Fissile Material Production in Russia

The production of fissile materials for weapons in Russia ended in 1994 and Russia has confirmed its continuing commitment to a moratorium on production.¹⁴² Weapon-grade uranium has not been produced since 1989.¹⁴³ Ten out of Russia's thirteen plutonium production reactors were shut down by 1992. The three remaining reactors operated exclusively to generate heat and electricity for nearby cities, but they produced as a by-product some 1.2 tons of weapons-grade plutonium per year. Since the fuel discharged from these reactors is not designed for extended storage, it has been reprocessed, but the separated plutonium was stored. Newly separated plutonium has not been used for nuclear weapons since 1994.¹⁴⁴ The two plutonium production reactors at Seversk were shut down in the summer of 2008. Completion of work on coal-fired plants to replace the heat and electric power from the third reactor at Zheleznogorsk is expected by the end of 2010. After that, Russia will have fully ended its production of weapon-grade plutonium.

Russia has never released information on how much HEU and weapon-grade plutonium it produced. According to non-governmental estimates, it currently has 945 ± 300 tons

of HEU and 145 ± 20 tons of weapon-grade plutonium.¹⁴⁵ As a contribution to making its nuclear weapon reductions irreversible, Russia declared 500 tons of weapon-grade HEU and 34 tons of weapons-grade plutonium excess for weapons purposes. Under the Russian-U.S. HEU Purchase agreement, the 500 tons of excess weapons HEU is being blended down to 4–5% U-235 and shipped to the United States for making power-reactor fuel. This contract is accompanied by a transparency protocol to assure the United States that it is indeed weapon-grade uranium that is being blended down. As of March 2008, 325 tons had been blended down.¹⁴⁶ Russia's excess weapon-grade plutonium is to be mixed with uranium and mostly used to fuel the fast-neutron BN-800 power reactor, which is under construction.

Definition and Declaration of Fissile Materials

The FM(C)T treaty would ban future production of nuclear materials for nuclear weapons and therefore should focus on materials that are used directly to produce weapons. According to Russian Governmental experts, these are:

- Uranium enriched to 90% or greater in U-235; and
- Plutonium containing more than 95% Pu-239.

The FM(C)T should not prohibit the production of fissile material for other military and civil non-explosive purposes, such as naval reactors or medical isotopes. Also, technological operations related with the “cleaning up” plutonium recovered from nuclear weapons before reuse should not be considered as “new” production of weapons fissile materials.

The treaty also should not bring already produced fissile materials under international safeguards. Russia considers the inclusion of existing stocks of weapons materials in the treaty as immediate nuclear disarmament, which would be unrealistic. It would require intrusive international inspections of the most sensitive nuclear facilities and “lead to establishing cumbersome verification mechanisms, and, accordingly, unacceptably high cost for their maintenance.”¹⁴⁷

Russia also opposes declarations of pre-existing stocks of nuclear materials in weapons or designated for weapons. It believes that this would be counter-productive. It believes such declarations could not be verified and therefore would not enhance confidence. Any attempt to verify such declarations indirectly through reconstruction of past production and disposition would require an enormous effort to examine records and physical evidence from several decades of large-scale activities.

In the mid-1990s, Russia expressed its readiness to consider exchanges among nuclear weapon states of information on the quantities and storage locations of fissile materials released in the process of dismantlement of excess nuclear weapons. It was also willing to consider placement of these materials under IAEA monitoring.¹⁴⁸ This idea has not reappeared in Russia's nuclear-arms reduction proposals since 2000, however.

Verification

Russia believes that IAEA safeguards should be the main instrument for verification of compliance with obligations under an FM(C)T. The IAEA has the necessary technical expertise and experience to undertake inspections at declared facilities and to investigate the possibility of undeclared fissile-material production.

Discussion on the verification of the FM(C)T has centered around two alternative approaches: a “comprehensive” approach and a “focused” approach. Russia opposes the

“comprehensive” approach, which would place all civilian nuclear activities under international safeguards. Applying safeguards to nuclear installations that were designed without technical features to facilitate verification and which are therefore not “verification friendly” would be technically difficult and require great financial expenditures. Moreover, the military and civilian nuclear activities in Russia are closely interconnected. RosAtom, which is responsible for most of Russia’s nuclear energy and weapons-production complex, would like to minimize verification costs and intrusiveness to the maximum extent possible.

For these reasons, Russia considers a “focused” approach, covering only enrichment and reprocessing facilities capable of producing fissile materials and the fissile materials produced by these facilities after an FM(C)T comes into force, more acceptable from a pragmatic point of view.¹⁴⁹ In its view, this approach seems more likely to be both negotiable and cost effective.

Russia’s position is that international verification should not cover activities by nuclear weapon states associated with the maintenance of their nuclear-weapon arsenals. This means that facilities at which weapons components containing fissile materials are fabricated, maintained, assembled or stored, or where weapons plutonium is cleaned should not to be subject to verification. Although Russia agreed to the Chemical Weapons Convention, with its provision for challenge inspections and managed access in 1997, it would definitely object to the possibility of challenge inspections at its nuclear-weapons facilities today.

Participation

Russia believes that an FM(C)T should include not only all nuclear weapon states, but also countries that are potentially capable of producing nuclear-explosive devices and that possess uranium enrichment and spent fuel reprocessing facilities. Russia believes that non-participation in an FM(C)T by any of the *de facto* nuclear weapon states (India, Israel, North Korea and Pakistan) would completely negate its value.

Finally, it should be noted that an FM(C)T is not currently a subject of discussion by Russia’s nuclear-arms-control community. This can be explained partly by the long period of no progress in discussions on possible FM(C)T negotiations at the Conference on Disarmament (CD). As a result, many experts consider the FM(C)T a “dead” topic. There are neither governmental organizations nor even individual experts in Russia’s government who are actively interested in promoting negotiations on the FM(C)T at the CD. The positions regarding an FM(C)T described here therefore should be considered “starting” positions. If the current deadlock at the CD is resolved and negotiations begin, some elements of the Russian approach might be reconsidered, in particular its approach to the definition of fissile materials under the FM(C)T.

Anatoli S. Diakov

South Africa

South Africa's position on the Fissile Material Treaty derives from its unique practical experience in building and then destroying a nuclear-weapon program, and the subsequent investigation undertaken by the International Atomic Energy Agency (IAEA) to verify the completeness of South Africa's declaration of its stocks of fissile material. Its principled position on nuclear disarmament and its leading role in both the Non-Aligned Movement (NAM) and the New Agenda Coalition enabled South Africa to gain traction on its position that a Fissile Material Treaty should have both nuclear non-proliferation and nuclear-disarmament objectives. Reflecting this view, South Africa has consistently refrained from using the more common, but limited in scope name for the future treaty, "Fissile Material Cut-off Treaty" preferring instead to refer to a Fissile Material Treaty (FMT).

During the 1994/95 consultations that led to the "Shannon mandate," South Africa was one of a few countries that argued that the future treaty should not only cap production of fissile material for nuclear explosive purposes, but should also cover existing stockpiles. Other NAM countries that held this view included Algeria, Egypt, Iran, Mexico and Pakistan. While, the 1995 Shannon Report stated that the Conference on Disarmament (CD) should "negotiate a non-discriminatory, multilateral and internationally and effectively verifiable treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices," it emphasized that this did not preclude any delegation from raising the issues of scope and verification within the Committee. This left the negotiating mandate open-ended which was considered necessary to get consensus on the mandate in time for the 1995 NPT Review and Extension Conference.

At the 2000 Review Conference, South Africa argued that, for the treaty to be considered as an effective disarmament measure (as it was listed in the 1995 Principles and Objectives for Nuclear Nonproliferation and Nuclear Disarmament), it should have both nuclear nonproliferation and nuclear disarmament objectives. In South Africa's view a "cut-off" treaty that did not address stockpiles would freeze the status quo of nuclear-capable countries but not serve to reduce nuclear weapons over time. It is significant that, as a result of South Africa's efforts, the 2000 NPT Review Conference, while it reiterated the original Shannon mandate among the so-called 13 steps toward nuclear disarmament in the final declaration adopted by that conference, also stated clearly that both "nuclear disarmament and nuclear non-proliferation objectives" should be taken into consideration during the negotiations of the treaty.

South Africa was one of the first delegations in the CD to put forward concrete proposals on an FMT when it submitted a working paper during the 2002 session. The South

African working paper dealt with some of the most vexing issues that negotiators of an FMT will face. South Africa argued, and continues to argue, the merits of a verifiable treaty that would cover both past and future production of weapons usable fissile material. South Africa also emphasized that, while declarations of stocks of weapons materials by all nuclear-capable states would not be feasible, declarations of excess materials should be made irreversible by the treaty.

The most recent statements by South African delegations to the CD, the General Assembly First Committee and in the context of the NPT review process show that South Africa's position has not changed. In fact the introduction by the United States of a draft treaty that excluded not only a disarmament dimension, but also verification, further fueled South African arguments that the treaty should be a verifiable nonproliferation and disarmament mechanism.

A FissBan sans "C"

South Africa believes that an FMT should prohibit production of fissile material for nuclear-weapon or nuclear-explosive purposes by all parties, including the NPT nuclear weapon states and the non-NPT states. The notion that effective verification of an FMT cannot be achieved suggests that the NPT too is not verifiable. The success and future credibility of an FMT would require verified assurances that fissile material is no longer being produced for weapons purposes.

The nonproliferation component should prevent or regulate further production of weapon-grade materials for legitimate (non-proscribed) uses such as fuel for research reactors, naval reactors, etc. An FMT could also prohibit the transfer of previously-produced fissile material between weapon states for weapon purposes.

The disarmament element should capture in an irreversible way weapons material declared as excess. To this end, an FMT should prohibit the use in weapons of fissile materials produced before the Treaty comes into force for a country if they are: in use for non-military purposes; in a weapon-production complex but declared to be excess to military needs; or in a reserve for future use as fuel in military (e.g. naval-propulsion) reactors.

The treaty should also address the security of stockpiled fissile material. International monitoring of civilian and excess weapons fissile materials would aid in securing them against theft. The treaty should encourage states to apply measures of physical protection equivalent to those provided for in the Convention on Physical Protection of Nuclear Material and in IAEA recommendations and guidelines.

An old policy with a twist. Given the close relationship between an FMT and current international efforts to minimize, if not eliminate, the use of highly enriched uranium (HEU) in the civilian sector, it is important to consider South Africa's position in this regard. After dismantling its nuclear weapons and associated programs in the early 1990s, over 800 kilograms of unirradiated HEU (averaging roughly 80% uranium 235) was placed under strict Additional Protocol type IAEA safeguards.¹⁵⁰ Of this amount, South Africa today maintains an estimated 400–450kg of unirradiated HEU stocks in a highly secured vault at its Pelindaba research facility site under 24-hour IAEA surveillance. In addition, IAEA teams inspect South African nuclear facilities, including the HEU on a regular basis to verify that the stockpile is secure and not diverted for any weapon related purposes. Pretoria considers this stockpile as a strategic national asset based on two main considerations.

Commercial value: Not only did the apartheid government invest considerable resources in producing the HEU over the life of the nuclear weapons program, but as the world's third largest supplier¹⁵¹ of industrial and medical isotopes, such as molybdenum-99¹⁵², the HEU represents a major commercial asset (the HEU is used as a "target" for neutron bombardment to produce molybdenum-99). In 2002/2003 the Nuclear Energy Corporation of South Africa (NECSA) sold 131 million rand (approximately US\$21 million) worth of isotopes and exported 86 percent of these sales to 50 different countries.¹⁵³

Political leverage: A very important consideration from a South African standpoint is that the stockpile provides political leverage in support of South Africa's longstanding nuclear disarmament objectives. While South African delegations at several international nonproliferation conference indicated that Pretoria would in principle not be opposed to minimizing the use of HEU in the civilian sector, they linked it to the elimination of excess military stockpiles of the NWS.

As such, Pretoria's HEU stockpile has a clear strategic value if considered against the backdrop of South Africa's longstanding position that fissile material removed from warheads and declared as excess military material stocks should be covered by a future FMT. In fact, the HEU stocks held at the Pelindaba site could be categorized as material removed from warheads. South Africa therefore considers the stockpile as a political strategic asset in its goal of achieving an FMT that covers both nonproliferation as well as disarmament objectives. In this regard the relevance of South Africa's HEU stocks to a future FMT was delineated at the 2006 Oslo International Symposium on HEU. Ambassador Abdul Samad Minty¹⁵⁴ clearly linked the need to minimize or eliminate civilian HEU to fissile material declared as excess in military stockpiles:

"We cannot exclusively focus on HEU without similar attention being given to other materials used in the production of nuclear weapons, including plutonium, tritium and other transuranic elements that have a proliferation potential" and "for any (FMT) to be considered as a disarmament measure, it would need to address, at the very least, the issue of excess stocks—that is, weapons material declared as excess, as part of an ongoing and irreversible process of the verified elimination of all fissile material for nuclear weapons or other nuclear explosive devices."

