ELIMINATING NUCLEAR THREATS

A PRACTICAL AGENDA FOR GLOBAL POLICYMAKERS

GARETH EVANS and **YORIKO KAWAGUCHI** CO-CHAIRS

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Nuclear Non-proliferation
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CO-CHAIRS' PREFACE

Eliminating nuclear weapons, and all the other security threats and risks associated with the use and misuse of nuclear energy, is as daunting a policy challenge as it is possible to imagine. Showing how to destroy the curse but retain the blessing of nuclear energy is not the easiest task that we, or our fellow Commissioners, have ever undertaken.

The nuclear problems the world has to address are immensely large, complex and difficult. Every state with nuclear weapons has to be persuaded to give them up. States without nuclear weapons have to neither want nor be able to acquire them. Terrorists have to be stopped from buying, stealing, building or using them. And in a world where, for good reason, the number of power reactors may double in the next twenty years, the risks associated with purely peaceful uses of nuclear energy have to be effectively countered.

Sceptics abound, telling us that nuclear disarmament, in particular, would be so hard to achieve it is pointless even to try. More troublingly, there are still voices saying that it is *dangerous* to try, because a world without nuclear weapons would be less safe than the one we have now. And with governments, high-level panels and commissions, think tanks and researchers working over these issues since the dawn of the nuclear age, we know that brand new ideas and approaches are in short supply.

But try to tackle these issues we must. No weapon ever conceived is as terribly indiscriminate and inhumane in its impact as an atomic or hydrogen bomb: no one listening, as we have, to the harrowing testimony of the *hibakusha* – the surviving victims of Hiroshima and Nagasaki – could ever want to see their experience repeated. And nuclear weapons are the only ones ever invented that have the capacity to wholly destroy life on this planet.

There remains no simpler or more compelling articulation of the case for action than that first put by the Canberra Commission over a decade ago: so long as any state has nuclear weapons, others will want them; so long as any such weapons remain, it defies credibility that they will not one day be used, by accident or miscalculation or design; and any such use would be catastrophic for our world as we know it.

Nuclear threats and climate change are the two great global issues of our age, and both defy complacency. In responding to these problems, business-as-usual is simply not an option. Policies must change, and attitudes must change. Above all, there has to be tackled head-on the mindset, still

tenacious, that the clock cannot be turned back, that nuclear weapons will be around forever, and that they continue to have a unique deterrent utility that somehow outweighs their disastrous downside. A very different idea has to become equally firmly embedded in the minds of policymakers and all those in the wider community who influence them: nuclear weapons may not be able to be uninvented, but in a sane and civilized world they can, and must, be outlawed.

When we were assigned the task of leading this Commission in July 2008, we saw its task as being primarily to energize a high-level international debate – to try to reverse the sleepwalk into which international nuclear policy had largely fallen since the burst of arms control energy that accompanied and immediately followed the end of the Cold War, and in particular to try to ensure that there would be no repetition at the Nuclear Non-Proliferation Treaty Review (NPT) Conference scheduled for May 2010 of the failure of its predecessor in 2005, and the World Summit of that year, to agree on anything at all.

There had been the beginnings of a new debate with the publication of the Shultz-Perry-Kissinger-Nunn "gang of four" article in January 2007, arguing from a hard-headed realist perspective that nuclear weapons had outlived any usefulness they might have had, but in mid-2008 global policymakers were still not focusing. By the beginning of 2009, however, things had changed. Newly elected U.S. President Barack Obama launched a series of nuclear disarmament, non-proliferation and security initiatives – to which President Dmitry Medvedev of Russia, in particular, was immediately responsive – and nuclear issues were squarely back on the global agenda.

With the long-needed international debate well and truly now under way, this Commission's role had to be more than just another call to attention. The need now is not just to identify the problems and point in the general direction of the right solutions. It is to bring all the complex, inter-related threads together; analyse in rather more detail both the opportunities and constraints that would be involved in moving forward; and try to map with rather more precision who should be doing what, when and how in responding to the whole range of nuclear threats and risks with which the world is now confronted. Central to our approach is the sense that the debate needed to focus squarely on specific action plans – short, medium and longer term – and that, above all, those plans have to be realistic. Idealistic, yes; pushing the envelope beyond most governments' comfort zones, yes; but also pragmatic, recognizing the many obstacles – political, practical and technical – that would need to be surmounted, and adjusting time-frames and ambitions accordingly.

It will be for others to judge how well this report succeeds in meeting these objectives. Some will undoubtedly see us as not being ambitious enough; others as excessively so. What we hope will be clearly apparent to everyone is the sense of urgency we feel about the need to tackle the problems here described, and our determination to keep clearly in sight the ultimate goal. That must be not to merely reduce or minimize nuclear threats and risks, but to eliminate them completely. The international community can only rest when we have achieved a world without nuclear weapons, and be confident that it will remain that way.

The consensus text on which we have agreed reflects our shared view of what is both desirable and politically achievable in the world as we know it today and want it to be. Although participating in their personal capacity, and not as representatives of their respective governments, Commissioners naturally brought to the table many different professional, policy and national interest perspectives, and the text on which we have agreed does not necessarily reflect in every respect their preferred positions. But we knew we could not begin to expect consensus in the wider international community on these issues if we could not find it among ourselves.

Acknowledgments

That the report we now present is a unanimous one is a tribute to the commitment brought to this effort by all our fellow Commissioners. We express our deep gratitude to them for the extraordinary qualities of knowledge, experience and judgment they brought to the preparation of this report over a year of long and often gruelling meetings. One very sad moment in the life of the Commission came with the news in December 2008 of the death of our colleague Ali Alatas, and we take this opportunity to pay particular tribute to this extraordinarily gifted and influential statesman, who we know passionately shared our dedication to achieving a nuclear weapon free world.

We have many others to thank, beginning with Australian and Japanese Prime Ministers Kevin Rudd and Yasuo Fukuda who had the vision to initiate this Commission, and the willingness to give it the ongoing support (continued by the latter's successors Taro Aso and Yukio Hatoyama) to ensure that it could really add value to the international nuclear debate. We also thank Foreign Ministers Stephen Smith, Masahiko Koumura, Hirofumi Nakasone and Katsuya Okada, for placing staff of their ministries at the Commission's disposal when so many other issues, from climate change and counter-terrorism to the global economic crisis, were demanding their attention. Japan and Australia have special interests in nuclear policy – as respectively the only country to have suffered the horror of nuclear attack, and the possessor of the world's largest reserves of uranium, the source

of nuclear fuel, which carries with it the responsibility to ensure that this resource is not misused – and it is the Commission's hope that, with the support of the perhaps unusual combination of these two governments behind it, our report will have real and continuing traction.

The Commission could not have begun to have done its work effectively without the tireless and professional efforts of its Secretary, Ian Biggs, the Australian Secretariat he led within the Department of Foreign Affairs and Trade, and on the Japanese side Toshio Sano and his team within the Ministry of Foreign Affairs. The organizational demands involved in putting together multiple Commission and Regional Meetings all over the world and physically producing a report of this length, all in just over a year, were intense almost beyond measure; but our joint team rose to the challenge admirably.

The research and consultations on which this report is based, and the way in which we went about our task, are described in detail in Annex C, "How the Commission Worked", which also identifies all the key individuals, including those in the Canberra and Tokyo Secretariats, from whose help we benefited. We profited enormously from the advice and input of the distinguished members of our Advisory Board, nearly all of whom participated in one or more of our full Commission meetings; the Associated Research Centres, which helped us greatly both in marshalling the necessary material and arguments and, where their home countries were involved, in organizing our crucial Regional Meetings; and our NGO Advisers, who ensured that we were fully alert to civil society as well as government sentiment as we went about our task. We are particularly grateful to those of our members, advisers and staff who, at our request, produced the initial drafts of different sections of the report from which we wrote the Co-chairs' text: Commissioners Alexei Arbatov and François Heisbourg; Advisory Board members and research consultants John Carlson, George Perkovich, Nobuyasu Abe, Lawrence Freedman, Shinsuke Kondo, Martine Letts, Patricia Lewis and V.R. Raghavan; Research Coordinator Ken Berry; Secretariat staff Ian Biggs, Toshio Sano and John Tilemann; and Australian experts Malcolm Coxhead and Steve McIntosh.

The Commission was intended to build upon, and take further, the work of distinguished earlier commissions and panels, and we acknowledge particularly in this respect the important reports of the 1996 Canberra Commission on the Elimination of Nuclear Weapons, the 1999 Tokyo Forum for Nuclear Non-Proliferation and Disarmament, the 2004 UN High-level Panel on Threats, Challenges and Change, the 2006 Blix Weapons of Mass Destruction Commission, and the 2008 Zedillo Commission of Eminent Persons on the future of the International Atomic Energy Agency (IAEA). Many of our Commissioners, Advisory Board members and researchers

were associated in one way or another with these earlier enterprises, and we have learned much from them.

Also deserving our warmest gratitude are all the participants in our Regional Meetings, who provided a wonderfully rich flow of information, ideas and diverse political perspectives, as well as an excellent real-world sounding board against which to test our own evolving ideas; the industry representatives who participated in our consultation in Moscow in June 2009, for enabling us to test the ground truth of our approach to the civil nuclear-energy sector; the *hibakusha*, or survivors of the Hiroshima and Nagasaki nuclear bombs, who movingly and memorably, in Washington and Hiroshima, told Commissioners of their experiences; the International Crisis Group and the University of Melbourne and the Japanese Diet, for allowing each of us, respectively, to devote time to this Commission while still in their employ; and the Australian and Japanese Ambassadors, High Commissioners, Chargés d'Affaires and missions in so many capitals, for their hospitality, programming skills and contacts as the Commission has moved around the world over the last year.

We thank finally each other, and again our fellow Commissioners, for believing in a world without nuclear weapons, and working tirelessly to make it both believable and achievable for policymakers worldwide.

GARETH EVANS
YORIKO KAWAGUCHI
Co-chairs

November 2009

SYNOPSIS:

A COMPREHENSIVE ACTION AGENDA

SYNOPSIS:
A COMPREHENSIVE ACTION AGENDA

A. WHY THIS REPORT, AND WHY NOW

- Nuclear weapons are the most inhumane weapons ever conceived, inherently indiscriminate in those they kill and maim, and with an impact deadly for decades. They are the only weapons ever invented that have the capacity to wholly destroy life on this planet, and the arsenals we now possess are able to do so many times over. The problem of nuclear weapons is at least equal to that of climate change in terms of gravity – and much more immediate in its potential impact.

- So long as any state has nuclear weapons, others will want them. So long as any such weapons remain, it defies credibility that they will not one day be used, by accident, miscalculation or design. And any such use would be catastrophic. It is sheer luck that the world has escaped such catastrophe until now.

- Maintaining the status quo is not an option. The threats and risks associated with the failure to persuade existing nuclear-armed states to disarm, to prevent new states acquiring nuclear weapons, to stop any terrorist actor gaining access to such weapons, and to properly manage a rapid expansion in civil nuclear energy, defy complacency. They must be tackled with much more conviction and effectiveness than the world has managed so far.

- There have been many major international commission, panel, research institute and think tank reports addressing these issues. What makes this report distinctive is, hopefully, its timeliness; comprehensiveness; global consultative reach; attention to pragmatic realities as well as ambitious ideals; intended accessibility to non-specialist policymakers; and strong action orientation, reflected in the short, medium and longer term action agendas that bind together its specific policy proposals.