Elements of an FMT

Stocks. South Africa holds the view that, for an FMT to be truly credible, it has to include stockpiles. If not, stockpiles of civilian weapons usable fissile material and material originating from dismantled weapons could potentially be fabricated into new weapons. Even if a future treaty completely prohibits the production of weapons usable material, sufficient material would exist in these categories to increase—not decrease—existing numbers in the arsenals of those states with nuclear weapons. This would make a complete mockery of the FMT as one of the key disarmament measures included in both the 1995 Principles and Objectives for Nuclear Nonproliferation and Nuclear Disarmament and the 2000 Review Conference final document.

Covering these existing stocks would:

- Contribute to nuclear disarmament, particularly in terms of transparency, accountability, and irreversibility;
- Strengthen non-proliferation by preventing the transfer of existing materials from the NWS or de facto nuclear weapons outside of safeguards to any non-weapon state;

- Tend to equalize the safeguards burden between weapon and non-weapon states;
- Close a verification loophole whereby a state could declare military fissile material produced after the Treaty's entry into force as pre-Treaty stocks; and
- Help prevent these materials from falling into the hands of terrorists.

These stocks should be subject to the verification machinery provided for in the treaty. Newly-produced material and weapon material declared as excess in the future would continuously be added to the starting inventory in an irreversible way.

While some excess material could still be in sensitive geometrical or compositional forms, thereby ruling out direct access by the IAEA, the approaches developed in the IAEA-Russia-U.S. Trilateral Initiative already provide for verification of such material through an "information barrier."

Once original weapons material, which had been declared excess, has been reworked into an insensitive form, it can be introduced into the standard IAEA-type verification system. The HEU would probably be downblended to LEU and the plutonium used for the production of MOX (mixed oxide) fuel or mixed with high-level radioactive waste for direct disposal. The rest of the material will be stored under normal verification conditions.

While South Africa strongly believes that the future treaty should not only cover future production, but also civilian and excess weapon materials, it has stated on several occasions that the lack of agreement to expand the scope of the treaty in this manner should not delay negotiations. South Africa is of the view that this issue should be addressed during the negotiations in the same manner as other aspects of the treaty.

Verification. The success and future credibility of an FMT would require verified assurances that fissile material is no longer being produced for weapons purposes. The notion that effective verification of an FMT cannot be achieved suggests that the NPT too is not verifiable. South Africa is also of the view that subjecting the nuclear weapon states and the three de-facto nuclear weapon possessors to international monitoring of at least their civilian nuclear activities would redress a long-standing concern of the nuclear industry in the non-weapon states that it is competitively disadvantaged by having to accept IAEA monitoring.

South Africa believes that an FMT verification system should be based on a set of legally binding agreements between each State party and the Treaty's designated verification entity. These verification agreements should be identical for all State parties, but have some provisions suspended to reflect the fact that the scope of verification under the treaty in weapon states would be limited to fissile material subject to the treaty. After its entry into force, the verification system should require declarations within a specific timeframe of all material covered under the treaty. South Africa believes that, while declarations of historical production should be welcomed, the practical difficulties regarding verifying their completeness and correctness should be acknowledged.

Decommissioned production facilities (enrichment and reprocessing plants) should be declared and inspected. While recognizing the right of states to produce and employ fissile material for non-explosive military applications, an FMT verification system should also require some form of verification that this material is not diverted to nuclear-weapon production.

Given the IAEA's expertise and experience in dealing with issues of safeguards and verification, South Africa favors the Agency as the most logical verification entity for an FMT. However, to effectively implement an FMT verification system would require the IAEA to increase its inspection force, which could take several years.

As far as compliance is concerned, South Africa believes that any concerns over non-compliance should be dealt with in a timeframe consistent with the threat. A promptly convened FMT Conference of State parties would offer opportunities to present the allegations and the response of the suspected noncompliant State party (or parties). The Conference should have plenipotentiary powers to require a report from the verification entity on progress made towards compliance by a noncompliant State and decide whether to refer the allegations to the UN Security Council and/or recommend other measures as appropriate.

Conclusion

While South Africa maintains strong positions on both the inclusion of stocks and on the need for a verifiable treaty, the South African delegation to the CD has on numerous occasions stated its willingness to start negotiations without preconditions.

This should not be interpreted, however, as willingness by South Africa to accept a treaty without these core elements. Indeed, South Africa's positions on nuclear matters have in recent years become more hard line. Pretoria may very well argue that a treaty that does not effectively make nuclear disarmament irreversible is not worth pursuing. South Africa may also become even more critical of attempts to restrict civilian uses of fissile material, including HEU, and to make the Additional Protocol a mandatory condition of supply under Article III of the NPT. South Africa has already linked initiatives to reduce or eliminate civilian use of HEU to the need for states with nuclear weapons to irreversibly reduce their stocks of weapon materials. Attempts to preempt the inclusion of stocks under a future treaty through informal, and non-binding declarations of fissile material holdings, or to create a "partial FMT" will likely result in increased South African skepticism over the value of the treaty.

South Africa's increased interest in nuclear energy should also be considered. By 2015 to 2020, Pretoria plans to have more than half of South Africa's electric-power needs satisfied by nuclear energy. As a consequence, Pretoria could be highly sensitive to any treaty obligations (whether preambular or not) that imply that there should be restrictions on civilian fissile production facilities or stocks of fissile material such as South Africa's stockpile of HEU that is a legacy of its nuclear weapon program. Given increased global interest in nuclear fuel as a sustainable energy source, and the current energy crisis in the South Africa, the government is unlikely to subject its energy needs to the mercy of external suppliers of enrichment services. For this reason, any draft FMT text should focus only on the "nuclear-weapons purposes" of fissile material as originally provided in the Shannon mandate. If not, the treaty is likely to come under fire by one of its strongest supporters.

Jean du Preez

United Kingdom

On February 5, 2008, UK Secretary of State for Defence, Des Browne, took the unusual step of addressing the Conference on Disarmament (CD) in Geneva on the subject of “Laying the Foundations for Multilateral Disarmament.”¹⁵⁵ In his speech, Browne spoke of the UK’s “vision of a world free of nuclear weapons” and reiterated that the UK government regards a “Fissile Material Cut-Off Treaty,” or FM(C)T, as a “key milestone towards building this climate for disarmament.” He declared that it “will limit the ability of signatory states to expand their nuclear arsenals and ... provide the necessary reassurance to their neighbours and the international community.” Browne also reaffirmed the UK’s 1995 moratorium on the production of fissile materials for weapons and subsequent placement of “excess” military fissile material under international safeguards. He did not, however, make any new offers to put more military plutonium or highly enriched uranium (HEU) under safeguards.

Browne confirmed that the research project on verifying nuclear-warhead dismantlement, conducted at the UK’s Atomic Weapons Establishment (AWE) at Aldermaston from 2001–2005, was being continued and expanded. This includes work relevant to the verification of an FM(C)T.

This chapter provides the latest government figures for UK holdings of military and civil fissile materials and then lays out UK positions and approaches for moving forward on a Fissile Material (Cutoff) Treaty.¹⁵⁶

Fissile Materials in the Military Nuclear Stockpile

In 1995, the UK declared a moratorium on the production of fissile materials for weapons purposes, which it continues to abide by, pending negotiations on a fissban.¹⁵⁷ Under the 1998 Strategic Defence Review, the UK declared 300 kg of weapons-grade plutonium (sufficient for about 60 weapons) as “excess to defence purposes.”¹⁵⁸ This was placed under Euratom safeguards and made liable to inspection by the IAEA. Though it appears unlikely that the UK would want to withdraw this material from safeguards and use it for weapons purposes in the future, the UK has not relinquished its ‘right’ to do so.

In 2000 and 2006, the UK published the following figures after reviewing records going back to the 1950s. The military nuclear stockpile is reported to contain:¹⁵⁹

- 3.51 tons of weapon-grade plutonium, held at AWE sites (principally at Aldermaston).

- 21.86 tons of uranium enriched above 20 percent (i.e. HEU) held in AWE and other facilities, including in spent naval-reactor fuel.¹⁶⁰

The UK declares its holdings of civilian plutonium and highly enriched uranium to the IAEA as part of its annual INFCIRC/549 statement.¹⁶¹

Negotiating forum

The British government has long been an advocate of a verified fissile materials cutoff treaty. It continues to regard the CD to be the most appropriate forum for negotiating this treaty and voted for the Shannon negotiating mandate at the CD in March 1995 and in subsequent resolutions at the UN First Committee.

The UK government continues to regard the FM(C)T as the next logical step towards fulfilling Article VI of the NPT, and believes that it also has intrinsic value for strengthening the broader international non-proliferation regime. Codifying agreements among the NPT nuclear weapon states through negotiations among themselves would not achieve the practical effect and symbolism of a global cap on production of fissile material for explosive military purposes.

While the UK might see a pragmatic rationale for negotiations between the five NPT nuclear weapon states and the three de facto nuclear weapon possessors, recognizing that this would bypass the obstacles placed in the path by other states' political agendas, it does not advocate or support moves to take negotiations outside the CD. The UK doubts that the treaty would be easier to negotiate outside the CD, and considers that attempts to do so could weaken the CD, perhaps fatally, and harm broader multilateral arms control efforts. Also, the UK and the European Union have a long-standing policy of calling for the universalisation of the NPT and for India, Israel and Pakistan to accede as non-nuclear weapons states. In this context, the UK government would regard as counterproductive an approach that may be construed by non-nuclear weapon states parties to the NPT as 'privileging' the three non-NPT nuclear weapon possessors by treating them in effect as nuclear weapon states in an eight party negotiation.

Verification

After the United States tabled its own draft mandate and text for a "Treaty on the Cessation of Production of Fissile Material for Use in Nuclear Weapons or Other Nuclear Explosive Devices" in May 2006,¹⁶² the UK became one of the first in the CD to support the U.S. position that negotiations should get started on this basis, i.e. without requiring verification as a precondition. Though some CD delegations interpreted this as a change of UK posture, Government officials stress that this is not so: after a decade of deadlock, the key task is to get negotiations underway, without preconditions. In the circumstances, the UK government was prepared to back the U.S. approach for pragmatic reasons. If the United States continued to oppose a mandate that specifies a multilaterally negotiated international verification system, then negotiations could not even get off the ground. The long impasse without a programme of work has already caused some to doubt the viability of the Conference on Disarmament, and UK officials believe that compromises should be made if there is a chance to get negotiations started. The verification issue can be revisited if U.S. policy changes.

While viewing a multilateral verification system to be desirable, the UK takes the view that the current U.S. approach does not amount to an unverified treaty, as is often argued, but a multilateral treaty that would establish the legal restriction and then rest on national technical means (NTM) for verification. The UK would be prepared to live with this, at least as a first step, since NTM are now highly sophisticated and the IAEA already verifies the non-production of fissile materials for weapons for all non-nuclear weapon state parties.

In his 2008 speech, Des Browne announced that the UK wanted to host a “technical conference of P-5 nuclear laboratories on the verification of nuclear disarmament before the next NPT Review Conference in 2010.”¹⁶³ One focus of such a meeting could be for the United Kingdom, the United States and Russia to share their verification exercises that may be of value to the FM(C)T.

The treatment of pre-existing stocks of fissile material under the FM(C)T

The UK shares the U.S. view that the scope of the fissban should be limited to halting future production. The UK supports voluntary measures by nuclear weapon states to place excess fissile materials under safeguards, but thinks that getting agreement on a workable definition of stocks of pre-existing materials to be excluded from future weapons use in the FM(C)T would be extremely difficult. For national security reasons, the UK would not accept verification on actual quantities in the military stocks—even if these were defined not to include the fissile materials contained in warheads.

UK officials also stress, however, that they are not arguing for stocks to be formally ruled out of the negotiations. They have no objection to questions about stocks—or anything else—being raised in the course of the negotiations, but do not envisage a situation in which the UK, the United States or any other nuclear weapon state would agree to any controls on pre-existing materials being part of the finalised treaty.

Entry into Force

For the UK, an important objective is halting further production of fissile materials for weapons by India, Israel and Pakistan. Four of the five NPT nuclear weapon states have already committed themselves to a production moratorium and the UK understands that China is, in practice, implementing a moratorium. The UK is cognizant of the problems for the CTBT of the rigid entry-into-force provision that Britain (among others) designed to lock in the three non-NPT states in 1996. Officials are not willing to talk about their negotiating positions in advance of fissban negotiations, arguing that their position is for this to be developed as part of the negotiations. It appears, however, that they would not again make the mistake of insisting on such a rigid entry-into-force provision.

Naval use of HEU

The UK—like the United States—uses weapon-grade uranium to fuel its nuclear-powered submarines. The UK stocks of HEU should be sufficient for both the current nuclear weapon stockpile and to fuel the submarines for decades.¹⁶⁴ The large U.S. stockpile of excess weapon-grade uranium that has been set aside for future U.S. naval reactor use might be available to supply UK submarines as well. Much of the UK stock of HEU was acquired from the United States under the 1958 U.S.-UK Mutual Defence Agreement.¹⁶⁵

Conclusions

Although the UK moved early to support the U.S. draft mandate of 2006 for FM(C)T negotiation, its core position on an FM(C)T is largely unchanged. The UK government sees the FM(C)T as the next essential step in the disarmament agenda—and, indeed, the first major nuclear disarmament measure for many years. The Government wants to see negotiations get going in the CD without preconditions, in the expectation that verification would be one of the key issues addressed during negotiations.

The UK does not want to go beyond a cutoff of production for future explosive military use; it considers that such a cutoff would achieve its core objective and reduce the time needed for negotiation. The UK would oppose the inclusion of stocks anywhere in the final treaty, but is willing to consider voluntary arrangements by nuclear weapon states to put more 'excess' materials under safeguards.

Rebecca Johnson

United States

Although both President Dwight Eisenhower (1956) and President Lyndon Johnson (1964) called for the conclusion of a U.S.-Soviet fissile material cutoff treaty, it was not until after the end of the Cold War, when both the United States and the Soviet Union had stopped the production of fissile materials for nuclear weapons, that the United States took a serious initiative to negotiate a Fissile Material (Cutoff) Treaty, or FM(C)T.

In his statement on nonproliferation on September 27, 1993, President Clinton called for an “international treaty prohibiting the production of highly enriched uranium and the separation of plutonium for nuclear explosives or outside international safeguards.” In December 1993, the United Nations General Assembly adopted by consensus a resolution (48/75L) on the prohibition of the production of fissile material for nuclear weapons or other nuclear explosive devices. This resolution, *inter alia*:

- Expressed the conviction of the international community that a nondiscriminatory, multilateral and internationally and effectively verifiable treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices would be a significant contribution to nuclear non-proliferation in all its aspects;
- Recommended the negotiation of such a treaty in the most appropriate international forum;
- Requested the International Atomic Energy Agency (IAEA) to provide assistance for examination of verification arrangements for such a treaty as required; and
- Called upon all States to demonstrate their commitment to the objectives of such a treaty.

The Clinton Administration worked hard in the Geneva-based Conference on Disarmament (CD) to begin negotiations on the text of an FM(C)T as soon as possible. In 1995, after consultations among the states participating in the CD, it agreed to begin negotiations based on the “Shannon mandate,” named after Canada’s ambassador to the CD at the time. Unfortunately, that negotiation mandate expired with the end of that year’s conference session, and since then has only been renewed once, for three weeks in 1998. Despite repeated calls from the UN General Assembly and NPT review conferences, negotiations on an FM(C)T have not resumed. Because the CD operates on the basis of consensus, a small number of states have been able to block further negotiations on a cutoff because of disagreements about its scope and purpose as well as linkages to negotiations on other issues.

The U.S. Senate's rejection of the Comprehensive Test Ban Treaty (CTBT) in 1999 also cast a long pall over CD efforts to get negotiations under way on the cutoff treaty. Finally, the U.S. decision to establish a national missile-defense system led China to link the cutoff treaty negotiations to the establishment of a new effort at the CD to ban space-based weapons. This linkage remains an important obstacle to the negotiation of a Fissile Material Cutoff Treaty.

The Bush Administration did not enter into office as an enthusiastic supporter of an FM(C)T. It then undertook a two-year review of the U.S. position on the FM(C)T. Finally on July 29, 2004, the U.S. ambassador to the CD announced that the United States supported the negotiation of a legally-binding treaty banning the production of fissile material for use in nuclear weapons or nuclear explosives. Two years later, in May 2006, the Bush Administration submitted a draft text to the CD that provided for a duration of only 15 years. A decision by consensus of the parties would be necessary for the treaty's extension beyond the 15 years. Stocks of already existing fissile material and the production of fissile material for non-explosive military purposes, such as fuel for naval propulsion, would not be covered.¹⁶⁶

Most importantly, the Bush Administration's proposed text of the FM(C)T contained no provisions for verification. The State Department issued an explanatory statement, that said,¹⁶⁷

"Our extensive review has concluded that there are serious concerns as to whether an 'effectively verifiable' FMCT is realistically achievable. Effective verification of an FMCT would require an inspection regime so extensive that it could compromise key signatories' core national security interests and so costly that many countries will be hesitant to accept it. Moreover, we have concluded that, even with extensive verification measures, we will not have high confidence in our ability to monitor compliance with an FMCT."

Thus the Bush Administration adopted the same approach to an FM(C)T as it took toward the Biological Weapons Treaty and the Strategic Reductions Treaty, i.e., to accept an arms control treaty without verification provisions.

In addition to their overall skepticism about verification, high-level officials in the Bush Administration believed that:

- Adequate verification would require extremely intrusive inspections including sampling in and around U.S. Department of Defense facilities, and
- It would be difficult or impossible to verify the absence of clandestine production facilities—especially enrichment plants.

Moreover, the Bush Administration had other concerns, including the potential loophole provided by the exclusion of the production of HEU for naval propulsion.

Both candidates for President have stated support for an FM(C)T. Senator Obama has said that he will work for "a verifiable global ban on the production of new nuclear weapons material."¹⁶⁸ And Senator McCain, in a speech on May 27, 2008, urged that the United States "should move quickly with other nations to negotiate a Fissile Material Cut-off Treaty to end production of the most dangerous nuclear materials."¹⁶⁹ McCain

has not indicated, however, whether he would support verification provisions for such a treaty.

It is not clear how much priority a new Administration will assign to the conclusion of an FM(C)T. Strong and enduring support from the United States will be a necessary (but not sufficient) condition for the successful conclusion for an FM(C)T. This means that a new Administration will have to devote the time, attention and resources not merely to conducting negotiations in the CD but also to promote the FM(C)T in capitals of the other states that have nuclear weapons, including both those that are parties to the NPT and those that are not. The United States may also have to compromise on positions that it has taken toward other issues in the CD in order to persuade some states to allow negotiations on an FM(C)T to go forward.

Assuming that a new Administration assigns priority to concluding an FM(C)T and that it abandons the position of the Bush Administration toward verification and will favor submitting facilities and materials subject to the treaty to safeguards, the following is an attempt to predict what its approach might be based on the thinking that had occurred during the Clinton Administration from 1993 until 2000. Much of the following is necessarily speculative in nature.

Basic Undertakings

A U.S. Administration seriously pursuing an FM(C)T is likely to take the position that each state party to an FM(C)T should refrain from producing fissile materials for use in nuclear explosive devices. Specifically, the treaty would prohibit the production of HEU, plutonium, and uranium-233 for nuclear explosives. The United States would regard reactor-grade plutonium as a nuclear-weapon-usable material and would insist on including a prohibition of reactor-grade plutonium for nuclear-explosive purposes in an FM(C)T. It would thus insist that the provisions of an FM(C)T, including inspections, apply to all grades of plutonium (except plutonium containing more than 80% plutonium-238). It is also likely to propose a ban on the “production” of americium and neptunium for nuclear explosives.¹⁷⁰ The treaty also would prohibit the enrichment of HEU to higher concentrations of U-235 and the enrichment of reactor-grade plutonium to weapons-grade plutonium for nuclear explosive purposes.

The United States would not envisage the treaty as prohibiting the production of HEU or the separation of plutonium under safeguards for civil nuclear activities. In addition, an FM(C)T would not bar the production of HEU for non-explosive military uses such as naval reactors. If safeguards were applied to HEU fuel produced after entry into force of an FM(C)T in a naval reactor or a reactor that is being used for tritium production for weapons, inspections would have to be carried out without exposing information that States consider classified.¹⁷¹

Both the Clinton and Bush Administrations supported a cutoff treaty that would apply only to future production, not existing stocks. A new Administration is likely to take the same position, which is consistent with the views of Russia, France, China and Israel. It is possible, however, that the United States could support an approach in which the nuclear weapon states assume an obligation to take steps in good faith to declare some fissile material produced prior to entry into force of the FM(C)T as excess to their defense needs and to submit such material to IAEA safeguards. In such an approach the treaty would permit, though not require, states to submit additional materials for safeguards, thereby removing them irreversibly from weapons use. An additional obligation under an FM(C)T would be to refrain from assisting other States to produce fissile materials for proscribed purposes. This would not preclude, however, the transfer

of fissile materials from one party to another for peaceful purposes or for naval fuel propulsion.

Finally, the States Party to an FM(C)T would have to accept safeguards to verify the undertaking not to produce fissile materials for purposes proscribed by the treaty. It would be particularly important that the ban on HEU production and plutonium separation for nuclear explosives be credibly verified. The United States would see the IAEA as the appropriate agency to carry out the inspections.

Other Key Design Characteristics of an FM(C)T

The United States will also likely take the position that an FM(C)T should be universal in membership and non-discriminatory. Membership would have to include all the nuclear weapon states (NWS) and non-nuclear weapon states party to the NPT as well as those states that are not party to the NPT such as the Democratic Republic of Korea, India, Israel and Pakistan. And, although the precise verification measures may not be identical in nuclear weapon states and non-nuclear weapons states, any differences in goals, burdens and costs of verification measures should be minimized.

Financing. Another issue of considerable interest to the United States will be the question of how the verification measures of an FM(C)T should be financed. The United States (as well as the other NWS) would likely take the position that the FM(C)T should be financed through the assessed budget of the IAEA. As with NPT safeguards, the United States would probably argue that all countries benefit from FM(C)T safeguards and therefore all should pay. This is likely to be a divisive issue, however, since the non-nuclear weapon states are likely to insist that the NWS bear all or a disproportionate share of the costs of verifying the treaty. A safeguards “shielding” formula was established in the early 1970s to screen all but the most developed countries from the financial impact of NPT safeguards. As a result, the United States pays 30% of the IAEA safeguards budget, compared to 25% of the non-safeguards budget.

Verification. The basic objectives of safeguards under an FM(C)T would be a) to verify that fissile material being produced in declared facilities is not being used for nuclear explosive purposes, and b) to deter and to detect any clandestine production of fissile material. There would be no attempt, however, to detect undeclared fissile material, since existing stocks would be excluded from verification for national security and nonproliferation reasons.

Safeguards would be applied to all reprocessing and enrichment facilities in States party to the treaty as well as the plutonium, U-233 and HEU products of these plants. In order to provide credible verification of the basic undertaking of the treaty, safeguards would have to apply to these materials at least up to the point of their irradiation in a reactor. Safeguards would therefore apply to plutonium or HEU (produced after entry into force of the treaty) through fuel fabrication and loading into a reactor. Safeguards would, of course, also apply to any reprocessing of the spent fuel produced from irradiation of any plutonium or HEU fuel produced after entry into force of the agreement.

Ideally, the safeguards obligations of nuclear weapon states and NPT non-weapon states should be the same for all enrichment and reprocessing activities and all fissile materials produced after entry into force. This may not be practical or cost-effective, however, in all instances. Specifically, achieving IAEA safeguards objectives for NPT non-weapon states in some of the old reprocessing facilities in weapon states may not be possible. In such instances, the safeguards objectives could formally parallel NPT safeguards agreements, i.e., timely detection of the diversion of significant quantities

of fissile material—but the “timely” and “significant” could be interpreted differently in states that have existing stocks outside safeguards. Whether such an approach would be acceptable to non-weapon states like Japan, which has a particularly heavy safeguards burden on its reprocessing plants, remains to be seen.

In addition, it may be necessary to provide for special safeguards procedures in the case where a state uses HEU fuel subject to the FM(C)T in order to produce tritium or for naval-reactor fuel. Adequate verification of this treaty also will require the IAEA to have the right to check for undeclared activities prohibited by the treaty.

The safeguards applied in non-weapon states under a cutoff would be satisfied by the implementation of the standard NPT safeguards agreement—INFCIRC/153 and its Additional Protocol (AP).¹⁷² Such states have already placed all their peaceful nuclear activities under IAEA safeguards.

On the other hand, a new kind of safeguards agreement would have to be applied in nuclear weapon states. Such an agreement would have to recognize the legitimate concerns of such states relating to the protection of national security information concerning nuclear weapons or naval propulsion. At the same time, the verification agreement would have to acknowledge the right of the IAEA to verify the obligations the weapon states have undertaken in the FM(C)T. To achieve this objective, the United States would likely agree to either:

- Special inspections and complementary access modeled after the NPT safeguards agreements and the Additional Protocol or
- Some form of challenge inspections and managed access for NWS along the lines of those found in the Chemical Weapons Convention.

Issues of Verification Application in the United States

An FM(C)T raises a number of issues for the implementation of verification measures in the United States. Among these are:

- What kind of safeguards agreement should be applied in the United States (and other NWS)?
- What facilities should the United States declare for purposes of verifying its obligations under an FM(C)T?
- How should the United States deal with particular problems related to its status as a nuclear weapon state and a state with a nuclear navy? In particular, what will the U.S. approach be to such questions as challenge inspections or managed access, environmental sampling and the use of HEU for naval propulsion?
- What kind of a safeguards agreement should apply in the United States? The existing agreement between the United States and the IAEA for the application of safeguards in the United States (the so-called voluntary-offer safeguards agreement) would not be appropriate for verifying an FM(C)T, since it does not obligate the IAEA to apply safeguards and permits a so-called “national security exclusion.”

Under the voluntary offer and its Additional Protocol, the United States provides the IAEA with a list of facilities and materials that are “eligible” for the application of safeguards in the United States. With limited exceptions, however, the IAEA does not actually apply safeguards in the United States due to a lack of financial resources.

Also, under the existing U.S.-IAEA safeguards agreement, the United States has the sole discretion to determine whether an activity implicates information of direct national security significance and therefore whether and how to withdraw nuclear materials or facilities from the list of facilities eligible for the application of IAEA safeguards in the United States. In contrast, under an FM(C)T, nuclear weapon states would not be allowed to withdraw facilities or materials from the treaty's safeguards agreement.