- With new U.S. and Russian leadership seriously committed to disarmament action, there is a new opportunity – the first since the immediate post-World War II and post-Cold War years – to halt, and reverse, the nuclear weapons tide once and for all. This report describes, not just rhetorically but in the detail that global policymakers need, how that opportunity can and should be seized. *[Section 1]*

B. NUCLEAR THREATS AND RISKS

- ***Existing Nuclear-Armed States.*** Twenty years after the end of the Cold War there are at least 23,000 nuclear warheads still in existence, with a combined blast capacity equivalent to 150,000 Hiroshima bombs. The U.S. and Russia together have over 22,000, and France, the UK, China, India, Pakistan and Israel around 1,000 between them. Nearly half of all warheads are still operationally deployed, and the U.S. and Russia each have over 2,000 weapons on dangerously high alert, ready to be launched immediately – within a decision window of just 4-8 minutes for each president – in the event of perceived attack. The command and control systems of the Cold War years were repeatedly strained by mistakes and false alarms. With more nuclear-armed states now, and more system vulnerabilities, the near miracle of no nuclear exchange cannot continue in perpetuity. *[Section 2]*

- ***New Nuclear-Armed States.*** The Nuclear Non-Proliferation Treaty (NPT) system has been under severe strain in recent years, with the International Atomic Energy Agency (IAEA) struggling with verification, compliance and enforcement failures, and backward steps occurring in the world's most volatile regions. India and Pakistan joined the undeclared Israel as fully-fledged nuclear-armed states in 1998; North Korea is now likely to have some half-dozen nuclear explosive devices; and Iran probably now has weapon-making capability, with real potential for generating a regional proliferation surge should it choose to cross the weaponization red-line. *[Section 3]*

- ***Nuclear Terrorism.*** Terrorist groups exist with the intent, and capacity, to create massive nuclear destruction. With manageable technology long in the public domain, and black market sourcing, a Hiroshima-sized nuclear device could possibly be detonated from a truck or small boat inside any major city. A "dirty bomb", combining conventional explosives with radioactive materials like medical isotopes, would be a much easier option: while not generating anything like the casualties of a fission or fusion bomb, it would have a psychological impact at least equal to 9/11. *[Section 4]*

- ***Peaceful Uses of Nuclear Energy.*** The likely rapid expansion of civil nuclear energy in the decades ahead, not least in response to climate-change concerns, will present some additional proliferation and security risks. Particularly if accompanied by the construction of new national facilities for enrichment at the front end of the fuel cycle and reprocessing at the back end, it could mean a great deal more fissile material becoming potentially available for destructive purposes. *[Section 5]*

C. MEETING THE CHALLENGE OF NUCLEAR DISARMAMENT

BASIC THEMES

- ***Delegitimizing nuclear weapons.*** The critical need is to finally transform perceptions of the role and utility of nuclear weapons, from occupying a central place in strategic thinking to being seen as quite marginal, and ultimately wholly unnecessary. There are good answers to all the familiar deterrence and other justifications for retaining nuclear weapons.

- It is neither defensible nor sustainable for some states to argue that nuclear weapons are an indispensable, legitimate and open-ended guarantor of their own and allies' security, but that others have no right to acquire them to protect their own perceived security needs.

- "Extended deterrence" does not have to mean extended *nuclear* deterrence. *[Section 6]*

- ***A phased approach.*** Achieving a nuclear weapon free world will be a long, complex and formidably difficult process, most realistically pursued as a two-phase process, with minimization the immediate goal and elimination the ultimate one. *[Section 7]*

- Short term (to 2012) and medium term (to 2025) efforts should focus on achieving as soon as possible, and no later than 2025, a "minimization point" characterised by very low numbers of warheads (less than 10 per cent of present arsenals), agreed "no first use" doctrine, and force deployments and alert status reflecting that doctrine. *[Sections 17, 18]*

- Analysis and debate should commence now on the conditions necessary to move from the minimization point to elimination, even if a target date for getting to zero cannot at this stage be credibly specified. *[Section 19]*

KEY POLICIES

- ***Action Consensus***. The 2010 NPT Review Conference should agree on a 20-point statement, "A New International Consensus for Action on Nuclear Disarmament", updating and extending the "Thirteen Practical Steps" agreed in 2000. *[16.6-11; Box 16-1]*

- ***Numbers***. No later than 2025 U.S. and Russian arsenals should be reduced to a total of 500 nuclear warheads each, with at least no increases, and desirably significant reductions, in the arsenals – now totalling some 1,000 warheads – of the other nuclear-armed states. A global maximum of 2,000 warheads would represent a more than 90 per cent reduction in present arsenals. *[18.1-3]*

- All nuclear-armed states should now explicitly commit *not to increase* the number of their nuclear weapons. *[17.15-16]*
- ***Doctrine.*** Pending the ultimate elimination of nuclear weapons, every nuclear-armed state should make as soon as possible, and no later than 2025, an unequivocal "no first use" (NFU) declaration. *[17.28]*
- If not prepared to go so far now, each such state – and in particular the U.S. in its Nuclear Posture Review – should at the very least accept the principle that the "sole purpose" of possessing nuclear weapons is to deter others from using such weapons against that state or its allies.
- Allied states affected by such declarations should be given firm assurances that they will not be exposed to other unacceptable risks, including from biological and chemical weapons. *[17.28-32]*
- New and unequivocal negative security assurances (NSAs) should be given by all nuclear-armed states, supported by binding Security Council resolution, that they will not use nuclear weapons against NPT-compliant non-nuclear weapon states. *[17.33-39]*
- ***Force Deployment and Alert Status.*** Changes should be made as soon as possible to ensure that, while remaining demonstrably survivable to a disarming first strike, nuclear forces are not instantly useable. Stability should be maximized by deployments and launch alert status being transparent. *[7.12-15; 17.40-50]*
- The decision-making fuse for the launch of any nuclear weapons must be lengthened, and weapons taken off launch-on-warning alert as soon as possible. *[17.43]*
- ***Parallel Security Issues.*** *Missile defence* should be revisited, with a view to allowing the further development of theatre ballistic missile defence systems, including potential joint operations in areas of mutual concern, but setting severe limits on strategic ballistic missile defences. *[2.30-34; 18.28-30]*
- *Conventional arms imbalances*, both quantitative and qualitative, between the nuclear-armed states, and in particular the relative scale of U.S. capability, need to be seriously addressed if this issue is not to become a significant impediment to future bilateral and multilateral nuclear disarmament negotiations. *[18.34-36]*
- Continuing strong efforts should be made to develop more effective ways of defending against potential *biological* attacks including building a workable verification regime, and to promote universal adherence to the

Biological and Toxin Weapons Convention and the Chemical Weapons Convention. *[17.29; 18.32-33]*

- Ongoing attempts to prevent an arms race in *outer space* (PAROS) should be strongly supported. *[18.31]*
- ***Testing.*** All states that have not already done so should sign and ratify the Comprehensive Nuclear-Test-Ban Treaty (CTBT) unconditionally and without delay. U.S. ratification is a critically needed circuit-breaker: it would have an immediate impact on other hold-out states, and add major new momentum to both disarmament and non-proliferation efforts.
- Pending the CTBT's entry into force, all states should continue to refrain from nuclear testing. *[Section 11]*
- ***Availability of Fissile Material.*** All nuclear-armed states should declare or maintain a moratorium on the production of fissile material for weapon purposes pending the negotiation and entry into force as soon as possible of a Fissile Material Cut-off Treaty (FMCT).
- On the question of pre-existing stocks, a phased approach should be adopted, with the first priority a cap on production; then an effort to ensure that all fissile material other than in weapons becomes subject to irreversible, verified non-explosive use commitments; and with fissile material released through dismantlement being brought under these commitments as weapon reductions are agreed.
- As an interim step, all nuclear-armed states should voluntarily declare their fissile material stocks and the amount they regard as excess to their weapons needs, place such excess material under IAEA safeguards as soon as practicable, and convert it as soon as possible to forms that cannot be used for nuclear weapons. *[Section 12]*

D. MEETING THE CHALLENGE OF NON-PROLIFERATION

BASIC THEMES

- Nuclear non-proliferation efforts should focus both on the demand side – persuading states that nuclear weapons will not advance their national security or other interests – and the supply side, through maintaining and strengthening a comprehensive array of measures designed to make it as difficult as possible for states to buy or build such weapons. *[Section 8]*

KEY POLICIES

- ***NPT Safeguards and Verification.*** All states should accept the application of the IAEA Additional Protocol. To encourage universal take-up, acceptance of it should be a condition of all nuclear exports. *[9.7]*
- The Additional Protocol and its annexes should be updated and strengthened to make clear the IAEA's right to investigate possible weaponization activity, and by adding specific reference to dual-use items, reporting on export denials, shorter notice periods and the right to interview specific individuals. *[9.8-9]*
- ***NPT Compliance and Enforcement.*** In determining compliance, the IAEA should confine itself essentially to technical criteria, applying them with consistency and credibility, and leaving the political consequences for the Security Council to determine. *[9.15]*
- The UN Security Council should severely discourage withdrawal from the NPT by making it clear that this will be regarded as prima facie a threat to international peace and security, with all the punitive consequences that may follow from that under Chapter VII of the UN Charter. *[9.20]*
- A state withdrawing from the NPT should not be free to use for non-peaceful purposes nuclear materials, equipment and technology acquired while party to the NPT. Any such material provided before withdrawal should so far as possible be returned, with this being enforced by the Security Council. *[9.21-22]*
- ***Strengthening the IAEA.*** The IAEA should make full use of the authority already available to it, including special inspections, and states should be prepared to strengthen its authority as deficiencies are identified. *[9.24]*
- The IAEA should be given a one-off injection of funds to refurbish the Safeguards Analytical Laboratory; a significant increase in its regular budget support, without a "zero real growth" constraint; and sufficient security of future funding to enable effective medium to long term planning. *[9.25-27]*
- ***Non-NPT Treaties and Mechanisms.*** The Nuclear Suppliers Group (NSG) should develop a criteria-based approach to cooperation agreements with states outside the NPT, taking into account factors such as ratification of the CTBT, willingness to end unsafeguarded fissile material production, and states' record in securing nuclear facilities and materials and controlling nuclear-related exports. *[10.3-9]*

- The Proliferation Security Initiative (PSI) should be reconstituted within the UN system as a neutral organization to assess intelligence, coordinate and fund activities, and make both generic and specific recommendations or decisions concerning the interdiction of suspected materials being carried to or from countries of proliferation concern. *[10.10-12]*

- ***Extending Obligations to Non-NPT States.*** Recognising the reality that the three nuclear-armed states now outside the NPT – India, Pakistan and Israel – are not likely to become members any time soon, every effort should be made to achieve their participation in parallel instruments and arrangements which apply equivalent non-proliferation and disarmament obligations. *[10.13-16]*

- Provided they satisfy strong objective criteria demonstrating commitment to disarmament and non-proliferation, and sign up to specific future commitments in this respect, these states should have access to nuclear materials and technology for civilian purposes on the same basis as an NPT member. *[10.17]*

- These states should participate in multilateral disarmament negotiations on the same basis as the nuclear-weapon state members of the NPT, and not be expected to accept different treatment because of their non-membership of that treaty. *[10.18]*