Thus to meet the verification obligations of an FM(C)T, the United States would have to conclude a new safeguards agreement with the IAEA that would require the application of safeguards in perpetuity to facilities and materials subject to the FM(C)T in the United States.

What U.S. facilities would be subject to an FM(C)T? The key facilities that would be subject to safeguards are those at which fissile material could be produced: enrichment and reprocessing facilities.

Enrichment facilities. The United States has stopped operations at its gaseous diffusion facilities at Portsmouth, Ohio and Oak Ridge, Tennessee. The IAEA would be expected to verify the shutdown of these plants.

At present there is only one operating enrichment facility in the United States—a gaseous diffusion plant operated by the United States Enrichment Corporation (USEC) (leased from the DOE) at Paducah, Kentucky. This facility is to be closed once its replacement begins operation.

Plans are underway to build three new facilities based on centrifuge technology and one based on laser technology:

- USEC is proposing to build a new enrichment plant at its Portsmouth, Ohio site using gas centrifuge technology developed by DOE, which would replace its far more energy-intensive Paducah gaseous-diffusion facility. The American Centrifuge facility has a planned capacity of 3.8 million SWUs, which it should reach in 2012.
- Louisiana Enrichment Services (LES), a subsidiary of Urenco is building in New Mexico the National Enrichment Facility (NEF) using Urenco gas-centrifuge technology. NEF has a planned capacity of 3 million SWUs, which it should reach in 2013.
- Areva expects to begin construction in the second quarter of 2010 of a 3 million SWU centrifuge plant near Idaho Falls.
- A joint subsidiary of GE and Hitachi (GEH) has signed an agreement with Silex Systems Limited, an Australia-based technology company, to license its laser-enrichment technology to produce low enriched uranium in the United States. The Canadian firm, Cameco, has purchased a minority stake in the venture. GEH plans to build the plant in Wilmington, North Carolina with a capacity between 3.5 and 6 million SWU.

The IAEA has extensive experience in safeguarding gas centrifuge facilities. It is expected that the Agency would apply the so-called Hexapartite approach (or any updated version thereof) in safeguarding future enrichment plants in the United States. A primary objective of the Hexapartite approach is to ensure that a centrifuge facility is not producing HEU. Verifying the non-production of HEU should not impose significant financial burdens on the IAEA.

Reprocessing facilities. The United States has a number of shut-down reprocessing facilities:

- Nuclear Fuel Services' West Valley plant near Buffalo, New York operated from 1966 until 1972, reprocessing spent fuel from a U.S. production reactor as well as some commercial spent fuel.
- In 1972 GE halted construction of a plant near Morris, Illinois to reprocess power-reactor fuel and decided not to pursue an operating license. Its spent fuel pool is used, however, to store fuel from shut-down power reactors.
- In 1970 Allied-General Nuclear Services began construction of a commercial reprocessing plant at Barnwell, SC. It halted the project, however, after concluding that reprocessing was not commercially viable.
- The PUREX reprocessing plant in Hanford, Washington was built to recover plutonium for U.S. nuclear weapons. It shut down in 1989 and in December 1992, the Department of Energy (DOE) announced its permanent closure.
- The Idaho Chemical Processing Plant was used to reprocess naval fuel to recover its unused HEU for recycle in the driver fuel of the Savannah River plutonium and tritium-production reactors. It shut down in 1992 after the Savannah River reactors shut down.
- At the Savannah River Plant, the F Canyon was used to recover plutonium from natural uranium targets for U.S. weapons and the H Canyon was used to recover HEU from the driver fuel of the Savannah River production reactors. The F Canyon is in a safe and stable mode but has not been decommissioned. H Canyon will continue to operate to process impure plutonium for disposal and HEU research-reactor fuels until 2019.

Thus the only operating reprocessing plant in the United States at the present time is located at the Savannah River Site (SRS). Since SRS was not designed to facilitate the application of safeguards and has never been cleaned out, any inspection regime for SRS would face formidable problems in devising a material accountancy system that would be cost-effective for such a facility. It is not certain, however, that SRS will still be operating when an FM(C)T enters into force.

In addition, as part of the ongoing Advanced Fuel Cycle Initiative (AFCI), the U.S. Department of Energy (DOE) is engaged in R&D on advanced separation and fuel manufacturing technologies. The Bush administration is also preparing a Preliminary Environmental Impact Statement whose purpose is to determine whether the United States should recycle commercial spent fuel.¹⁷³ If the United States were to proceed with such recycling, the verification measures of an FM(C)T would have to apply to the reprocessing facilities as well as the Mixed-Oxide (uranium-plutonium, MOX) fuel fabrication facilities that might be constructed as part of such a program in the United States. The safeguards would apply up to the point of irradiation of the MOX fuel in reactors. Any such program would greatly increase the cost of verifying an FM(C)T in the United States. It should be noted, however, that any Democratic Administration that would take office in 2009 is much less likely than the Bush Administration to promote early plutonium recycle in the United States. It is likely that some R&D on new separations and fuel technologies would continue. If the efforts remain small-scale, the safeguards impact would be modest, but larger-scale technology demonstrations could entail significant safeguards effort.

The IAEA will have to verify that all the above reprocessing plants are shut down. If H Canyon continues to operate, or if spent fuel recycling or deployment takes place in the United States, the objective would be to account for any fissile material that it produced, including downstream fuel fabrication up to irradiation in a reactor.

Special or challenge inspections and managed access. An FM(C)T will require that the inspecting agency have the authority to conduct special or challenge inspections in order to detect clandestine enrichment or reprocessing activities by a state party to the treaty. At the same time any special or challenge inspections regime under an FM(C)T must include provisions to manage access of inspectors to facilities or activities of direct national security significance to the United States. The position that the United States is likely to take on this issue in an FM(C)T has perhaps been foreshadowed by the analysis that the Bush Administration submitted to Congress in connection with the ratification of the Additional Protocol to the U.S. Voluntary Safeguards Agreement with the IAEA. The following is based on that document.¹⁷⁴

The United States will have undeclared nuclear material and activities outside the scope of the FM(C)T verification agreement, including certain activities at locations that are part of the U.S. civil nuclear program, consistent with its status as a nuclear weapon state.¹⁷⁵ The United States will therefore insist on the right to use managed access in connection with activities with direct national security significance to the United States or in connection with locations or information associated with such activities.

An agreement between the United States and the IAEA to verify the obligations of an FM(C)T therefore will have to provide for managed access in order to prevent the dissemination of proliferation sensitive information, to meet safety or physical protection requirements, or to protect proprietary or commercially sensitive information.

Any such agreement would also have to permit the United States to use managed access to protect activities, information, or locations of direct national security significance, e.g., at reactors that test naval as well as civilian fuel or facilities that fabricate both naval and civil research reactor fuel. This gives the United States the discretion to use managed-access to protect activities, information, or locations of direct national-security significance. Such circumstances may arise, for example, where unclassified, civil nuclear activities are being conducted at installations where national security activities are also being carried out and it has been determined that managed access procedures can be implemented to allow Agency access to the unclassified activities while fully protecting classified information.

The United States would also insist on exercising its right under any managed access provisions to preclude the use of particular measures if their use would result in access by the Agency to activities with direct national-security significance to the United States or to locations or information associated with such activities.

Environmental sampling. Several types of environmental sampling could be employed in verifying the obligations of an FM(C)T. These include on-site sampling to detect clandestine activities; sampling outside the boundary of a suspect facility; and wide-area sampling. Environmental sampling will undoubtedly be a highly controversial issue. The United States will have to determine whether environmental sampling is possible without divulging proliferation-related information.

Under Article 9 of the Additional Protocol (AP) to the Voluntary Offer, the United States must provide the Agency with access to locations specified by the Agency to carry out wide-area environmental sampling, provided that, if the United States is unable to pro-

vide such access, it shall make every reasonable effort to satisfy Agency requirements at alternative locations. Article 9 of the AP further provides that the Agency shall not seek such access until the IAEA Board of Governors has approved the use of wide-area environmental sampling and the required procedural arrangements and following consultations between the Agency and the United States. To date, such arrangements have not been brought before or approved by the Board. The United States informed the Agency, in connection with the AP, that even if such arrangements were approved, the United States does not foresee circumstances in which the Agency would need to propose to conduct wide area environmental sampling. Wide-area sampling may prove impractical because it is too costly for widespread deployment.¹⁷⁶ More relevant are the provisions for location-specific environmental sampling, as provided under Article 5.c of the Additional Protocol.

Naval nuclear propulsion program. As of 2007 the United States has set aside some 128 tons of HEU for its naval propulsion program. Additional quantities could presumably be set aside from excess weapons stocks in the future if determined necessary. Thus, it is highly unlikely for the foreseeable future that the United States will need to produce additional quantities of HEU for naval needs. Nevertheless, the United States undoubtedly will want to keep open an option to do so and therefore will insist on a provision in the FM(C)T that would allow for non-proscribed military uses of fissile material produced after entry into force of an FM(C)T, i.e., the use of HEU produced after entry into force of the treaty for naval fuel.

This would be similar to or the same as paragraph 14 of the NPT safeguards agreement (INFCIRC/153) which provides for the non-application of IAEA safeguards on nuclear material for non-proscribed military uses. Such a provision would allow HEU produced or declared for naval use after the entry into force of an FM(C)T to avoid safeguards once it enters a naval fuel fabrication facility. The safeguards approach that the IAEA presently applies at civil enrichment facilities are designed to verify that such plants are not producing HEU. If the United States or other states with naval propulsion programs decided to use for naval propulsion HEU produced after entry into force of an FM(C)T, the Agency may have to modify its safeguards approach to enrichment facilities used for such purposes, including more frequent inspections and verification of inventories of HEU product.

In addition, if the United States or other naval powers were to consider as classified the exact isotopic composition or the quantities of the HEU produced for naval purposes, such safeguards would have to be designed to protect this sensitive information. The application of traditional safeguards would cease prior to the HEU entry into a fuel fabrication plant. Thus, if the United States or any other naval power were to decide to produce HEU for naval propulsion following entry into force of an FM(C)T, the IAEA would face a formidable challenge in designing an inspection regime that provides a high confidence that the HEU withdrawn from safeguards was being used solely for non-explosive purposes.

The reprocessing of naval reactor spent fuel is not likely to be an issue for the FM(C)T in the United States since the spent fuel from U.S. naval reactors is not currently reprocessed. The DOE stores the spent fuel together with other highly radioactive wastes of the U.S. military nuclear program at special storage sites at the Idaho National Laboratory where it awaits ultimate disposal.

Fred McGoldrick

Dealing with the Challenges

Dealing with the Challenges: Achieving an FM(C)T

It is clear that the nuclear weapon states have a variety of concerns that will work to delay and limit the reach of an FM(C)T. In particular, many think of an FM(C)T as a cutoff treaty that would ban only future production of fissile material for weapons.

The non-weapon states, in contrast, want an FM(C)T to serve as a significant step toward the eventual elimination of nuclear weapons. They want a cutoff to be accompanied by cuts in existing weapons stocks and constraints to prevent the conversion to nuclear weapons of existing stocks of civilian fissile material and material declared excess to military needs.

Overall, the following issues will have to be dealt with if an FM(C)T is to be achieved:

- How much is enough?
- Israel's linkage of the FM(C)T to Iran's nuclear program,
- Cost and intrusiveness of verification,
- Whether pre-existing civilian stocks and excess military stocks are placed irreversibly under IAEA safeguards, and
- Countries that will have to ratify to bring the Treaty into force.

How much is enough?

The U.S.-Soviet arms race was driven by "counterforce" strategies that required each of the adversaries to have nuclear weapons to destroy the others' nuclear missiles and bombers and their command and communication infrastructure. Offensive weapons multiplied further to accommodate anticipated losses, especially from a first strike by the other side.

States that acquired nuclear weapons after the United States and Soviet Union, however, saw no point, in trying to compete in counterforce capabilities with either nuclear superpower. The nuclear arsenals of the U.K., France and China plateaued when they had acquired hundreds of nuclear weapons. Indian and Pakistani strategists speak of reaching a similar level. Israel probably adopted the same logic.

The situations for China, India and Pakistan are complicated for different reasons, however, and therefore must be discussed separately.

China. China is concerned that the United States may develop a capability for precision conventional attack against China's nuclear weapons backed up by a ballistic-missile defense system that might be able to shoot down those missiles that survived. The United States is deploying a defense nominally against a possible future threat from North Korean nuclear-armed ballistic missiles but China's intercontinental ballistic missiles would come from the same direction and currently number only in the tens. Their effectiveness as a deterrent could be put into question therefore by a relatively modest U.S. missile-defense deployment *if such a missile defense proved effective*. This may be why China, although it is believed not to have produced fissile material for weapons since the early 1990s, also has declined to join publicly the moratorium declared by France, Russia, the UK and the United States.

For analysts familiar with how easily mid-course ballistic-missile defense (BMD) can be overwhelmed with decoys, the Bush Administration's expenditure of about \$10 billion per year on BMD seems wasteful. Just in case the United States devises a way to discriminate between decoys and real warheads, however, China's nuclear planners would like the option of being able to overwhelm a U.S. defense with a large number of real warheads.