- ***Priorities for the 2010 NPT Review Conference.*** The primary focus should be on reaching agreement on:
  - a new 20-point statement, "A New International Consensus for Action on Nuclear Disarmament", updating and extending the "Thirteen Practical Steps" agreed in 2000;
  - measures to strengthen NPT safeguards and verification, compliance and enforcement, and the IAEA (as above);
  - forward movement on the Middle East Weapons of Mass Destruction Free Zone, with the UN Secretary-General convening an early conference of all relevant states to address creative and fresh ways to implement the 1995 resolution;
  - strengthened implementation of nuclear security measures (see Meeting Terrorism Challenge below); and
  - further support for peaceful uses of nuclear energy. *[Section 16]*

E. MEETING THE CHALLENGE OF NUCLEAR TERRORISM

BASIC THEMES

- Effectively countering terrorism of any kind involves a complex mix of nationally and internationally coordinated protection and policing strategies (most immediately important in dealing with the threat of nuclear terrorism), and also political, peacebuilding and psychological strategies (necessary to address the underlying causes of terrorist behaviour).
- At the 2010 Nuclear Security Summit, and in related policy deliberations, the main need is to focus on the effective implementation of existing agreed measures rather than the development of new ones. *[Section 13; Box 13-1]*

KEY POLICIES

- All states should agree to take effective measures to strengthen the security of nuclear materials and facilities, including by adopting and implementing the 2005 amendment to the Convention on the Physical Protection of Nuclear Material, accelerating delivery of the Cooperative Threat Reduction and associated programs worldwide, and making a greater commitment to international capacity building and information sharing. *[13.5-16]*
- On the control of material useable for "dirty bombs", further efforts need to be made to cooperatively implement the Code of Conduct on the Safety and Security of Radioactive Sources, with assistance to states in updating legislation and licensing practice and promoting awareness among users. *[13.17-21]*
- Strong support should be given to the emerging science of nuclear forensics, designed to identify the sources of materials found in illicit trafficking or used in nuclear explosions. *[13.22-25]*

F. MEETING THE CHALLENGE OF CIVIL NUCLEAR ENERGY

BASIC THEMES

- The use of nuclear energy for peaceful purposes should continue to be strongly supported as one of the three fundamental pillars of the NPT, along with disarmament and non-proliferation. Increased resources should be provided, including through the IAEA's Technical Cooperation Programme, to assist developing states in taking full advantage of peaceful nuclear energy for human development.
- Proliferation resistance should be endorsed by governments and industry as an essential objective in the design and operation of nuclear facilities, and promoted through both institutional and technical measures – neither is sufficient without the other. *[Section 14]*

KEY POLICIES

- ***Nuclear Energy Management***. Support should be given to the initiative launched at the 2008 Hokkaido Toyako G8 Summit for international cooperation on nuclear energy infrastructure, designed to raise awareness worldwide of the importance of the three Ss – safeguards, security and safety – and assist countries concerned in developing the relevant measures. *[14.4-6]*
- New technologies for spent fuel treatment should be developed to avoid current forms of reprocessing altogether. *[12.26]*
- The increasing use of plutonium recycle, and the prospective introduction of fast neutron reactors, must be pursued in ways which enhance non-proliferation objectives and avoid adding to proliferation and terrorism risks. *[14.9-15]*
- International measures such as spent fuel take-back arrangements by fuel suppliers, are desirable to avoid increasing spent fuel accumulations in a large number of states. *[14.13]*
- ***Multilateralizing the Nuclear Fuel Cycle*** – in particular through fuel banks and multilateral management of enrichment, reprocessing and spent fuel storage facilities – should be strongly supported. Such arrangements would play an invaluable role in building global confidence in the peaceful uses of nuclear energy, and provide an important foundation for a world free of nuclear weapons, for which a necessary requirement will be multilateral verification and control of all sensitive fuel cycle activities. *[Section 15]*

G. MOBILIZING AND SUSTAINING POLITICAL WILL

BASIC THEMES

- The will to do something difficult, sensitive or expensive will rarely be a given in international or domestic politics. It usually has to be painfully and laboriously constructed, case by case, context by context, with four main elements needing to come together:
  - *leadership*: without which inertia will always prevail – top down (from the major nuclear-armed states, particularly the U.S. and Russia), from peer groups (like-minded states worldwide) and bottom up (from civil society);
  - *knowledge*: both specialist and general, of the nature, magnitude and urgency of the nuclear problem: requiring better education and training in schools and universities, and stronger advocacy directed to policymakers, and those in the media and elsewhere who most influence them;
  - *strategy*: having a confident sense that there is a productive way forward: not just general objectives, but realistic action plans with detailed paths mapped and target benchmarks set; and
  - *process*: having the institutional and organisational means at hand – "campaign treaties", or other research and advocacy structures – to advance the relevant strategy in practice. *[Section 20]*

KEY POLICIES

- ***Nuclear Weapons Convention.*** Work should commence now, supported by interested governments, on further refining and developing the concepts in the model convention now in circulation, making its provisions as workable and realistic as possible, with the objective of having a fully-worked through draft available to inform and guide multilateral disarmament negotiations as they gain momentum. *[20.38-44]*

- ***Report Card.*** To help sustain political will over time, a regular "report card" should be published in which a distinguished international panel, with appropriately professional and broad based research support, would evaluate the performance of both nuclear-armed and non-nuclear-armed states against the action agendas identified in this report. *[20.49-50]*

- ***Monitoring and Advocacy Centre.*** Consideration should be given to the establishment of a "Global Centre on Nuclear Non-proliferation and Disarmament" to act as a focal point and clearing house for the work being done on nuclear non-proliferation and disarmament issues by many different institutions and organizations in many different countries, to provide research and advocacy support both for like-minded governments and for civil society organisations, and to prepare the "report card" described above. *[20.51-54]*

THE COMPREHENSIVE ACTION AGENDA

THE SHORT TERM ACTION AGENDA TO 2012: ACHIEVING INITIAL BENCHMARKS

On Disarmament

- Early agreement on a Strategic Arms Reduction Treaty (START) follow-on treaty, with the U.S. and Russia agreeing to deep reductions in deployed strategic weapons, addressing the issue of strategic missile defence and commencing negotiations on further deep cuts in all classes of weapons.
- Early movement on nuclear doctrine, with all nuclear-armed states declaring at least that the sole purpose of retaining the nuclear weapons they have is to deter others from using such weapons against them or their allies (while giving firm assurances to such allies that they will not be exposed to unacceptable risk from other sources, including in particular chemical and biological weapons).
- All nuclear-armed states to give strong negative security assurances to complying non-nuclear weapon states parties to the NPT, supported by binding Security Council resolution, that they will not use nuclear weapons against them.
- Early action on nuclear force postures, with particular attention to the negotiated removal to the extent possible of weapons from "launch-on-warning" status.
- Early commitment by all nuclear-armed states to not increasing their nuclear arsenals.
- Prepare the ground for a multilateral disarmament process by all nuclear-armed states conducting relevant studies; engaging in strategic dialogues with the U.S., Russia and each other; and commencing a joint dialogue within the framework of the Conference on Disarmament work program.

On Non-Proliferation

- A positive outcome for the May 2010 NPT Review Conference, with member states reaching agreement on measures to strengthen the NPT regime, including improved safeguards, verification, compliance and enforcement; measures to strengthen the effectiveness of the IAEA; "A New International Consensus for Action on Nuclear Disarmament"

statement on disarmament issues; and measures to advance the implementation of the Middle East and other existing and proposed Nuclear Weapon Free Zones.

- Satisfactory negotiated resolution of the North Korea and Iran nuclear program problems.
- Movement toward strengthening non-proliferation regimes outside the NPT, and applying equivalent disciplines to NPT non-members.

On Both Disarmament and Non-Proliferation

- Bring into force the Comprehensive Nuclear-Test-Ban Treaty.
- Conclude negotiations on an Fissile Material Cut-off Treaty.

On Nuclear Security

- Bring into force the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material, accelerate implementation of the cooperative threat reduction and associated programs designed to secure dangerous nuclear weapons, materials and technology worldwide, and achieve greater commitment to international capacity building and information sharing.

On Peaceful Uses of Nuclear Energy

- Movement toward greater multilateralization of the nuclear fuel cycle, and government-industry cooperation on proliferation-resistant technologies and other measures designed to reduce any risks associated with the expansion of civil nuclear energy.
- Promotion of international cooperation on nuclear energy infrastructure to raise awareness worldwide of the importance of the three Ss – safeguards, security and safety – and assist countries concerned in developing relevant measures.

[Section 17]

THE MEDIUM TERM ACTION AGENDA TO 2025: GETTING TO THE MINIMIZATION POINT

- Progressive achievement of interim disarmament objectives, culminating by 2025 in a "minimization point" characterized by:
  - low numbers: a world with no more than 2,000 nuclear warheads (less than 10 per cent of today's arsenals);
  - agreed doctrine: every nuclear-armed state committed to no first use;
  - credible force postures: verifiable deployments and alert status reflecting that doctrine.
- Progressive resolution of parallel security issues likely to impact on nuclear disarmament negotiations:
  - missile delivery systems and strategic missile defence;
  - space based weapons systems;
  - biological weapons;
  - conventional arms imbalances.
- Development and building of support for a comprehensive Nuclear Weapons Convention to legally underpin the ultimate transition to a nuclear weapon free world.
- Complete implementation (to extent already not achieved by 2012) of short-term objectives crucial for both disarmament and non-proliferation:
  - Comprehensive Nuclear-Test-Ban Treaty in force;
  - Fissile Material Cut-off Treaty negotiated and in force, and a further agreement negotiated to put all fissile material not in weapons under international safeguards;
  - Measures to strengthen the NPT regime and the IAEA agreed and in force;
  - Nuclear security measures in force, and cooperative threat reduction and associated programs fully implemented;
  - Progressive implementation of measures to reduce the proliferation risks associated with the expansion of civil nuclear energy.

[Section 18]

THE LONGER TERM ACTION AGENDA BEYOND 2025: GETTING TO ZERO

- Create political conditions, regionally and globally, sufficiently cooperative and stable for the prospect of major war or aggression to be so remote that nuclear weapons are seen as having no remaining deterrent utility.
- Create the military conditions in which conventional arms imbalances, missile defence systems or any other national or intergovernmental-organisation capability is not seen as so inherently destabilizing as to justify the retention of a nuclear deterrent capability.
- Create verification conditions that will ensure confidence that any violation of the prohibition of nuclear weapons would be readily detected.
- Create the international legal regime and enforcement conditions that will ensure that any state breaching its prohibition obligations not to retain, acquire or develop nuclear weapons will be effectively penalized.
- Create fuel cycle management conditions that will ensure complete confidence that no state has the capacity to misuse uranium enrichment or plutonium reprocessing for weapons development purposes.
- Create personnel oversight conditions to ensure confidence that individuals' know-how in the design and building of nuclear weapons will not be misapplied in violation of prohibition obligations.