The Soviet-U.S. Antiballistic Missile (ABM) Treaty was negotiated to avert just such a wasteful defense-offense arms race. Now it seems that some similar constraint on a Chinese-U.S. defense-offense arms race would be desirable. China has, in fact, been proposing, that, in parallel to negotiations of an FM(C)T, there be discussions in the CD on Prevention of an Arms Race in Outer Space (PAROS). Neither the Clinton nor the G.W. Bush Administration was willing to consider any linkage of PAROS negotiations to those on an FM(C)T.

If the next U.S. Administration wishes to make progress on the FM(C)T, however, it will have to deal with China's current thinking that the two issues are linked and enter into discussions with China and other concerned countries on constraints on space weaponization and ballistic-missile defense. It is also possible that, if the next U.S. Administration moves away from counterforce strategies and toward deep cuts (to 1000 or fewer warheads) China will become less concerned about maintaining a buildup option.

India and Pakistan. A special problem arises in South Asia from that fact that, in parallel with its production and separation of plutonium for weapons, India has a much larger plutonium-separation program focused on providing fuel for its breeder-reactor program. In the near term, the question is what significance should be imputed to India's large and growing stock of separated reactor-grade plutonium, which is an order of magnitude larger than its stock of weapon-grade plutonium. There are a number of reasons why weapon designers would prefer to use weapon-grade plutonium, but it is well known that reactor-grade plutonium can be used to make nuclear weapons and, in fact, India let it be known that one of its 1998 nuclear tests used reactor-grade plutonium.

In the longer term, in the context of negotiations on the U.S.-India deal, India's declaration that its breeder program has a national-security mission could also cause problems. The only national-security mission that a breeder reactor could plausibly have would be producing more plutonium for weapons, and, in fact, a breeder reactor could consume reactor-grade plutonium in its core while producing weapon-grade plutonium in the uranium "blanket" surrounding the core. If India takes advantage of this capability for producing weapon-grade plutonium, then, around 2015, when its first large

breeder reactor is scheduled to come on line, its rate of production of weapon-grade plutonium will climb steeply.

India has enough weapon-grade plutonium for perhaps one hundred weapons and Pakistan has enough HEU and separated weapon-grade plutonium to produce about the same number of warheads. Pakistan would like to have a credible threat of first nuclear use in response to an overwhelming Indian conventional attack and apparently sees quantitative nuclear inferiority as undercutting that credibility. It would certainly be much easier to persuade Pakistan to join in an FM(C)T if India removed the ambiguity about its reactor-grade plutonium by declaring that it is for civilian purposes only and would be placed under international safeguards when India becomes a Party to the FM(C)T.

Israel's nuclear weapons and Iran's enrichment program

Israel is the only nuclear-armed state that has not overtly tested a nuclear weapon. It does not acknowledge having nuclear weapons even though it is generally understood to have acquired them over three decades ago. It is also the only nuclear weapon state to publicly oppose the FM(C)T—in part because of its policy of “opacity.” The government of Israel considers opacity to be the least provocative nuclear posture that it can assume toward the other countries in the region.

Israel would not have to acknowledge possessing nuclear weapons to join the FM(C)T. But, under an internationally verified FM(C)T, it would either have to convert its fissile-material production facilities to peaceful uses and open them to IAEA inspection or dismantle them completely before the FM(C)T comes into force.

Although Israel is currently the only nuclear weapon state in the Middle East, it is deeply concerned about Iran's uranium-enrichment program, which, if it is not dismantled, will give Iran the capability to quickly make highly enriched uranium. This program would not be affected by an FM(C)T because it is already subject to IAEA safeguards. The FM(C)T therefore seems worse than useless to Israel. It would threaten Israel's nuclear opacity while not reducing the threat from Iran's uranium enrichment program.

One way to deal with this concern would be to combine the FM(C)T with an agreement to establish a nuclear fuel-cycle-free zone in the Middle East. Israel would have to verifiably shut down any enrichment and reprocessing activities, i.e. join the FM(C)T and, in exchange, Iran would have to end its enrichment program and all the other countries in the Middle East would have to commit not to acquire uranium-enrichment or reprocessing plants. Such an agreement would be the Middle East equivalent of the 1992 Korean Peninsula Denuclearization Agreement (although that also committed the parties not to make, receive, possess, test or use nuclear weapons). Despite this constraint, South Korea has been able to deploy the world's sixth largest fleet of nuclear-power reactors (20 reactors with 17 GWe of capacity as of 2008).

Given its lack of faith in the IAEA, Israel would probably be reluctant to allow international verification of an FM(C)T on its territory in exchange for IAEA assurances that Iran had given up its enrichment program. Israel has stated that, if a durable Middle East peace is achieved, it will agree to a Middle East Nuclear Weapons Free Zone but also that it will want Israeli inspectors to be able to verify that the other States Party are complying. It would likely also insist on such rights in connection with a fuel-cycle-free zone. Israel presumably would have to accept reciprocal inspections of its own nuclear sites by its neighbors. This might be done through the Middle East equivalent of the

Brazil-Argentine Agency for the Accounting and Control of Nuclear Materials (ABACC) through which Argentina and Brazil assure each other bilaterally in parallel with IAEA inspections that their nuclear facilities are used only for non-weapon purposes.

For their part, Iran, and other states in the Middle East, may not be willing to give up the right to enrich and reprocess under safeguards while Israel keeps its existing weapon stockpile. They might be more interested, however, if Israel gives binding assurances that it will give up its nuclear weapons as part of a broader settlement in the region.

Cost and intrusiveness of verification

U.S. policy under the Bush Administration has been to oppose international verification as costly, intrusive and ineffective. A successor Administration might have a different evaluation of the costs and benefits of verification, however, and return to the U.S. approach during the 1990s under the Clinton Administration of supporting an “effectively verifiable” treaty.

A powerful argument for FM(C)T verification is that the non-weapon states that are Parties to the Non-proliferation Treaty have already accepted international verification aimed at achieving the same goal. They have opened themselves up to relatively intrusive verification at facilities containing nuclear materials and those that have ratified the Additional Protocol have opened up other facilities where R&D and manufacture is done on nuclear-related equipment such as gas centrifuges. They also accept the possibility of challenge inspections at suspect sites and, if the IAEA Board approves, wide-area environmental monitoring for evidence of clandestine reprocessing or enrichment activities.

The weapon states have accepted varying levels of international verification of their nuclear activities. France and the UK have probably accepted the broadest verification because the EURATOM Treaty requires that all non-military nuclear facilities in the European Union be open to EURATOM inspection. All U.S. civilian facilities have been offered for IAEA inspection under the U.S. Voluntary Offer, but there have been relatively few inspections because the IAEA’s safeguards budget is limited and the Agency considers inspections in nuclear weapon states to be primarily of symbolic value.

In most definitions of the FM(C)T, all newly separated plutonium would be subject to inspection at least until it was irradiated in fuel. In the nuclear weapon states that are currently committed to plutonium recycle (China, France, India, Russia) this would result in a very substantial effort by the IAEA and by the national authorities and facility operators that would have to provide the IAEA with access and information. Japan’s Rokkasho and Tokai reprocessing plants by themselves account today for about 20 percent of the IAEA’s inspection effort. Less costly approaches to IAEA monitoring of pre-existing reprocessing plants may be possible, but would still be very demanding.

Given the potential cost of safeguarding reprocessing facilities, it might be useful to have the IAEA, Japan (the only non-weapon state with a fully developed plutonium-recycle program) and the nuclear weapon states with reprocessing programs agree on how to minimize the burden of IAEA safeguards without undermining their effectiveness and how to deal with the issues associated with existing reprocessing facilities in nuclear weapon states that were designed without safeguards in mind.

Russia has been reluctant to open its nuclear facilities to international inspectors and has placed only a small number on the eligible list of its voluntary safeguards agreement with the IAEA. Russia also proposed a very narrow definition of fissile materials

in 2000, when it last seriously addressed the issue of an FM(C)T. If that definition were accepted, countries could enrich HEU up to 90% in U-235 and separate plutonium containing up to 95 percent Pu-239 without having IAEA safeguards follow the material. The Hiroshima bomb used uranium with an average enrichment of only 80% U-235. And, it is now well known that plutonium of almost any isotopic composition can be used to make a nuclear weapon. The Russian definition therefore would compromise both the nonproliferation and disarmament benefits of an FM(C)T.

Both India and Pakistan have limited IAEA inspections to facilities and materials imported from abroad, for which the acceptance of IAEA safeguards was a condition of supply. As part of the U.S.-India proposed deal to allow India to import nuclear technology and materials without accepting full-scope safeguards, India's nuclear establishment has agreed to place under safeguards eight of the reactors that it built without foreign assistance and some fuel cycle facilities.

China has agreed to IAEA inspection at an enrichment facility imported from Russia as a consequence of an agreement with Russia. China is concerned, however, that international inspections at its shut-down production facilities might reveal information about its past production of fissile material for weapons.

In fact, such inspections might reveal the isotopics of the HEU and plutonium used in China's weapons but the design and performance of modern nuclear weapons is insensitive to the exact isotopics. It seems unlikely that the minimal international inspections required to establish that production facilities remain shut down would reduce significantly the uncertainties in foreign estimates of the amounts of weapon-grade uranium and plutonium that China has produced. China's Government should commission its own studies to satisfy itself on this point.

Pre-existing stocks of fissile materials

Many non-weapon states want to be assured that, as part of an FM(C)T, pre-existing stocks of fissile material in civilian use and weapons materials that already have been declared excess for military purposes are prevented from flowing into the weapons complexes and swelling the nuclear arsenals in much the same way as would new production of fissile materials for weapons.

If all plutonium in the civilian sectors of the weapon states were put under IAEA safeguards, it also would be possible to avoid the complication of having to separate pre- and post-FM(C)T materials in peaceful use.

France, India, Russia and the U.K. all have large stocks of separated civilian plutonium. Indeed, the stockpiles of civilian plutonium in France, India and the U.K. are each an order-of-magnitude larger than their estimated weapon stocks. Civilian plutonium in France and the U.K. is subject to EURATOM safeguards. Russia, which has a huge stockpile of weapon-grade plutonium, would be expected to have no interest in using its civilian plutonium for weapons purposes. As already discussed, India would have to decide to forgo the option of using its pre-existing stockpile of reactor-grade plutonium for weapons before being willing to place it under IAEA safeguards. The FM(C)T would become more meaningful, however, if these countries *did* place their stockpiles of reactor-grade plutonium irreversibly under IAEA safeguards—either as a part of the Treaty or in a parallel commitment.

Russia and the United States have also declared large quantities of separated plutonium excess for military purposes. This material is therefore civilian, although much of it is still in weapon components. It too could be put irreversibly under IAEA monitoring

so as to provide international assurance that it would remain civilian. Indeed, Russia and the United States launched the Trilateral Initiative with the IAEA in 1996 to devise ways in which monitoring could begin even while weapons material was in classified form. Unfortunately, both Russia and the United States seem to have lost interest in this initiative around 2002.

Finally, Russia and the United States have both declared excess very large quantities of weapon-grade uranium but the United States has reserved much of its excess for future use in naval reactor fuel. This material too could be placed under IAEA monitoring—at least until it is shipped to a fuel-fabrication facility. If acceptably non-intrusive monitoring techniques can be developed, the HEU fuel might be followed all the way to loading in naval reactors. Such monitoring techniques would have to be developed in any case if HEU was produced for naval-reactor fuel after an FM(C)T came into force.

Countries that will have to ratify to bring the Treaty into force

The Comprehensive Test Ban Treaty was opened for signature in 1996. As of August 2008, 144 countries had ratified but the Treaty requires the ratifications of 44 specific states, including *all* of the nuclear weapon states, for it to come into force. Nine of those 44, including six of the nine nuclear weapon states (counting North Korea) have not yet ratified.

In contrast, the Nonproliferation Treaty required only the ratification of its three depository states (the Soviet Union, UK and United States) and any 40 other states, and came into force in less than two years after it was opened for signature in 1968.

The U.S. Draft FM(C)T of 2006 proposed entry into force upon the ratification of the five NPT nuclear weapon states. China and Russia might be inclined to require that India and Pakistan to join as well. Russia might add Israel and China might add North Korea. One of the issues that will have to be negotiated, therefore, will be whether or not all of the nuclear weapon states will be required to ratify the FM(C)T before it comes into force.

As with the NPT, not requiring ratification by all the nuclear weapon states would allow for early entry into force and speedier development of the attendant verification practices. It might also generate pressure on the hold-out states to join.

Frank von Hippel, Co-Chair, International Panel on Fissile Materials

Endnotes

Country Perspectives: China

- ¹ David Albright and Corey Hinderstein, *Chinese Military Plutonium and Highly Enriched Uranium Inventories*, Institute for Science and International Security, Washington, D.C., 30 June 2005.
- ² Natural Resources Defense Council, "Chinese Nuclear Forces, 2008," *Bulletin of the Atomic Scientists*, July/August 2008, Vol. 62, No. 3. pp. 42–44.
- ³ Li Bin, "Understanding China's Nuclear Strategy," (in Chinese) *World Economics and Politics*, No. 9, 2006, pp. 16–22; or Li Bin, "Tracking Chinese Strategic Mobile Missiles," *Science & Global Security*, Vol. 15, No. 1, 2007, pp. 1–30.
- ⁴ David Albright, Frans Berkhout, and William Walker, *Plutonium and Highly Enriched Uranium 1996: World Inventories, Capabilities, and Policies*, SIPRI, Oxford University Press, 1997, pp. 128–129.
- ⁵ *China's National Defense in 2006*, Information Office of the State Council of the People's Republic of China, 29 December 2006, Beijing, p. 9.
- ⁶ Hans Kristensen, "Chinese Submarine Patrols Rebound in 2007, but Remain Limited," www.fas.org/blog/ssp/2008/01/chinese_submarine_patrols_rebo.php.
- ⁷ China's Official White Paper in 2006 believes that "China's Overall Security Environment Remains Sound," *China's National Defense in 2006, op. cit.*, p. 6.
- ⁸ *Fact Sheet: The Chemical Weapons Convention and the OPCW—How They Came About*, Organisation for the Prohibition of Chemical Weapons, www.opcw.org/docs/fs1.pdf.
- ⁹ *Global Fissile Material Report 2008*, International Panel on Fissile Materials, Princeton, NJ, September 2008.
- ¹⁰ The two most important of these reservations are: 1) If a private organization refuses to voluntarily accept a challenge inspection, the U.S. Executive must obtain a search warrant from a judge; and 2) All samples collected in the United States by inspectors of the Organization for the Prohibition of Chemical Weapons must be analyzed by laboratories located in the United States, "US Chemical Weapons Convention Ratification," *Disarmament Diplomacy*, No. 14, April 1997.
- ¹¹ "China's Position Paper on the New Security Concept," China's working paper submitted to the ARF foreign minister meeting, 31 July 1999, www.china-embassy.ch/eng/xwss/t138294.htm.

Country Perspectives: France

- ¹² This report is based documents and interviews with officials from the Ministry for Foreign Affairs, Ministry of Defense, and the French delegation to the UN Conference on Disarmament. These departments are rather reticent to communicate on the FMCT and in general on military nuclear activities.
- ¹³ Robert S. Norris and Hans Kristensen, "French Nuclear Forces, 2005." *Bulletin of the Atomic Scientists*, July/August 2005.

- ¹⁴ Speech by M. Nicolas Sarkozy, President of the Republic, Cherbourg, 21 March 2008, www.ipfmlibrary.org/sar08.pdf; for an analysis see J.-M. Collin, "Sarkozy and the French nuclear deterrence", BASIC, Getting to Zero Paper, 15 July 2008, www.basicint.org/gtz/gtz02.htm.
- ¹⁵ Speech by M. Jacques Chirac, President of the Republic, Brest, Île Longue, 19 January 2006
- ¹⁶ Assuming a thermonuclear warhead contains on average about 4 kg of plutonium and 25 kg of highly enriched uranium.
- ¹⁷ The reduction of the Strategic Air Force will see the closing of one or two special bunkers (Dépôts Ateliers de Munitions Spéciales/DAMS) out of the five currently operational. It also will decrease the number of transports of nuclear warheads for maintenance between the DAMS and the Valduc center.
- ¹⁸ Mary Byrd Davis, *La France Nucléaire matières et sites*, Wise-Paris, 2002.
- ¹⁹ D. Albright, F. Berkhout, and W. Walker, *Plutonium and Highly Enriched Uranium 1996: World Inventories, Capabilities and Policies*, SIPRI, Oxford University Press, 1997.
- ²⁰ Délégation Générale pour l'Armement, "France Qualifies Rafale to Full F3 Standard", press release, 7 July 2008: "The first deliveries of aircraft produced to the F3 standard will start at the beginning of 2009. The aircraft already in service will be brought up to the new standard. The F3 standard allows to use the ASMP-A nuclear missile."
- ²¹ Speech by M. Nicolas Sarkozy, 21 March 2008, *op. cit.*
- ²² *Défense et Sécurité Nationale: Le Livre Blanc*, June 2008, available at www.defense.gouv.fr. The previous White Paper dates from 1994.
- ²³ France closed its nuclear-weapon test site in the Pacific in 1996.
- ²⁴ Bruno Barrillot, "Audit Atomique: Le cout de l'arsenal nucléaire français 1945–2010," *Observatoire des Armements*, CDRPC, 2000.
- ²⁵ *Les grands chantiers de démantèlement au CEA*, Dossier de presse CEA, 2006.
- ²⁶ "Marcoule dismantling," *Les Echos*, 26 November 2004.
- ²⁷ Mary Byrd Davis, *La France Nucléaire matières et sites*, Wise-Paris, 2002.
- ²⁸ *Ibid.*
- ²⁹ Speech by M. Nicolas Sarkozy, 21 March 2008, *op. cit.*
- ³⁰ Interview with Frederic Desagneaux, Assistant spokesman of Ministry of Foreign Affairs.
- ³¹ Interview with Michele Ramis-Plum, Deputy of the Permanent Representative at the CD.
- ³² Statement by Jean-François Dobelle Ambassador, Permanent Representative of France to the Conference on Disarmament, 24 June 2008.
- ³³ For details, see Mycle Schneider and Yves Marignac, *Spent Nuclear Fuel Reprocessing in France*, IPFM Research Report No. 4, April 2008, www.ipfmlibrary.org/rr04.pdf.
- ³⁴ Eurodif is expected to close in 2014 and be dismantled by 2020.
- ³⁵ INFCIRC/549/Add.5/11, Communication Received from France Concerning its Policies regarding the Management of Plutonium Statements on the Management of Plutonium and of Highly Enriched Uranium, 20 August 2007.
- ³⁶ This included in 2004, resolution 59/81 introduced by Canada, and in 2005, the resolution entitled: "A path to the total elimination of nuclear weapons," introduced by Japan. Statement by Mr. François Rivasseau, Ambassador, Permanent Representative of France to the Conference on Disarmament, Plenary Session of the Conference on Disarmament, 2 March 2006.

- ³⁷ France believes Pakistan, India, and China do not wish to see an FM(C)T because it would endanger fissile-material production for their nuclear arsenals.
- ³⁸ The other five points in the plan are to ratify the Comprehensive Test Ban Treaty, dismantle all nuclear testing sites transparently, negotiate a treaty banning short- and intermediate-range surface-to-surface missiles, adhere to and implement the Hague Code of Conduct Against Ballistic Missile Proliferation, and mobilize on all other fields of disarmament.
- ³⁹ Michel Picard and Bruno Tertrais, "La Propulsion Nucléaire, Un Savoir-Faire Indispensable a la Souveraineté Nationale," Fondation pour la Recherche Stratégique, 30 June 2006; Chunyan Ma and Frank von Hippel, "Ending the Production of Highly Enriched Uranium for Naval Reactors," *The Nonproliferation Review*, Spring 2001.
- ⁴⁰ Statement by Jean-François Dobelle Ambassador, Permanent Representative of France to the Conference on Disarmament, 24 January 2007.
- ⁴¹ The Ottawa treaty to ban landmines and the current Oslo process for banning cluster munitions are examples of multinational arms control talks outside the UN structure.

Country Perspectives: Germany

- ⁴² *Report of Ambassador Gerald E. Shannon of Canada on Consultations on the Most Appropriate Arrangement to Negotiate a Treaty Banning the Production of Fissile Material for Nuclear Weapons or Other Nuclear Explosive Devices*, CD/1299, 24 March 1995, www.reachingcriticalwill.org/political/cd/shannon.html.
- ⁴³ *Creating a new momentum for a Fissile Material Cut-Off Treaty (FMCT)*, Working Paper submitted by Germany, NPT/CONF.2010/PC.II/WP.21, 30 April 2008, www.ipfmlibrary.org/ger08.pdf.
- ⁴⁴ Statement by the Utilities Employing Nuclear Energy and the Nuclear Industry in Germany on the IAEA Programme 93+2, 3 June 1996. See also A. Schaper, "Implementing Safeguards in Countries of Concern," in: E. Häckel and G. Stein (eds.), *Tightening the Reins: Towards a Strengthened International Nuclear Safeguards System*, Springer Verlag, Berlin, 2000.
- ⁴⁵ *Federal Government Seeks Multilateralization of Nuclear Fuel Cycle*, German Federal Foreign Office, press release, 19 February 2008.
- ⁴⁶ The people forming this currently rather small community of German experts interested in the FM(C)T are government officials (mainly from the Foreign Ministry; the Ministry for Environment, Nature Protection, and Reactor Safety; and the Ministry of Economics and Technology), experts from research institutes, universities, and the safeguards community; and representatives of the nuclear industry.
- ⁴⁷ For details, see A. Schaper, *Principles of the Verification for a Future Fissile Material Cutoff Treaty (FMCT)*, Frankfurt Peace Research Institute Report No. 58, 2001.
- ⁴⁸ *A Cut-off Treaty and associated costs – An IAEA Secretariat Working Paper on Different Alternatives for the Verification of a Fissile Material Production Cut-Off Treaty and Preliminary Cost Estimates Required for the Verification of these Alternatives*, International Atomic Energy Agency, presented at the Workshop on a Cut-Off Treaty, Toronto, Canada, 17–18 January 1995.
- ⁴⁹ An example is a statement by the EU Council at the NPT Review Conference, "Calling on nuclear weapon States, as agreed at the Moscow G7/P8 Summit on Nuclear Safety on 19 and 20 April 1996 to place fissile material designated as no longer required for defence purposes under appropriate international safeguards and physical protection," Council Common Position of 13 April 2000 relating to the 2000 Review Conference of the Parties to the Treaty on the Non-proliferation of Nuclear Weapons Official Journal L 097, Document 400X0297, 19 April 2000, p. 1, Article 2 (2 i).
- ⁵⁰ An example is the design study of a pilot plant for the disposition of excess Russian weapons plutonium, *Basisauslegung für eine Pilotanlage zur Produktion von Uran-Plutonium-Brennstoff aus waffenfähigem Plutonium und zum Einsatz dieses Brennstoffs in Kernreaktoren, Abschlußbericht*, Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH, Siemens Aktiengesellschaft und Ministerium für Atomenergie der Russischen Föderation (MINATOM), 28 February 1997.

⁵¹ "Agreement Between the Government of the United States of America and the Government of the Russian Federation Concerning the Management and Disposition of Plutonium Designated as No Longer Required for Defense Purposes and Related Co-operation," U.S. Department of Energy, Washington, D.C., 1 September 2000, www.ipfmlibrary.org/doe00.pdf.

⁵² Annette Schaper, *forthcoming*.

⁵³ At the 1995 NPT Review Conference, eight European countries (Austria, Denmark, Finland, Hungary, Ireland, the Netherlands, Norway, and Sweden) together with Australia, Canada, and New Zealand drafted a text to be included in the conference's final document, recommending "that no new civil reactors requiring highly-enriched uranium be constructed," see NPT/CONF.1995/MC.II/WP.8, April 21, 1995. David Fischer and Harald Müller, *United Divided: The Europeans at the NPT Extension Conference*, Peace Research Institute Frankfurt Report No. 40, November 1995, p. 34.

Country Perspectives: India

⁵⁴ *Report of Ambassador Gerald E. Shannon of Canada on Consultations on the Most Appropriate Arrangement to Negotiate a Treaty Banning the Production of Fissile Material for Nuclear Weapons or Other Nuclear Explosive Devices*, CD/1299, 24 March 1995, www.reachingcriticalwill.org/political/cd/shannon.html.

⁵⁵ *Draft Decision On The Establishment Of An Ad Hoc Committee Under Item 1 Of The Agenda Entitled 'Cessation Of The Nuclear Arms Race And Nuclear Disarmament'*, CD/1547, 11 August 1998, reprinted in "FMT: Breakthrough at Last at the CD," *Disarmament Diplomacy*, September 1998, www.acronym.org.uk/fissban/fmctaug.htm.

⁵⁶ "India-U.S. Joint Statement," 18 July 2005, www.indianembassy.org, mirrored at www.ipfmlibrary.org/ind05.pdf.

⁵⁷ www.reachingcriticalwill.org/political/cd/speeches06/17MayIndia.pdf.

⁵⁸ Text of the document titled "Implementation of the India-United States Joint Statement of July 18, 2005: India's Separation Plan" tabled in Parliament on 7 March 2006, www.indianembassy.org, mirrored at www.ipfmlibrary.org/ind06.pdf.

⁵⁹ *Henry J. Hyde United States-India Peaceful Atomic Energy Cooperation Act of 2006*, Public Law 109-401.

⁶⁰ "The term 'produce fissile material' does not include activities involving fissile material produced prior to entry into force of the Treaty, provided that such activities do not increase the total quantity of plutonium, uranium-233, or uranium-235 in such fissile material." Article II.3, Draft Text for an FMCT proposed by the United States, tabled on 18 May 2006 in Geneva at the Conference on Disarmament, www.ipfmlibrary.org/fmct-usdraft.pdf.