[Section 19]

ABBREVIATIONS

ABACC	Argentine-Brazilian Agency for Accounting and Control of Nuclear Materials
ABM Treaty	Anti-Ballistic Missile Treaty
ALCM	air-launched cruise missile
BMD	ballistic missile defence
BWC	Biological and Toxin Weapons Convention
CANDU	Canadian Deuterium (heavy water) (natural) Uranium power reactor
CCW	Convention on Certain Conventional Weapons
CD	UN Conference on Disarmament
CDI	Center for Defense Information
CFE	Treaty on Conventional Armed Forces in Europe
CPPNM	Convention on the Physical Protection of Nuclear Material
CSI	Container Security Initiative
CTBT	Comprehensive Nuclear-Test-Ban Treaty
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organization
CTR	Cooperative Threat Reduction
CWC	Chemical Weapons Convention
DUPIC	Direct Use of Pressurized Water Reactor Spent Fuel in CANDU reactor
FAS	Federation of American Scientists
FMCI	Fissile Material Control Initiative
FMCT	Fissile Material Cut-off Treaty
G8	Group of Eight (Canada, France, Germany, Italy, Japan, Russia, the United Kingdom and the United States)
G-20	Group of Twenty (Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, United Kingdom, United States and the European Union)
GCR2P	Global Centre for the Responsibility to Protect

GICNT	Global Initiative to Combat Nuclear Terrorism
GIF	Generation IV International Forum
GLCM	ground-launched cruise missile
GNEP	Global Nuclear Energy Partnership
GWe	gigawatts (billion watts) electrical
HEU	high enriched uranium
IAEA	International Atomic Energy Agency
ICAN	International Campaign to Abolish Nuclear Weapons
ICBL	International Campaign to Ban Landmines
ICBM	intercontinental ballistic missile
ICJ	International Court of Justice
IISS	International Institute for Strategic Studies
IMS	CTBT International Monitoring System
INF Treaty	Intermediate and Short Range Nuclear Forces Treaty
IRBM	intermediate range ballistic missile
ISIS	Institute for Science and International Security
ITDB	IAEA Illicit Trafficking Database
IUEC	International Uranium Enrichment Centre
kt	kiloton, thousand tons TNT equivalent
kWh	kilowatt hours
LEU	low enriched uranium
LOW	launch on warning
LUA	launch under attack
LWR	light water reactor
MIRV	multiple independently targetable re-entry vehicle
MOX	mixed oxide (plutonium and uranium)
MRBM	medium range ballistic missile
Mt	megaton, million tons TNT equivalent
MTCR	Missile Technology Control Regime
MWe	megawatts (million watts) electrical
NAM	Non-Aligned Movement
NAS-CISAC	National Academy of Sciences Committee on International Security and Arms Control
NATO	North Atlantic Treaty Organization

NCA	National Command Authorities
NFU	no first use
NGOs	non-governmental organizations
NORAD	North American Aerospace Defense Command
NNWS	non-nuclear-weapon state, as defined by the NPT
NSA	negative security assurance
NSG	Nuclear Suppliers Group
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
NTI	Nuclear Threat Initiative
NWC	model Nuclear Weapons Convention
NWFZ	nuclear weapon free zone
NWS	nuclear-weapon state, as defined by the NPT (United States, Russia, United Kingdom, France, China)
OTA	U.S. Office of Technology Assessment
PAROS	Prevention of an Arms Race in Outer Space
PSI	Proliferation Security Initiative
PTBT	Partial Test Ban Treaty
PWR	pressurized water reactor
R&D	research and development
RDD	radiation dispersal device
RERTR	Reduced Enrichment for Research and Test Reactors program
RRW	Reliable Replacement Warhead
SALT	Strategic Arms Limitation Treaty
SLBM	submarine/sea-launched ballistic missile
SLCM	sea-launched cruise missile
SIPRI	Stockholm International Peace Research Institute
SNT	sensitive nuclear technology (uranium enrichment and plutonium separation)
SORT	Strategic Offensive Reductions Treaty
SRAM	short-range air-to-surface missile
SSBN	ship submersible ballistic nuclear (strategic nuclear submarine)
SSOD	(UN General Assembly) Special Session on Disarmament

SSP	U.S. Stockpile Stewardship Program
START	Strategic Arms Reduction Treaty
THAAD	Terminal High Altitude Area Defense missile defense
TMD	theatre missile defense
TNW	tactical nuclear weapon
TTBT	Threshold Test Ban Treaty
UNCOPUOS	UN Committee on the Peaceful Uses of Outer Space
UNGA	UN General Assembly
UNIDIR	UN Institute for Disarmament Research
UNSCR	UN Security Council Resolution
WANO	World Association of Nuclear Operators
WINS	World Institute for Nuclear Security
WNA	World Nuclear Association
WMD	weapons of mass destruction (nuclear, chemical, biological)
WMDFZ	weapons of mass destruction free zone

PART I:

SEIZING THE MOMENT

1. WHY THIS REPORT, AND WHY NOW

THE PROBLEM: A GLOBAL THREAT DEFYING COMPLACENCY

1.1 Nuclear weapons are the most inhumane weapons ever conceived, inherently indiscriminate in those they kill and maim, and with an impact deadly for decades. Their use by anyone at any time, whether by accident, miscalculation or design, would be catastrophic. They are the only weapons ever invented that have the capacity to wholly destroy life on this planet, and the arsenals we now possess – combining their blast, radiation and potential "nuclear winter" effects – are able to do so many times over. Climate change may be the global policy issue that has captured most attention in the last decade, but the problem of nuclear weapons is at least its equal in terms of gravity – and much more immediate in its potential impact.

1.2 The risks associated with the failure of existing nuclear-armed states to disarm, the failure to prevent new states acquiring nuclear weapons, and the failure to stop any terrorist actor gaining access to such weapons, are very real. They outweigh any conceivable benefit that might attach to the continued possession of these weapons by anyone. They defy the complacency with which they have by and large been regarded since the end of the Cold War. And they must be tackled with much more conviction and effectiveness than we have managed so far.

1.3 Twenty years after the end of the Cold War there are at least 23,000 nuclear warheads still in existence, nearly every one of them having many times the destructive power of the bombs that devastated Hiroshima and Nagasaki. The U.S. and Russia have over 22,000 of them, and the other nuclear-armed states around 1,000 between them. They have a blast capacity alone equivalent to 2,300 million tons of TNT, which adds up to more than 150,000 Hiroshima-scale explosions – or 760 times the combined destructive power of all the bombs used by every combatant in World War II.

1.4 Nearly half of all these weapons – some 10,000 – remain operationally deployed. And, most extraordinarily of all, over 2,000 of the U.S. and Russian weapons remain on dangerously high alert, ready to be launched on warning in the event of a perceived attack, within a decision window for each country's president of four to eight minutes. We know now that there were many occasions when the very sophisticated command and control systems of the Cold War years were strained by mistakes and false alarms.

We know how destructive cyber attacks on defence systems could be with today's sophisticated technology – and can guess how much more so such attacks might be in the future. It is hard to believe that the luck of the Cold War – the near miracle of no nuclear exchange – can continue in perpetuity.

1.5 In recent years, moreover, we have seen the beginnings of a breakdown in the non-proliferation system, which despite many forebodings, and the non-participation of France and China until 1992, had held together remarkably for the first thirty years of existence of the Nuclear Non-Proliferation Treaty (NPT). India and Pakistan, who had never signed the treaty, joined the undeclared Israel as fully-fledged nuclear-armed states in 1998, with each of them now possessing at least 60 warheads, and in the case of Israel perhaps closer to 200. North Korea has declared its withdrawal from the NPT, and is now likely to have five or six nuclear explosive devices. Iran, with its uranium enrichment program, probably now has weapon-making capability if it chooses to go down that path. With these developments all occurring in the world's most volatile regions, with less reason to be confident about weapons security and command systems than in the case of the longer-established nuclear powers, and with considerable potential for what has been described as a "cascade" of proliferation should Iran, in particular, cross the weaponization red-line, the risk of something going badly wrong here is disconcertingly high.

1.6 Add to all that now the risk of terrorist actors getting their hands on the makings of a nuclear weapon. We can no longer be under any illusions about the intent of certain messianic groups to cause destruction on a massive scale. And – although the probability is small, and probably lower than some alarmist accounts have suggested – their capacity should not be underestimated to put together and detonate a Hiroshima-sized nuclear device. Using manageable technology long in the public domain and back-channel sourcing of the kind the A.Q. Khan network taught us to be alarmed about, such a device exploded from the inside of a large delivery truck in Trafalgar Square or Times Square, or in the centre of any other major city, would cause in each case hundreds of thousands of deaths and injuries. A much easier option for terrorist groups would be to make a "dirty bomb", combining conventional explosives with radioactive materials like medical isotopes, which would generate nothing like the casualties of a fission or fusion bomb but have a psychological impact at least equal to 9/11.

1.7 There are also potentially significant risks, in this context, associated with the likely rapid expansion of civil nuclear energy in the decades ahead, in response not least to the need for non-fossil fuel contributions to base-load electricity generation. The present total of 436 nuclear power reactors is expected to grow, even with long planning and construction lead-times and taking into account closures along the way, to as many as 800 by 2030, with

many new countries taking up this option. If this is accompanied by the construction of new national facilities for enrichment at the front end of the fuel cycle and reprocessing at the back end, this civil nuclear "renaissance" could mean a great deal more fissile material becoming potentially available for destructive purposes.

THE OPPORTUNITY: RENEWING THE MOMENTUM FOR ACTION

1.8 The only complete solution to the problem of nuclear weapons is to achieve their complete elimination – to create a world in which no state possesses nuclear weapons, where there are no unsafeguarded stockpiles of the high enriched uranium or separated plutonium on which they depend, and where we can be confident that no new nuclear threats will emerge. The problem has been a long time in the making, and its solution – beginning with all the existing nuclear-armed states renewing or pledging their commitment to elimination, and meaning what they say – will be long and complex in the delivery. Moreover, as the history of disarmament and non-proliferation efforts over the last twenty years starkly reminds us, one cannot assume that new momentum for change will be readily sustained: gains hard won can be rapidly lost. But there is now a new opportunity, matching that of the immediate post-World War II years and the early 1990s, to halt and reverse the tide once and for all.

1.9 The end of the Cold War saw a brief but extremely productive period of nuclear disarmament and threat reduction activity. Scores of thousands of warheads were decommissioned – bringing the global total to close to its present levels from the extraordinary 70,000 weapons that had existed in the mid-1980s. Unilateral cuts to national arsenals were made by the U.S., Russia, UK and France; the 1991 Strategic Arms Reduction Treaty (START) produced significant cuts in the number of offensive strategic weapons actually deployed; agreement was reached by Washington and Moscow on the elimination of Intermediate Range Nuclear Forces; ground-based battlefield nuclear weapons were removed from Europe; and France and the UK have eliminated all ground-based nuclear weapons of all ranges from their inventories. The U.S. Congress endorsed in 1992 the imaginative and forward-looking cooperative threat reduction programs sponsored by Senators Sam Nunn and Richard Lugar, designed to lock down dangerous weapons and materials – and in particular to reduce the chance of their falling into the hands of terrorist groups, or nations that sanction terrorism – in the former Soviet Union (and subsequently expanded to a number of countries since, notably Pakistan).

1.10 At the same time, intense diplomatic efforts to universalize the non-proliferation regime were rewarded by remarkable gains in preventing the further spread of nuclear weapons. In the early 1990s South Africa gave up its weapons program and joined the NPT, while three states of the former Soviet Union – Belarus, Kazakhstan and Ukraine – abandoned nuclear weapons and also joined the NPT as non-nuclear-weapon states. In South America, nuclear rivalry between Argentina and Brazil was contained when Argentina finally ratified the regional nuclear weapon free zone (the Treaty of Tlatelolco) and both subsequently joined the NPT. The high-water mark in non-proliferation diplomacy was the 1995 conference of NPT parties, which agreed to the treaty's indefinite extension.