⁶¹ David Albright and Susan Basu, *India's Gas Centrifuge Enrichment Program: Growing Capacity for Military Purposes*, Institute for Science and International Security, 18 January 2007. This is about twice that estimated by M. V. Ramana based on the meeting the need to fuel the prototype submarine reactor. See M. V. Ramana, "An Estimate of India's Uranium Enrichment Capacity," *Science & Global Security*, Vol. 12, 2004, pp. 115-124.

⁶² www.indianembassy.org/policy/CTBT/nuclear_doctrine_aug_17_1999.html.

⁶³ www.thehindu.com/2003/01/05/stories/2003010504810100.htm.

⁶⁴ R. Rajaraman, "Nuclear Posture", *The Hindu*, Editorial Page, 7 February 2003; R. Rajaraman, "Cap the nuclear arsenal now" *The Hindu*, 25 January 2005.

⁶⁵ Alexander Glaser and M. V. Ramana, "Weapon-grade Plutonium Production Potential in the Indian Prototype Fast Breeder Reactor," *Science & Global Security* 15, 2007, p. 85.

⁶⁶ R. Rajaraman, "India-U.S. deal and the nuclear ceiling", *The Hindu*, 10 September 2005; R. Rajaraman, "Fallout from Nuclear Deal" *Economic and Political Weekly*, pp. 3353-34, 5 August 2006.

Country Perspectives: Israel

⁶⁷ See, e.g., the statement by Gideon Frank, former Chairman of the Israeli Atomic Energy Commission at the 2007 annual meeting of the International Atomic Energy Agency (IAEA), www.iaec.gov.il/docs/StatementGC51.pdf.

⁶⁸ Recent reports indicate that Israel has been lobbying the Nuclear Suppliers Group (NSG) to change its export control guidelines that now prohibit the transfer of nuclear materials and technology to non-NPT states such as India and Israel so that Israel will have the same access to such materials and technology as the United States has agreed to grant India in the proposed U.S.-India nuclear agreement. Unlike the proposed change in U.S. policy that is based on granting India an exemption from U.S. laws and NSG guidelines, the Israeli initiative is based on meeting a set of “nuclear responsibility criteria” rather than a specific exemption. The U.S. government has opposed the Israeli initiative: while there is widespread, bipartisan support in Washington for stronger ties with India that proponents claim would be facilitated by the proposed agreement, the United States wants to avoid dealing simultaneously with Israel (and Pakistan) on the sensitive issue of nuclear technology transfer. See, e.g., Glenn Kessler, “Israel Submits Nuclear Trade Plan”, *The Washington Post*, September 30, 2007, p. A23.

⁶⁹ For an overview, see Avner Cohen, *Israel and the Bomb*, Columbia University Press, New York, 1998.

⁷⁰ Avner Cohen and William Burr, “Israel Crosses the Threshold,” *Bulletin of the Atomic Scientists*, May/June 2006.

⁷¹ Which now includes a submarine-based component. For details, see Lawrence Prabhaker, Joshua Ho, and Walter Bateman, *The Evolving Maritime Balance of Power in the Asia-Pacific*, World Scientific, 2006, pp. 228–229.

⁷² Strong, albeit opaque, support for Israel’s possession of nuclear weapons on the basis of its ongoing need to deter threats to its existence, was offered by former U.S. Secretary of Defense Donald Rumsfeld at a press conference in Frankfurt, Germany in February 2004 and by former UK Foreign Secretary Jack Straw in a Ministerial Statement to the House of Commons on February 25, 2004. In the Q&A session following Rumsfeld’s remarks, there occurred the following exchange: “Mr. Secretary, you talked about countries that were trying to produce weapons of mass destruction. You talked about Iraq and you talked about Iran and North Korea. I have a question, a direct question to you. What are you doing with Israel? As far as Israel is concerned, Israel has more atomic weapons in the region than any other country. Why do you remain silent in regard to Israel? I think it’s important to answer this question because this has to do with the world, the strategy that we are pursuing today. I think that if the position towards Israel were different then the situation would be different in the Near East, and this is a great problem.” Rumsfeld: “You know the answer before I give it, I’m sure. The world knows the answer. We take the world like you find it; and Israel is a small state with a small population. It’s a democracy and it exists in a neighborhood that in many—over a period of time has opined from time to time that they’d prefer it not be there and they’d like it to be put in the sea. And Israel has opined that it would prefer not to get put in the sea, and as a result, over a period of decades, it has arranged itself so it hasn’t been put in the sea.” An even stronger statement in support of Israeli nuclearization was offered by Straw: “The threat of extinction places Israel in a different category from any other country in the world.”

⁷³ For more details about these initiatives, see the statement by Gideon Frank, *op. cit.*

⁷⁴ The generic argument that the character and behavior of a regime should influence the intensity of efforts by other states and the international community to oppose its acquisition of nuclear weapons has been made, e.g., by Richard Haas, *The Opportunity*, Public Affairs, New York, 2005, p. 160. In the specific case of Israel and “other civilized states” on the one hand and Iran on the other, the argument has been vigorously—if inadvertently—made by Israeli Prime Minister Ehud Olmert in an interview with a German television station in December 2006. For an article on Olmert’s “slip of the tongue” and the reaction in Israel, see, e.g., Philippe Naughton, “Olmert’s nuclear slip-up sparks outrage in Israel,” *Times Online*, 12 December 2006, www.timesonline.co.uk. Besides the case for treating Iran and Israel differently with regard to possession of nuclear weapons on moral and political grounds, there is also an important legal distinction: Iran has signed the NPT as a non-nuclear weapons state while Israel has not. However, in this regard it should be noted that Iran continues to deny that its nuclear program has a military rationale.

- ⁷⁵ In contrast to non-nuclear state parties to the NPT, which are obligated to accept safeguards on all their nuclear materials and facilities, the acceptance of safeguards on materials and facilities on weapons states NPT parties is voluntary, non-NPT parties are only obligated to accept safeguards on materials and facilities as a condition of technology transfer.
- ⁷⁶ Primarily because of recent U.S. objections to an FMCT with verification provisions, the issue of verification is now being reexamined. However, the weight of current opinion in the non-proliferation community is that verification is essential, and that its cost and level of intrusiveness can be reduced to acceptable levels.
- ⁷⁷ Emily B. Landau, *Arms Control in the Middle East: Cooperative security Dialogue and Regional Constraints*, Sussex Academic Press, 2006; Peter Jones, *Towards a Regional Security Regime for the Middle East: Issues and Options*, SIPRI, Stockholm, 1998; and Peter Jones, "Negotiating Regional Security and Arms Control in the Middle East: The ACRS Experience and Beyond," *Journal of strategic Studies*, 26 (3), pp. 137–154, 2003.
- ⁷⁸ Aluf Benn, "The Struggle to Keep Nuclear Capabilities Secret," *Ha'aretz*, 14 September 1999.
- ⁷⁹ *Ibid.*
- ⁸⁰ "Arab League will call for leaving nuclear treaty if Israel admits to atomic weapons," *The Associated Press*, 5 March 2008.
- ⁸¹ See, e.g., Frank Barnaby, *The Invisible Bomb*, I.B. Tauris, London, 1989, pp. 38–40.
- ⁸² One possible non-intrusive way of verifying that plutonium wasn't being extracted from spent fuel would be to remotely monitor the noble gas fission products, specifically krypton-85, that are released during the reprocessing of spent nuclear fuel. However, it's technically possible to prevent the release of these gases, so that the Arab states might demand challenge on-site inspections to verify that plutonium wasn't being produced. If Israel didn't want to shut down the Dimona reactor, it could insist that such inspections be conducted according to the principle of "managed access", but it is very doubtful that the process would work without compromising opacity. If Israel could be persuaded to shut down the Dimona reactor and produce tritium at a new reactor or an accelerator specifically designed for this purpose, it might be easier to achieve credible verification of the non-production of plutonium without seriously compromising opacity. This possibility deserves further study.
- ⁸³ "FMCT: Explanation of vote by Mr. Alon Bar," UN First Committee, 4 November 2004, www.ipfmlibrary.org/bar04b.pdf.
- ⁸⁴ Interest in global nuclear disarmament has been rekindled lately by the publication of an op-ed by George Schultz, William Perry, Henry Kissinger, and Sam Nunn, "A World Free of Nuclear Weapons," *The Wall Street Journal*, 4 January 2007, p. A15.
- ⁸⁵ See, e.g., Tony Judt, "The 'Problem of Evil' in Postwar Europe," *The New York Review of Books*, 14 February 2008, p. 35. Besides a nuclear attack by Iran itself, Israelis also worry that Iran might transfer nuclear explosives to sub-national groups such as Hezbollah and Hamas which are viewed as proxies of Iran that share its view that Israel is an illegitimate state.
- ⁸⁶ Israel has long supported the establishment of a Nuclear Weapons Free Zone in the Middle East after such a just and durable peace has been achieved, but this support has been largely rhetorical. What is missing is recognition by Israel that nuclear weapons, even in the possession of "responsible" states, pose significant dangers, and hence of the importance of avoiding a mind-set and actions that make the lack of progress towards a just and durable peace a self-fulfilling prophecy.
- ⁸⁷ Such a zone has been suggested by, e.g., Marvin Miller and Lawrence Scheinman, "Israel and a Nuclear Weapons Free Zone in the Middle East" in Morton Bremer Maerli and Sverre Lodgaard (eds.), *Nuclear Proliferation and International Security*, Routledge, London and New York, 2007, p. 143.
- ⁸⁸ In particular, verification means should go beyond implementation of the Additional Protocol to include the establishment of a wide-area environmental sampling network in the region.
- ⁸⁹ See recent statement by Arab foreign ministers, *op. cit.*

⁹⁰ This view has received strong support from McGeorge Bundy, William J. Crowe, Jr. and Sidney D. Drell, *Reducing the Nuclear Danger*, Council on Foreign Relations, New York, 1993, pp. 62–72.

Country Perspectives: Japan

⁹¹ Working Paper submitted by Japanese Government to Conference on Disarmament, “FMCT: A contribution to Constructive Discussions,” May 2006, www.reachingcriticalwill.org/political/cd/papers06/16MayJapan.pdf.

⁹² *Ibid.*

⁹³ Statement by Ambassador Yoshiki Mine, Permanent Representative of Japan to the Conference on Disarmament (FMCT), Geneva, 16 May 2006. www.disarm.emb-japan.go.jp/statements/Statement/060516FMCT.htm. Earlier papers and statements referred to include Working Paper submitted by Japanese government to Conference on Disarmament, “Working paper on a Treaty to ban the production of fissile materials for nuclear weapons and other nuclear explosive devices,” August 2003. www.disarm.emb-japan.go.jp/statements/Statement/030814FMCT.htm, and Statement by Ambassador Dr. Kuniko Inoguchi, Permanent Representative of Japan to the Conference on Disarmament, Geneva, 14th August, 2003, www.disarm.emb-japan.go.jp/statements/Statement/030814CD.htm. The author also thanks Prof. Masahiro Kikuchi of Hosei University and Dr. Kinji Koyama of the Japan Institute of International Affairs for their valuable advice and comments.

⁹⁴ For Japan’s civilian plutonium programs and their challenges, see Tadahiro Katsuta and Tatsujiro Suzuki, *Japan’s Spent Fuel and Plutonium Management Challenges*, IPFM Research Report No. 2, September 2006, www.ipfmlibrary.org/rr02.pdf.

⁹⁵ Ambassador Yukiya Amano, “Reducing the Enrichment Level of Uranium Fuel (Japan’s Experience),” Presentation at the International Symposium Minimisation of Highly Enriched Uranium (HEU) in the Civilian Nuclear Sector, Oslo, Norway, 19 June 2006. According to the Japan Atomic Energy Commission, the Kyoto Fast Critical Assembly (KUCA) was approved for conversion to LEU fuel in October 2007 and will be converted by March 2009; the Tokai Fast Critical Assembly (FCA), Kyoto University Reactor (KUR), and University of Tokyo reactor (Yayoi), cannot be converted, and there are currently no official plans for their future; no official application has yet been submitted for conversion of the Kinki University nuclear reactor (UTR-KINKI).

⁹⁶ Mine, 2006, *op. cit.*

⁹⁷ The plutonium in power reactor spent fuel typically contains 50–60% Pu-239, while weapon-grade plutonium has over 90% Pu-239.

⁹⁸ Mine, 2006, *op. cit.*

⁹⁹ Mine, 2006, *op. cit.*

¹⁰⁰ Masahiro Kikuchi, “Kakukakusan Mondai To Kenshou Sochi (Verification Measures and Proliferation Issues),” Chapter 14, Asada and Tozaki (eds.), *Kaku-Gunshuku Fukakusan No Ho To Seiji (Law and Politics in Nuclear Disarmament, Non-proliferation)*, Sinzan Sha, 2007; Kinji Koyama, “Verification Measures for Fissile Material Cut-off Treaty (FMCT),” Paper presented at the Seminar Conference on Technical Issues concerning Fissile Material Cut-off Treaty, 12 May 1988, Geneva, Switzerland.

¹⁰¹ Working Paper, August 2003, *op. cit.*

¹⁰² *Ibid.*

¹⁰³ *Ibid.*

Country Perspectives: Pakistan

¹⁰⁴ United Nations General Assembly Resolution 48/75L, 16 December 1993.

¹⁰⁵ Wade Boese, “Pakistan Supports Cutoff Talks At Opening of Third CD Session,” *Arms Control Today*, June/July 1998.