1.11 But this momentum was not sustained. India and Pakistan became overtly nuclear-armed states in 1998, declining repeated pleas for them to join the NPT – as has Israel (which has never acknowledged its nuclear-armed status). In the same year, multilateral negotiations on a fissile material production cut-off treaty – or anything else – stalled in the Geneva Conference on Disarmament, and remained that way for over a decade. In 1999 the U.S. Senate failed to ratify the Comprehensive Nuclear-Test-Ban Treaty, and it has languished since with the support still required to bring it into force of eight other key countries – some overtly sheltering behind the American position. The Moscow Treaty of 2002, giving (imperfect) legal force to earlier announced unilateral cuts, was the last interest shown in arms control by the new Bush administration, which later in the same year unilaterally withdrew from the Anti-Ballistic Missile Treaty, storing up in the process multiple problems for future disarmament negotiations.

1.12 Efforts were certainly made to introduce new non-proliferation disciplines in the aftermath of 9/11, and with the discovery of the A.Q. Khan smuggling network, the concern about Iraq's nuclear program and the emergence of the North Korea and Iran problems. But when it came to disarmament the response of the key nuclear-armed states was seen by others as amounting to neglect at best and mockery at worst. This was hardly calculated to win a positive response from the non-nuclear weapon states who were being asked to do more on the proliferation side – and it didn't. The 2005 NPT Review Conference broke down without reaching substantive agreement on anything, and the UN World Summit in the same year also failed – for want of consensus – to say anything at all about nuclear non-proliferation or disarmament. As the end of the first decade of the 21st century approached, the hyperactivity of the early 1990s had become a slow-motion sleepwalk.

1.13 The wheel, however, has now turned again. The initial breakthrough can be traced to the January 2007 *Wall Street Journal* opinion article by the four U.S. statesmen, Secretaries Henry Kissinger, George Shultz, William Perry and Senator Sam Nunn (followed up with an equally thoughtful and

compelling piece a year later). From different sides of politics, all of them are hard-headed foreign policy realists with impeccable Cold War credentials. They argued, compellingly, that nuclear weapons had, with the end of the Cold War, outlived whatever utility they might have had; that the various risks associated with their retention by existing powers, and acquisition by new ones – not to mention terrorist actors – meant that the world would be much better off without them; and that it was time to commence a serious step-by-step process toward their elimination. Their statement struck sparks around the world, and was followed by many similar and supportive statements by groups of highly experienced and influential former officials in Europe and elsewhere.

1.14 The political momentum was consolidated with the election of President Barack Obama as President of the United States in November 2008, who launched a series of diplomatic initiatives, focusing particularly on nuclear non-proliferation and disarmament, for which he was awarded the Nobel Peace Prize within a year of taking office. Strongly personally committed to a world without nuclear weapons, as he made abundantly clear in his speech in Prague in April 2009, he was determined to deliver quickly some significant forward movement on disarmament. He pledged to immediately negotiate a START follow-on treaty with Russia to achieve significant further round cuts in each side's deployed strategic weapons, and found a responsive partner in Russian President Medvedev. He pledged to "immediately and aggressively" pursue U.S. ratification of the CTBT, although knowing that delivering the Senate on this would be a tougher call. He changed the U.S. position on fissile material cut-off treaty negotiations, agreeing that it should be verifiable, paving the way for the long stalemate in Geneva to at last be overcome. He made clear that he wanted to seriously "reduce the role of nuclear weapons in our national security strategy", with this objective being pursued in the first instance in the Nuclear Posture Review due for submission to Congress early in 2010. He chaired a meeting of the UN Security Council in September 2009 which produced the wide-ranging consensus Resolution 1887. He announced that the U.S. would host a world summit on nuclear security issues early in 2010. All this in turn injected a positive atmosphere into the preparatory process for the 2010 NPT Review Conference, with an agenda for that conference being agreed earlier, and in a much better atmosphere, than anyone recalling the meltdown of 2005 had a right to expect.

1.15 Wider afield, international cooperation on some other major global issues has moved further and faster in the past year than anyone could reasonably have expected. The unprecedentedly united and effective response to the global financial crisis of 2008–2009, and the emergence of the G-20 as a crucial policy-making and coordinating institution – with a membership genuinely reflecting the world of today and not, like the Security

Council, that of 1945 – have given real hope that the world's most intractable problems will be tackled much more constructively in the future.

1.16 This, then, is the environment – very much more promising than that of the last decade or more – in which this International Commission on Nuclear Non-proliferation and Disarmament has been established, and seeks to make its own significant contribution to the global policy debate. We are conscious that this debate has already taken wing, and that there are many players now engaged actively and effectively in it – individual governments, groups of governments, intergovernmental organizations, and a distinguished group of national and international think-tanks, research institutes and well-known non-governmental organizations, among the last-mentioned the Nuclear Threat Initiative, the Middle Powers Initiative, Global Zero and International Physicians for the Prevention of Nuclear War.

1.17 We are also conscious that our work follows that of a number of previous high-level panels and commissions over the last two decades whose reports have themselves made unquestionable contributions, notably the Canberra Commission on the Elimination of Nuclear Weapons in 1996, the Tokyo Forum for Nuclear Non-Proliferation and Disarmament in 1999, the Weapons of Mass Destruction Commission led by Hans Blix in 2006, and the Commission of Eminent Persons on the Role of the IAEA to 2020 and Beyond led by Ernesto Zedillo in 2008. If this Commission is to add real value to the international debate, we will have to not only bring information, analysis and argument together in a way that policymakers find useful, but break some new ground.

THIS COMMISSION'S ROLE: A COMPREHENSIVE ACTION AGENDA

1.18 The Commission was launched in September 2008 as a joint initiative of Australian Prime Minister Kevin Rudd and then Japanese Prime Minister Yasuo Fukuda, later endorsed by Prime Minister Yukio Hatoyama, with the stated objective of reinvigorating, at a high political level, awareness of the global need for nuclear non-proliferation and disarmament, in the context of the 2010 NPT Review Conference and beyond. Although supported and resourced by the governments of the two countries – both active and engaged contributors to the nuclear disarmament cause over many years – the Commission is a completely independent body, with its members appointed in their personal capacity rather than as representatives of their respective countries.

1.19 As described more fully in Appendix C, this report is the product of discussion at four full Commission meetings over the period October

2008 to October 2009, in Sydney, Washington DC, Moscow and Hiroshima, and regional consultative meetings held over the same period in Santiago, Beijing, Cairo and New Delhi. We also benefited, at our Moscow meeting, from a day-long consultation with leaders of the nuclear energy industry world-wide. The Commission was aided by advice and analysis contributed by a wide range of experts who served on the Advisory Board and by interactions with a global network of Associated Research Centres, all well-known research institutes in their own right, in Australia, Canada, China, Costa Rica, France, Japan, the UK and U.S. While drawing on a mass of already published literature, we also commissioned over fifty studies to address specific issues where supplementary research was needed, most of which have been published on the Commission website, www.icnnd.org.

1.20 The value added by this report will, we hope, be seen to follow from a number of factors. First, its timeliness: unlike most previous endeavours of this kind, we have had the sense that we are not so much resisting a tide as catching a wave. Second, the representativeness of the Commission's membership and the extent of our consultative outreach: this has been a genuinely global enterprise, in which we have done our best to expose ourselves directly to the widest possible range of interests, opinions and ideas. Third, the comprehensiveness of the report: whereas most previous commission reports of this kind have tended to focus mainly on one or other of the issues of disarmament, non-proliferation or peaceful uses of nuclear energy, we have tried to give more or less equal weight to all three, reflecting their close interdependence. Fourth, its realism: whereas writing on this subject can easily emerge as a rather idealistic wish-list, we have tried to match our own very strong idealism with pragmatic recognition that the real world is full of constraints that have to be acknowledged and somehow overcome. Fifth, its intended accessibility: policymakers and those who influence them, including the media, tend not to be specialists, and if a report is to be read, understood and have any impact it has to be written in a way that is not impenetrable to the uninitiated.

1.21 The last, and in many respects most important, way in which we have tried to add value is to ensure that this report is very specifically action-oriented, with a clear sense of what priorities it would be most productive to pursue, and by whom, at each stage of a long, evolving policy process. We have set out specific priority objectives for the 2010 NPT Review Conference, and Short, Medium and Longer Term Action Agendas for the periods, respectively, to 2012, 2025 and beyond 2025. The hope is that our analysis and recommendations, packaged this way, will prove both a reference point and guide to practical action over the years ahead for government and intergovernmental decision-makers, and those in civil society who will be seeking to shape those actions.

1.22 The Commission envisages this report, with its action plans, not as an end in itself, but as playing a part in a continuing process in which all relevant sectors of the global community will need to be, and stay, engaged. The right government decisions will only be made and carried through if the necessary political will is generated and sustained, and that means a central role for non-governmental organizations, parliamentarians, the media and anyone else whose business it is to educate, energize and hold to account national and international policymakers and those who most influence them. Mechanisms will need to evolve to monitor progress in a broad-based and transparent process, accompanied by periodic publishing of reports to highlight successes and identify shortcomings. For their own part Commission members are committed to taking forward the ideas in this report through advocacy and engagement with strategic policymakers and civil society worldwide.

PART II:

ASSESSING NUCLEAR THREATS AND RISKS

2. THE RISKS FROM EXISTING NUCLEAR-ARMED STATES

THE DESTRUCTIVE CAPABILITIES OF EXISTING WEAPONS

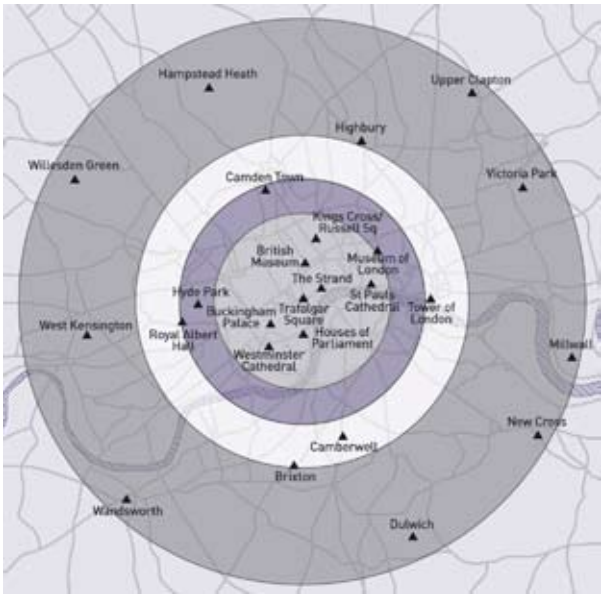
2.1 The destructive power of nuclear weapons is mind-numbing in more ways than one: far too much policy debate about the role of nuclear weapons is abstract and detached from the horrific reality of their lethal capability. The short point is that the combined stockpile of existing weapons is capable of destroying our world as we know it many times over. Their basic blast power is phenomenal, whether the yield of any given weapon (the amount of energy discharged in a nuclear detonation) is measured in kilotons (abbreviated as kt, corresponding to thousands of tons of conventional TNT explosive) or megatons (Mt, or millions of tons of TNT). While direct blast effects cause most casualties, thermal radiation effects go well beyond the demolition radius of the shock wave, and direct radiation can cause death and acute illness for many months – and terrible deformities in exposed unborn babies. Residual radiation contaminates the land, and is a cancer risk to exposed populations for decades.