- ¹⁰⁶ Ambassador Munir Akram, Statement at the special session of the Conference on Disarmament, 2 June 1998, www.fas.org/news/pakistan/1998/06/980602-pak-cd.htm.
- ¹⁰⁷ United Nations Security Council Resolution 1172, 6 June 1998.
- ¹⁰⁸ Ambassador Munir Akram, Statement in the Conference on Disarmament on CTBT, FMCT issues, 30 July 1998, www.fas.org/nuke/control/fmct/docs/980730-cd-pak.htm.
- ¹⁰⁹ *Ibid.*
- ¹¹⁰ *Ibid.*
- ¹¹¹ *Ibid.*
- ¹¹² Ambassador Munir Akram, Statement at the Conference on Disarmament, 11 August 1998, www.acronym.org.uk/fissban/pak.htm.
- ¹¹³ There is an assumed uncertainty of 15% in these estimates of HEU annual production and accumulated stocks, reflecting a lack of information about the evolution of the number and separative work capacity of Pakistan's centrifuges as well as the uranium isotope ratios in the depleted uranium tails. See Zia Mian, A.H. Nayyar, R. Rajaraman and M.V. Ramana, *Fissile Materials in South Asia and the Implications of the U.S.-India Nuclear Deal*, IPFM Research Report No. 1, September 2006, www.fissilematerials.org/rr01.pdf. The estimates have been updated to 2007. These estimates do not include the possibility recently reported that over the past decade Pakistan may have increased its capacity for uranium enrichment for weapons by moving to more advanced centrifuges with three to four times greater separative power than its first and second generation machines. Mark Hibbs, "Pakistan developed more powerful centrifuges", *Nuclear Fuel*, Vol. 32, No. 3, 29 January 2007, and Mark Hibbs, "P-4 centrifuge raised intelligence concerns about post-1975 data theft," *Nucleonics Week*, Vol. 48, No. 7, 15 February 2007.
- ¹¹⁴ Zia Mian et al., *Fissile Materials in South Asia*, *op. cit.*
- ¹¹⁵ J. Warrick, "Pakistan Expanding Nuclear Program," *The Washington Post*, 24 July 2006; and "U.S. Disputes Report on New Pakistan Reactor," *The New York Times*, 3 August 2006. See also, T. Cochran, *What is the Size of Khushab II?*, Natural Resources Defense Council, Washington, D.C., 8 September 2006, and D. Albright and P. Brannan, "Update on the Construction of the New Large Khushab Reactor," ISIS, Washington, D.C., 4 October 2006. Pictures of the third reactor were released in June 2007; D. Albright and P. Brannan, "Pakistan Appears to be Building a Third Plutonium Production Reactor at Khushab Nuclear Site," Institute for Science and International Security, 21 June 2007.
- ¹¹⁶ D. Albright and P. Brannan, "Chashma Nuclear Site in Pakistan with Possible Reprocessing Plant," Institute for Science and International Security, 18 January 2007.
- ¹¹⁷ Ambassador Masood Khan, Statement to the Conference on Disarmament, 16 May 2006, www.ipfmlibrary.org/pak06.pdf.
- ¹¹⁸ *Ibid.*
- ¹¹⁹ R. Rajaraman, *India*, in this volume.
- ¹²⁰ Based on a report of conversation with diplomats.
- ¹²¹ G. Perkovich, *India's Nuclear Bomb: The Impact on Global Proliferation*, University of California Press, Berkeley, 1999.
- ¹²² R. Rajaraman, *India*, in this volume.
- ¹²³ "Pakistan Moves Closer to Sign Nuclear Treaty," *The Nation*, Lahore, 26 October 1998.
- ¹²⁴ Amit Baruah, "N-Arms Deployment a Reciprocal Matter," *The Hindu*, 11 November 1998.
- ¹²⁵ "No CTBT Signing During US Visit: FM," *Dawn*, 15 November 1998.

- ¹²⁶ Zia Mian et al., *Fissile Materials in South Asia*, *op. cit.*
- ¹²⁷ "Press release by Inter-Services Public Relations, No. 318/2007", August 1, 2007, www.ispr.gov.pk/Archive&Press/Aug2007/2-Aug-2007.htm.
- ¹²⁸ W. Boese, "Negotiations Elude Disarmament Body Again," *Arms Control Today*, October 2007.
- ¹²⁹ Ambassador Masood Khan, 16 May 2006, *op. cit.*
- ¹³⁰ *Ibid.*
- ¹³¹ Pakistan statement to Conference on Disarmament, 28 June 2007, www.reachingcriticalwill.org/political/cd/speeches07/2session/June28Pakistan.html
- ¹³² *Agreement between India & Pakistan on Prohibition of Attack Against Nuclear Installations and Facilities*, 1988, www.indianembassy.org, mirrored at www.ipfmlibrary.org/ind88.pdf. The facilities that each state can include in its list are "nuclear power and research reactors, fuel fabrication, uranium enrichment, isotopes separation and reprocessing facilities as well as any other installations with fresh or irradiated nuclear fuel and materials in any form and establishments storing significant quantities of radio-active materials."
- ¹³³ www.stimson.org/southasia/?SN=SA2001112047.
- ¹³⁴ "Pakistan's Instrument of Ratification," 29 October 1997, www.stimson.org/?SN=CB20011220107.
- ¹³⁵ Ambassador Masood Khan, to the Conference on Disarmament, 17 June 2008, www.reachingcriticalwill.org/political/cd/speeches08/2session/June17Pakistan.pdf.
- ¹³⁶ New Zealand (24 June 2008): "When we begin negotiations, we will certainly argue vigorously and present very strong arguments in favor of inclusion of verification and existing stocks." www.reachingcriticalwill.org/political/cd/speeches08/2session/June24NewZealand.html.
- ¹³⁷ Iran (26 May 2008): "We are in favor of an FMCT that is comprehensive, verifiable, and which covers the existing stocks," www.reachingcriticalwill.org/political/cd/speeches08/2session/May26Iran.pdf.
- ¹³⁸ Brazil (20 May 2008): "Brazil favors an FMCT which includes a multilateral verification mechanism and stockpile controls," www.reachingcriticalwill.org/political/cd/speeches08/2session/May20Brazil.pdf.

Country Perspectives: Russia

- ¹³⁹ Statement by Ambassador Valery Loshinin, 16 May 2006.
- ¹⁴⁰ Although this statement does not make clear whether it includes civilian fissile materials produced before the FM(C)T comes into force, my understanding is that it does.
- ¹⁴¹ *Ibid.*
- ¹⁴² Statement by Ambassador Valery Loshinin, Permanent Representative of the Russian Federation at the Plenary Meeting of the Conference on Disarmament, Geneva, 2 March 2006.
- ¹⁴³ Vladimir Rybachenkov, "Problems related with elaboration of the international Convention on the ban on the production of fissile materials for weapons purposes," presentation at the Carnegie Center workshop, Moscow, 2 February 2000.
- ¹⁴⁴ Statement by Ambassador Valery Loshinin, 16 May 2006.
- ¹⁴⁵ Including material declared excess, *Global Fissile Material Report 2007* updated to take into account the blend-down of 40 additional tons of excess weapon-grade uranium.
- ¹⁴⁶ USEC press release, 5 March 2008.

¹⁴⁷ *Ibid.*

¹⁴⁸ "Setting the Context for the Cut-Off Treaty," Statement by Ambassador Berdennikov at the Canadian workshop, Toronto, Canada, 17 January 1995.

¹⁴⁹ Vladimir Rybachenkov, "Problems related with elaboration of the international Convention on the ban on the production of fissile materials for weapons purposes," *op. cit.*

Country Perspectives: South Africa

¹⁵⁰ While the Additional Protocol did not yet exist at the time, its mechanisms such as 24-hr surveillance monitoring were tested in South Africa.

¹⁵¹ See keynote address by Minerals and Energy Affairs Minister Mosibudi Mangena, at a Conference on Peaceful Uses of Nuclear Energy in Johannesburg, March 2007.

¹⁵² Technetium 99m, the daughter product of Molybdenum-99 (Mo-99), is globally the most commonly utilized medical radioisotope. Annually, it is used for approximately 20–25 million medical diagnostic procedures, comprising some 80% of all nuclear medicine procedures. South Africa is one of only a few major commercial producers of Mo-99, all of them irradiating HEU targets in research, test, or isotope production reactors and recovering Mo-99 in dedicated processing facilities.

¹⁵³ "Nuclear Energy Corp Sells Isotopes Worth R131-M," *Financial Times Information*, South African Press Association, 10 September 2003.

¹⁵⁴ Ambassador Minty is the South African Governor on the IAEA Board of Governors and the Ambassador for Disarmament.

Country Perspectives: United Kingdom

¹⁵⁵ Des Browne, UK Secretary of State for Defence, Speech to the Conference on Disarmament plenary, 5 February 2008.

¹⁵⁶ I am grateful for briefings from officials in the Department for Business, Enterprise and Regulatory Reform (formerly the Department for Trade and Industry), the Foreign and Commonwealth Office (FCO) and the Ministry of Defence (MoD).

¹⁵⁷ Michael Littlejohns, "UK 'has halted the build-up on N-material,'" *Financial Times*, 19 April 1995.

¹⁵⁸ Ministry of Defence, *Strategic Defence Review*, July 1998, www.ipfmlibrary.org/mod98.pdf.

¹⁵⁹ These figures are taken from a Ministry of Defence briefing to the IPFM, October 2007.

¹⁶⁰ The UK statements define as HEU all uranium enriched to 20% or more uranium-235.

¹⁶¹ See Chapter 1, *Global Fissile Material Reports 2007 and 2008*.

¹⁶² United States of America, Draft Mandate, 18 May 2006 (CD 1776) and *Treaty on the Cessation of Production of Fissile Material for Use in Nuclear Weapons or Other Nuclear Explosive Devices*, May 18, 2006 (CD/1777).

¹⁶³ This echoed a call for nuclear disarmament by UK's outgoing Foreign Secretary Margaret Beckett to the Carnegie Endowment Nonproliferation Conference on 25 June 2007, and her proposal for "the UK to be at the forefront of both the thinking and the practical work. To be, as it were, a 'disarmament laboratory'." Margaret Beckett, Secretary of State for Foreign and Commonwealth Affairs, *Speech to the Carnegie Endowment of International Peace Non-Proliferation Conference*, Washington DC, 25 June 2007.

¹⁶⁴ Average annual requirements by UK submarines has been estimated at 0.110 tons per year, Ole Reistad and Styrkaar Hustveit, "HEU Fuel Cycle Inventories and Progress in Global Minimization," *Nonproliferation Review* 15 (2008), p. 265.

¹⁶⁵ D. Albright, F. Berkhout and W. Walker, *Plutonium and Highly Enriched Uranium 1996*, SIPRI, Oxford University Press, 1997, pp. 118–119; and S. Aftergood and F. von Hippel, “The U.S. Highly Enriched Uranium Declaration: Transparency Deferred but not Denied,” *Nonproliferation Review*, 14, 2007, p. 149.

Country Perspectives: United States

¹⁶⁶ U.S. Mission to the United Nations in Geneva Press Release, “US Tables Draft FM(C)T Text at Conference on Disarmament,” 18 May 2006. Full text available at www.ipfmlibrary.org/fmct-usdraft.pdf.

¹⁶⁷ USA: *White Paper on a Fissile Material Cutoff Treaty – Conference on Disarmament*, U.S. Department of State, 18 May 2006, www.state.gov/t/isn/rls/other/66901.htm.

¹⁶⁸ Barack Obama, “Renewing American Leadership,” *Foreign Affairs*, July/August 2007. See also S.1977, “Nuclear Weapons Threat Reduction Act of 2007,” which Senator Obama co-sponsored with Senator Chuck Hagel.

¹⁶⁹ www.johnmccain.com, press release, 27 May 2008.

¹⁷⁰ Note, however, that the clean-up of stocks of plutonium produced prior to entry into force of the FM(C)T, such as removing the build-up of americium is not considered reprocessing.

¹⁷¹ The United States does not use HEU to produce tritium.

¹⁷² This includes special inspections, complementary access as well as environmental sampling on the basis of either location-specific, or under certain conditions, wide-area monitoring.

¹⁷³ “GNEP Programmatic Environmental Impact Statement,” U.S. Department of Energy, www.gnep.energy.gov/PEIS/gnepPEIS.html.

¹⁷⁴ U.S.-IAEA *Safeguards Agreement: Article-by-Article Analysis of the Additional Protocol*, www.state.gov/t/isn/trty/11757.htm.

¹⁷⁵ *Ibid.*, p. 3.

¹⁷⁶ *Global Fissile Material Report 2007*, Chapter 9.

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Over the past six decades, our understanding of the nuclear danger has expanded from the threat posed by the vast nuclear arsenals created by the superpowers in the Cold War to encompass the proliferation of nuclear weapons to additional states and now also to terrorist groups. To reduce this danger, it is essential to secure and to sharply reduce all stocks of highly enriched uranium and separated plutonium, the key materials in nuclear weapons, and to limit any further production.

The mission of the IPFM is to advance the technical basis for cooperative international policy initiatives to achieve these goals.

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