2.2 At its peak in 1984–1985, the aggregate world stockpile of nuclear weapons held by all nuclear weapon states was some 70,000 warheads. Their cumulative destructive power peaked in 1974 (when the numbers were smaller but the weapons larger) at a level of about 25,000 Mt – 1,600,000 times the power of the Hiroshima bomb. Just three 1Mt nuclear warheads, of the kind widely deployed on U.S. and Soviet strategic missiles at the height of the Cold War, had between them destructive power greater than the sum of all conventional munitions exploded by all states during World War II.

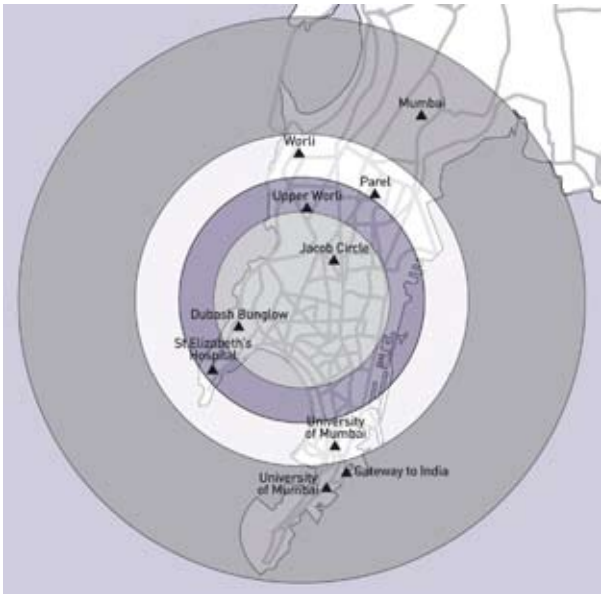
2.3 Weapon numbers have been dramatically reduced since then, mainly during the flurry of decommissioning activity in the immediate post-Cold War years, and average strategic weapon sizes are smaller: more like 300 kt than in the megaton plus range. But that still means a destructive capability for each such weapon some twenty times greater than the bomb that destroyed Hiroshima, and the scale of the damage that could be caused by dropping just one of them on any major city today should be deeply sobering for even the most disengaged specialist. And we are still living with a global inventory of some 23,000 nuclear weapons of all sizes, with a combined blast-destruction capability of 2,300 Mt, equivalent to 150,000 Hiroshima bombs.

BOX 2-1

IMPACT OF STRATEGIC NUCLEAR WEAPON STRIKES ON LONDON AND MUMBAI



Detonation of 300kt nuclear weapon 1000m above Trafalgar Square, London, on a working day.
Estimated Fatalities: 240,000
Estimated Casualties: 410,000



Detonation of 300kt nuclear weapon 1000m above Central Mumbai, on a working day.
Estimated Fatalities: 1,100,000
Estimated Casualties: 2,200,000

- Conflagration – Most people die instantly or over next 24 hours
- Third degree burns and radiation poisoning
- Second degree burns and radiation poisoning
- First degree burns and radiation poisoning

2.4 In the 1980s Western and Soviet scientists conducted research that showed what the climatic effect of large-scale nuclear war might be. Enormous pollution of atmosphere by debris and smoke would screen the sunlight for decades and lead to what was called "nuclear winter", extinguishing many species of flora and fauna, drastically changing ecological balances, and causing famine and social disintegration in societies not directly affected by nuclear explosions. Critics used various uncertainties in the original studies and the first climate models (which were relatively primitive by current standards) as a basis to denigrate and reject these scenarios, and for a number of years nuclear winter was widely regarded in government and media circles as a somewhat suspect theory. But interest in it has re-emerged in the context of renewed interest in climate modelling, and new research, published in 2007–2008, suggests that just a limited regional nuclear exchange, for example between India and Pakistan, with each side attacking the other's major cities with 50 low-yield Hiroshima-sized weapons, would throw up major concentrations of soot into the stratosphere which would remain there for long enough – a decade or more – to cause unprecedented climate cooling worldwide, with major disruptive effects on global agriculture.

NUMBERS AND CLASSES OF EXISTING WEAPONS

2.5 **Atomic vs. hydrogen weapons.** There are two principal classes of nuclear weapons, variously described as atomic (also called fission or sometimes, confusingly, nuclear) and hydrogen (also called fusion, or thermonuclear). "Fission" involves the splitting of a large atom into smaller ones, and "fusion" the fusing of two or more lighter atoms into a larger one, while "thermonuclear" refers to nuclear reactions occurring at very high temperatures. Atomic bombs use, as their explosive material, weapons grade uranium (as in the Hiroshima weapon) or plutonium (as in the Nagasaki one). Depending on the design, a basic nuclear weapon can be made with around 15 kilograms of high enriched uranium (containing 90 per cent or more of uranium-235 isotopes), or 4–5 kilograms of plutonium (containing 93 per cent or more of plutonium-239 isotopes) – or even less in the case of advanced designs. The trigger for producing a critical mass of the metal in question is a high energy conventional explosive. Compared to uranium charges, less plutonium is needed to achieve a nuclear yield, but plutonium requires a much more sophisticated implosion type trigger mechanism. (On the difference between "gun" and "implosion" designs, see Box 4-1 in Section 4). The upper yield limit for pure fission bombs appears to be around 700 kt.

2.6 Hydrogen weapons, by contrast, provide for virtually unlimited explosive power, with the Cold War superpowers having designs capable

of achieving 100 Mt. This class of nuclear weapon is also called fusion, or thermonuclear, since it is based on the release of energy through the fusion of deuterium and tritium atoms – commonly available hydrogen isotopes – at temperatures and pressures higher than those at the centre of the sun, produced using an atomic fission charge as the trigger. A process of using fusion to in turn boost the fission reaction of the plutonium or uranium core permits manufacturing relatively small explosive devices of very high yield which can be easily fitted into a great variety of delivery systems. Most contemporary nuclear weapons are combination fission–fusion devices which have a significantly more efficient yield-to-weight ratio than earlier weapons.

2.7 Thermonuclear weapons form the bulk of the U.S., Russian, British, French and Chinese nuclear arsenals. Other nuclear states have atomic munitions. Israeli, Indian and North Korean weapons or explosive devices are believed to be based on plutonium cores, while Pakistan is believed to use uranium. The nature of each state's current inventory, to the extent that it can be assessed, is described in more detail below.

2.8 **Strategic vs. "sub-strategic" weapons.** At least in the context of U.S.-Russia arms control negotiations, nuclear weapons are generally subdivided in two classes, strategic and sub-strategic, with sub-strategic systems further divided into medium-range, and theatre or tactical (battlefield). But even in this bilateral context, and certainly elsewhere, this basic distinction is much more blurred than appears at first sight. As we will note again in Section 18, when addressing the issue of disarmament counting, whatever the formal definitions in treaties like START (which focus on the nature and range of various delivery systems rather than the yields of the warheads themselves), for practical military purposes the differences are extremely elusive. States living side-by-side do not think of "strategic" weapons just in terms of those mounted on intercontinental-range missiles. And even "tactical" or "battlefield" weapons, designed for theatre operational combat tasks, will if used in densely populated areas be more or less indistinguishable in the havoc they cause from much bigger weapons, or those capable of being delivered over longer distances.

2.9 *Strategic* weapons are assigned the task of destroying an opponent's capacity to wage war by inflicting unacceptable damage on its strategic forces, conventional forces, economic assets and infrastructure, and urban-industrial centres. Such missions may be performed through a first strike (usually conceived as disarming or counterforce), or a second, retaliatory, strike (usually conceived as countervalue, but also counterforce to the extent that there are such targets left to attack). As the terms imply, "counterforce" refers to the targeting of some element of military infrastructure, while "countervalue" refers to the targeting of an opponent's cities and civilian

populations. It is these capabilities which give rise to the concept of nuclear deterrence at the global level.

2.10 Strategic weapons, of the kind in issue in the post-START U.S.–Russian negotiations, cover land-based intercontinental ballistic missiles (ICBMs) with a range of 5,500 km and more, sea-launched ballistic missiles (SLBMs) on nuclear strategic submarines (SSBNs), and heavy bombers, usually with ranges of more than 10,000 km armed with gravity (air-dropped) bombs, short-range air-to-surface missiles (SRAMs) and long-range air-launched cruise missiles (ALCMs). Many ICBMs and all SLBMs are equipped with multiple individually targeted re-entry vehicles (MIRVs), also called multiple warheads (each aimed at an individual target). All these missiles and bombs have thermonuclear warheads, with yields within a wide range, from a few dozen kilotons to a few megatons. Their accuracy, measured as a radius of a circle around the target within which the impact is expected, is from several hundred to less than one hundred meters for ballistic missiles and a few meters for cruise missiles.

2.11 *"Sub-strategic"* nuclear weapons are understood, by implication from the START definition of strategic weapons, to be those with ranges shorter than 5,500 km. As a rule, medium range nuclear weapons have yields in the same range as strategic arms and are targeted at the same classes of sites (military and urban-industrial) as strategic weapons, depending on their accuracy. Hence, such forces have traditionally been considered strategic, despite their having medium instead of intercontinental range. All Soviet and U.S. IRBMs, MRBMs and ground-launched cruise missiles (GLCMs) were eliminated by the 1987 Treaty on Intermediate Nuclear Forces and Shorter Range Forces (INF-SRF Treaty), and today the only existing U.S. and Russian intermediate class nuclear weapons are sea-launched cruise missiles (SLCMs) of up to 3,000 km range deployed on nuclear attack submarines, and Russian medium-range bombers. Britain and France do not have medium-range nuclear weapons, but China, Israel, India, and Pakistan possess them in relatively considerable numbers. North Korea has tested and deployed medium range ballistic missiles but most probably, although expert opinion differs on this subject, does not have nuclear munitions reduced to a size capable of delivery by these systems.

2.12 Tactical nuclear weapons (TNW) usually have shorter than 500 km range and lower yield (although on both range and yield there are exceptions to this rule). In the past, they have included small, sub-kiloton nuclear mines and nuclear artillery shells; short-range tactical ballistic missiles (some with megaton yield warheads); nuclear gravity bombs; torpedoes and depth charges; as well as the infamous "suitcase" nuclear weapons designed for special forces demolition operations. A primary distinctive feature of TNW is their predominant use of conventional platforms, launchers and delivery vehicles. Most importantly, TNW differ from strategic and medium range

nuclear arms in that their role is not to cripple the economy, population and strategic nuclear capability of an opponent, but to thwart its large scale military operations. However, regardless of theory or war plans, it is clear that any massive use of tactical nuclear weapons would be virtually equal in its devastating immediate and long term consequences to the use of strategic nuclear arms in densely populated regions. Moreover, any use of tactical nuclear weapons runs the huge risk of triggering a full-scale nuclear war employing every other class of weapon in the relevant states' arsenals.

2.13 During the Cold War NATO deployed about 7,000 tactical nuclear weapons in Europe to offset Soviet conventional superiority, while the Warsaw Pact deployed 10,000 such arms to counter the Atlantic Alliance. Significant numbers of TNW still remain in Europe. U.S.–Russian parallel unilateral commitments on TNW reductions of the early 1990s did not envision any agreed definitions, counting rules or verification procedures. Hence, while having substantially reduced the number of TNW, this approach has created uncertainties and mutual distrust regarding remaining numbers, location, types and missions of this class of nuclear weapon. Presently TNW are held by the U.S. and Russia (in drastically reduced numbers over the last twenty years), France (although it classifies its land- and carrier-based tactical nuclear capable aircraft as an arm of its strategic force), probably China, as well as Israel, India, and Pakistan. North Korea has short-range missiles, but appears to lack the compact nuclear munitions necessary to arm them.

2.14 **Defining "nuclear-armed states".** Nuclear weapons or explosive devices (the distinction is slight, and depends on judgments about stability, predictability and deliverability) are presently possessed by nine states. Five of them are the nuclear-weapon states defined as such by the Nuclear Non-Proliferation Treaty (NPT) – the U.S., Russia, France, UK and China – who of course happen also to be, although not for any directly connected reason, the Permanent Five members of the UN Security Council. Three others are outside the NPT, India, Pakistan and – although it does not acknowledge that it possesses any such weapons, or weapon-making capacity – Israel. When referring collectively to these 5+3 – as will the Commission many times throughout this report – we will use the expression "nuclear-armed states".

2.15 A question arises as to whether the ninth state, North Korea, should also be so described as a "nuclear-armed state". It has conducted two nuclear tests in October 2006 and June 2009, has enough plutonium to develop some five or six weapons, and in terms of delivery systems has hundreds of SRBMs and a few dozen MRBMs, and has been testing an ICBM. But on the other side of the equation, its handful of nuclear explosive devices may not yet be operationally deliverable as weapons (with most, if not all, experts

agreeing that it has not so far been able to miniaturize its nuclear explosive devices sufficiently to allow their delivery by ballistic missiles or aircraft); its purported withdrawal from the NPT has not been accepted at face value by many states; and in any event, with the ongoing Six-Party Talks process, this situation may conceivably prove reversible by negotiation in the not too distant future, in a way that is manifestly not likely with the 5+3. Given these considerations, the Commission has concluded that it is premature to describe North Korea as a "nuclear-armed state" in the same sense as the others, and wherever relevant in the text we treat its position separately.

2.16 Nuclear statistics are highly controversial and speculative, even with regard to the great nuclear powers. Discrepancies stem from different counting rules for strategic weapons, opaque data on tactical nuclear arms, and great uncertainty over nuclear munitions stored in reserve or awaiting dismantling, utilization or reprocessing. Official data on China and Israel is not available at all. But on the best available information and estimates we have, the size and shape of each of the nuclear-armed states' present arsenals may be summarized as follows and in Box 2-2.

2.17 **United States.** The U.S. currently has what it calls "operationally deployed" 2,700 nuclear warheads, of which 2,200 are in offensive strategic and 500 in tactical nuclear forces, together with as many as 1,000 land, sea and aircraft-based strategic delivery systems. Claimed discrepancies between START counting rules and what the U.S. considers to be operationally deployed weapons have led to some continuing disputation on numbers of strategic warheads and their associated delivery systems, but on any view present U.S. strategic force levels are much lower than they were in late 1980s (about 12,000 warheads), or as compared to START ceilings (6,000 warheads and 1,600 delivery systems). Deeper reductions have been made during the past two decades in tactical nuclear weapons. Compared to about 8,000 TNW at Army and Air Force bases and an unknown quantity on naval vessels in the late 1980s, the current U.S. force consists of approximately 500 active warheads: 400 gravity bombs and 100 warheads for SLCMs. Of these around 200 bombs are still deployed at six airbases in five European states (Belgium, Germany, Italy, the Netherlands and Turkey).

2.18 There is greater uncertainty associated with nuclear weapons in storage which are subdivided into active, reserve or spare warheads (relatively quickly deployable on assigned delivery systems), and inactive (held in long-term storage and awaiting dismantlement). Unofficial estimates are that the U.S. presently has 2,500 warheads in the former category and 4,200 in the latter. The rate of dismantling of old warheads at the Pantex Plant in Texas is about 350 units per year, at which rate – though it has been much higher in the past – it would take twelve years to eliminate the current backlog of warheads slated for retirement.

BOX 2-2

NUCLEAR ARSENALS 2009

Country	Strategic		Other		To Be Dismantled	Total by Country	Yield Range (kt)	Total Yield (Mt)
	Deployed	Reserve	Deployed	Reserve				
U.S.	2200	2000 – 3000[1]	500	500	4200	9400 – 10,400	Sub-kt – 455	647[2]
Russia	2800[3]	4750[4]	2000 – 3000[4]	3400[4]	?[4]	12,950 – 13,950	Sub-kt – 1000	1,273[2]
China	130 – 186[5]	54	~[6]	~		184 – 240	200 – 3300	294
France	<300[7]	0[8]	0	0		<300	100 – 300	55
UK	160[9]	0	0[10]	0		160	100	16
Israel[11]	60 – 200[12]	~	0	0		60 – 200	~	1.6 – 12
India[13]	60 – 70[12]	~	0	0		60 – 70	15 – 200[13]	1
Pakistan[13]	>60[12]	~	0	0		>60	Sub-kt – 50[13]	1.3
North Korea	0	0	0	5 – 6[14]		5 – 6	Sub-kt – 8[14]	0.05
TOTALS (Rounded)	5770 – 5975	6800 – 7800	2500 – 3500	3900	>4200	**23,200 – 25,400**		**2300**

Sources: These figures represent the Commission's best judgment, based on published estimates and compilations by the Bulletin of the Atomic Scientists, Carnegie Endowment for International Peace, Center for Defense Information (CDI), Federation of American Scientists (FAS), International Institute for Strategic Studies (IISS), and the Stockholm International Peace Research Institute (SIPRI), and input from the Commission's research consultants.

Notes to the Table: see the Notes and Sources section at the end of this report.

2.19 The U.S. nuclear arms modernization program does not currently envision construction of new ballistic missiles, submarines or heavy bombers, though it is developing a new generation nuclear ALCM, and there remains a significant domestic constituency pressing for development of a "Reliable Replacement Warhead" (RRW). The service life of existing equipment has been extended till 2030 and higher yield warheads from dismantled missiles installed on them.

2.20 **Russian Federation.** Russia's strategic offensive nuclear force is largely transparent and its data seen as accurate. In 2009 it consisted of 634 delivery vehicles and 2,825 nuclear warheads. Russia's ICBM force has 385 launchers and missiles carrying 1357 nuclear warheads (on the average of 500 Kt yield). The sea-based force consists of 13 SSBNs, 208 SLBMs and 612 nuclear warheads divided between the Northern and Pacific fleets. On average

only one or two submarines are constantly on patrol (60–100 warheads), compared to ten or fifteen during the Cold War. The air wing consists of 77 heavy bombers and 856 cruise missiles.

2.21 The Russian sub-strategic nuclear force is much less transparent. By the end of the 1980s, the Soviet Union had about 23,000 TNW. Most estimates put the current number at about 2,000 weapons with Russia, emulating NATO's Cold War strategy, maintaining a relatively large TNW force to offset NATO's perceived growing conventional superiority and possibly China's as well. Of these, approximately 600 are air-to-surface missiles and gravity bombs; 200 are missiles, bombs and depth charges on land-based naval aircraft; around 400 are on naval anti-ship, anti-submarine, and air-defence missiles and torpedoes. It is commonly assumed that in peacetime all these weapons are stored in depots at air force and navy bases, except for a few naval missiles and torpedoes loaded on ships and submarines on sea patrol.

2.22 During the 1990s all ground force tactical nuclear warheads – and a large proportion of air force, navy and air defence TNW – were redeployed to central storage depots deep inside Russian territory. At such depots they, and many strategic warheads (removed from dismantled ICBMs and SLBMs), are serviced as spare munitions for replacement of deployed warheads. Otherwise they await dismantlement or utilization, including blending for fuel for atomic power plants, or for fissile materials recycling for newly manufactured warheads. The total number of Russian nuclear weapons in central storage is unknown but most probably there are many thousands.

2.23 The Russian weapon modernization program is designed to renovate the strategic force, largely of 1970s and 1980s vintage, that is becoming in large part obsolete both in terms of design and lack of maintenance, although some aspects of it have encountered serious technical problems, construction delays and huge cost overruns. Future Russian strategic force numbers will naturally decline due to the mass withdrawal of old systems and the slow rate of new deployments, which opens the door to quite radical strategic nuclear disarmament, in the START follow-on negotiations and subsequently, provided that the U.S. also agrees to go down to similar levels, and – as further discussed later in this report – other military and political problems are resolved. Russia has announced that it is developing a new "gliding" re-entry vehicle for its ICBMs, specifically designed to penetrate potential U.S. ballistic missile defences, and its sub-strategic forces are being modernized with a new tactical land-based missile, which may be equipped with a nuclear or precision guided conventional warhead and have variable short or medium range.

2.24 **France** has the third largest strategic force in the world, consisting of 108 delivery vehicles and up to 300 nuclear warheads. It has three SSBNs with 48 missiles and 240 warheads, with one submarine usually on patrol. In addition 60 land-based and 24 carrier-based strike aircraft are capable of delivering in total about 60 medium-range air-to-surface missiles. France's modernization program includes a fourth SSBN (to be commissioned in 2010), deployment of a longer range SLBM system, and a new strike aircraft with new nuclear missiles. Although by START classification French planes would be counted as tactical or medium-range delivery vehicles, they are considered an arm of the "strategic strike force". It is planned to reduce the number of nuclear capable aircraft by half, which may bring force numbers down to 100 delivery vehicles and 250–270 warheads. France does not possess sub-strategic nuclear forces, apart from the aircraft mentioned.

2.25 **United Kingdom.** The UK's nuclear arsenal consists of 4 SSBNs with a total of 48 missiles and 144 nuclear warheads. Submarines and warheads are British while the (Trident) missiles are leased from the United States. One SSBN is normally being overhauled at any given time, while of the three deployed submarines one is on sea patrol. It is commonly assumed that there are ten spare missiles and 40 warheads in storage. After a heated debate in 2005–2007 a decision was taken by the government to start planning (though no major resources have yet been committed) for construction of a follow-on class of submarines, for leasing modified Trident-2 missiles from the U.S. and developing a new type of nuclear warhead after 2024, when the current model SSBNs end their service lifetime; it was subsequently announced in September 2009 that this fleet would be reduced from four to three. Britain does not possess any other strategic force or any sub-strategic nuclear weapons.

2.26 **China** is the only one of the five nuclear weapon states recognized under the NPT that does not provide any official data on its existing and planned nuclear forces. The official justification of this policy is that China's nuclear forces are much smaller than those of other nuclear powers and secrecy about numbers is needed for better deterrence. China is nevertheless estimated to have approximately 190–200 nuclear warheads which makes it the fourth (and potentially the third) largest nuclear weapon state. No information exists on any possible nuclear reserve. Foreign official and academic estimates presently assume China is in possession of about 130 land-based ballistic missiles of intercontinental, intermediate and medium range, and varying in age. All of them are currently single-warhead. China also is testing an experimental nuclear submarine with 12 SLBMs and is believed to be constructing another. The bomber force consists of 20 old medium range airplanes, copied from a 1950s Soviet design. China is commonly believed to possess, despite official denials, around 150–350 tactical cruise and ballistic missiles, many of which are deployed within reach of Taiwan and capable of

carrying nuclear warheads. Around 40 gravity bombs may be delivered to target by obsolete medium range bombers, and by strike aircraft.

2.27 **India** does not provide official data on its nuclear forces, but is generally believed to have 60–70 operationally deployed nuclear weapons. Its ballistic missile force consists of SRBMs (150 km range) and MRBMs (700-1,000 km, with a 3,000 km missile being tested), and sea-based ballistic missiles. Medium range and strike bombers may also be used for carrying out nuclear raids, while Russian-made fighter planes can carry nuclear weapons as well and their range can be extended by India's mid-air refuelling capacity.

2.28 **Pakistan** has a nuclear arsenal, also officially non-transparent, estimated at approximately 60 weapons. They can be delivered to target by ballistic missiles and by U.S., French and Chinese-manufactured fighter aircraft. Pakistan has two types of SRBMs (400–450 km range), and one type of MRBM (2,000 km). Another type of MRBM is in the testing stage, while a third is being developed. All of these systems are ground-mobile. A ground-based cruise missile, apparently similar to a Chinese model, is undergoing testing and will be developed in both air-based and sea-based versions. The latter is to be deployed on diesel submarines built locally under French supervision. It is assumed that Pakistan's missile program was developed with the active cooperation at various times of North Korea and China.

2.29 **Israel** differs from other nuclear states by not only withholding official information on its nuclear forces, but by having never officially confirmed having them at all. It is estimated to possess from 60 to 200 nuclear weapons, about 50 of them as missile warheads, and the rest deliverable by aircraft. Depending on the estimates of the size of Israel's nuclear stockpile, it is either comparable to or exceeds the nuclear arsenal of Britain, as well as that of India and Pakistan. Israel has 50 MRBMs (1,500–1,800 km range) capable of striking, among others, targets in the south of Russia. In 2008 Israel tested an extended range "Jericho III" missile with a maximum range of 4,800–6,500 km, which took it across the threshold of being an intercontinental ballistic missile. Apart from missiles Israel has one of the most powerful air forces in the world; including 205 U.S.-made fighter planes capable of carrying nuclear weapons. A new development is Israel's acquisition of three diesel-powered submarines, manufactured in Germany, with two more ordered in 2006, believed to accommodate sea-launched nuclear capable cruise missiles.

MISSILES AND MISSILE DEFENCE

2.30 **Missile defence systems.** Since the destructive potential of the weapons and delivery systems described will depend at least partially on the nature and quality of the defensive systems arrayed against them, it is important to take those systems into account, and be able to make some judgment

about whether they are, on balance, lessening the nuclear danger or adding to it. The most controversial issue in this respect is undoubtedly strategic or "national" missile defence, targeting intercontinental-range ballistic missiles, and potentially seriously affecting the balance of capabilities between the major nuclear powers if it could ever be made effective by either side. The argument, in short, is that mutual deterrence depends on each side being vulnerable to retaliation from the other, and that mutuality breaks down if one side has significantly greater capability to defend against a retaliatory strike. The situation destabilizes to the extent that it encourages a scramble to acquire enough new weaponry for retaliatory capacity to stay ahead of defence. There is also an incentive to retain dangerously high alert launch-on-warning capability (as discussed below), for fear that even more offensive weapons will be lost if not immediately used in the face of a perceived attack.

2.31 Initially Ballistic Missile Defence (BMD) systems were deployed by the U.S. and Soviet Union in limited numbers in the late 1960s and early 1970s, but then – with eventual acceptance by both sides of the kind of argument just made – were restricted by the Anti-Ballistic Missile (ABM) Treaty of 1972. The BMD systems relied on ballistic missile early warning systems, battle management radars and ballistic anti-missiles of various ranges armed with nuclear warheads. Russia maintains one strategic BMD site to protect the Moscow area with one battle-management radar and about 50 short-range nuclear armed anti-missiles. After abrogation of the ABM Treaty in 2002 – which generated little major controversy at the time, although the debate is now very much springing to life again – the U.S. started deployment of a conventionally armed precision guided (direct-impact) BMD system in California (about 30 long-range ballistic anti-missiles) and Alaska (three anti-missiles).

2.32 The then U.S. administration also planned a European deployment in Poland (ten anti-missiles) and the Czech Republic (battle management radar), which although officially based on a concern that Iran was developing long-range missiles that could hit the U.S., generated a furious reaction from Russia as a threat to its own nuclear deterrence. Characterized by critics as a system that did not work deployed against a threat which did not exist, as well as standing in the way of U.S.–Russia disarmament negotiations which did meet a real-world need, this deployment was halted by the Obama administration in September 2009, in favour of a system to be specifically directed to shorter-range missiles posing a more immediate danger in South East Europe and the Middle East. As discussed further in Section 18, this issue is bound to be a recurring one in future disarmament negotiations, not only between the U.S. and Russia, and the arguments won and lost over the ABM treaty in the past will need to be revisited.

2.33 By and large questions concerning theatre missile defence (with systems targeting medium-range missiles in a localized region) or tactical missile defence (dealing with shorter ranges still), have been less controversial, and certainly the development of defensive systems in this context continues apace on all sides, in the absence of any evident willingness globally to ban short and intermediate range missiles entirely, as discussed below. The relevant history is that in 1997 the U.S. and Russia reached an agreement on delineation between strategic and theatre BMD systems, according to limits on the speed of interceptions from ground, air and sea-based systems. That agreement was designed to preserve the ABM Treaty of 1972 while allowing the parties to develop theatre missile defences against medium and tactical ballistic missiles of third states. The 1997 agreement never entered into force due to U.S. opposition and eventual withdrawal from the 1972 ABM Treaty. However, in future, the 1997 agreement may be used to prevent theatre BMD systems' development from hindering START follow-on negotiations.

2.34 But, just as noted above in the context of defining "strategic" nuclear weapons, what is strategic and what is theatre will depend more on one's geography than anything inherent in the ranges or payloads of the weapons or delivery systems themselves. For nuclear-armed states within reach of each other's nuclear forces, there will always be an argument as to whether any BMD development and deployment is stabilizing, or rather encouraging the build-up or modernization or both of offensive nuclear arms and hindering negotiations on mutual nuclear disarmament. For example, even though these have been formally designated as targeted against North Korea, China has reacted very negatively not only to the U.S. strategic BMD in Alaska and California, but also as to theatre BMD sea- and land-based systems in North East Asia (Aegis/Standard-3 and THAAD), which have been supported by Japan as legitimate defence measures to compensate for its own lack of offensive capability.

2.35 **Curbing missile proliferation.** International efforts to curb missile proliferation have been limited. The only treaties which deal with missiles in any way were bilateral U.S.–Russian agreements, including the 1972 Anti-Ballistic Missile Treaty and the 1987 Intermediate Nuclear Forces (INF) treaty (formally, the Treaty between the United States of America and the Union of Soviet Socialist Republics on the Elimination of their Intermediate-Range and Shorter-Range Missiles). The latter sought to eliminate nuclear and conventional ground-launched ballistic and cruise missiles with intermediate ranges, defined as between 500–5,500 km. By the treaty's deadline of 1 June 1991, the U.S. had destroyed 846 of these missiles and the Soviet Union 1,846 – a total of 2,692. Concerned with US plans to deploy ballistic missile defence installations in Eastern Europe, Russia in 2007 threatened to withdraw from the INF treaty.

2.36 The Missile Technology Control Regime (MTCR) was established in the same year that the INF treaty was finalized (1987). Its aim is to restrict the proliferation of missiles, complete rocket systems, unmanned air vehicles, and related technology capable of carrying a 500 kilogram payload at least 300 kilometres. It has had limited effect due both to its reliance on voluntary national export control legislation, and its limited membership, currently standing at 34. The MTCR also developed the International Code of Conduct against Ballistic Missile Proliferation (known as the Hague Code of Conduct) which was launched in November 2002 and now has 130 subscribing states. Although being the only normative instrument to verify the spread of ballistic missiles, the Code is voluntary and non-binding, and a significant number of its members have failed to meet its reporting requirements. It also does not deal with cruise missiles. Russia was instrumental in setting up in 2000 the Global Control System for the Non-Proliferation of Missiles and Missile Technologies, which in turn has created an associated Joint Centre for the Exchange of Data, but this has not moved the debate forward to any significant degree.

2.37 Proposals made to develop multilateral treaties covering missiles, including through multilateralizing the INF, have met with little support, and seem likely to continue to do so, for the simple reason that many states have at least short range, and some have intermediate range, missiles which they regard as essential for their defence. Moreover, many states are concerned by what they regard as another example of double standards in that some of the principal members of the MTCR have retained not only ICBMs but also have substantial quantities of longer range cruise and "precision guided munitions" which, while respecting the MTCR rules, can make up by numbers and quality what they might otherwise lose in the payloads they can carry. The Commission supports all efforts to curb the proliferation and achieve reduction in the numbers of missiles, but remains pessimistic as to whether this endeavour will make a significant contribution to the objective of nuclear non-proliferation and disarmament. That said, it is important that there be no backward step, and continued failure to multilateralize the INF should not be used as an excuse for either present party to withdraw from it.

ALERT STATUS OF EXISTING WEAPONS

2.38 During the Cold War years huge resources were invested in raising the combat readiness of nuclear forces. Now, the only nuclear weapons kept on very high alert status and ready to launch within minutes after receiving orders are U.S. and Russian ICBMs and SLBMs on submarines on sea patrol, some Russian SLBMs on submarines at bases, French and (with some uncertainty) British SLBMs on submarines at sea. All U.S. and Russian

heavy bombers were taken off alert (aircraft removed from runways and their nuclear weapons placed in storages at airbases). All U.S. and Russian sub-strategic nuclear weapons are de-alerted, except a few Russian naval nuclear torpedoes and tactical missiles on attack submarines on sea patrol. All Chinese, Indian, Pakistani, and Israeli nuclear forces are believed to be kept off alert in peacetime, with the practice commonly adopted of separating warheads from missiles and aircraft.

2.39 Strategists and operation planners usually make a distinction between short-notice alert and launch-on-warning (LOW) or launch-under-attack (LUA) policy, (also popularly, if inaccurately, described as "hair trigger alert"). The former relates to all combat ready weapons that *may* be launched quickly (in a few minutes time) after receiving the order, primarily ICBMs and SLBMs at sea. The latter is associated with weapons that *must* be launched quickly upon receiving information about an opponent's attack in order to avoid destruction on the ground. With ICBM flight time being about 30 minutes and SLBM fifteen to twenty minutes, LOW provides political leaders with decision-making time of only four to eight minutes (after deducting time for missile attack detection and confirmation, and the time for the response launch sequence and fly-away). And this time would be available only if the leaders are safe and ready, and everything works perfectly according to planned procedures. Russian strategic doctrine relies on LOW; the U.S., while not relying on it, maintains the policy. It places a premium on the quality of warning systems, which have not always been reliable in the past. Former U.S. Defense Secretary William Perry, a member of this Commission, directly recalls three major such experiences, one of them involving NORAD computers indicating that 200 ICBMs were on their way from the USSR to the U.S. The prospect that a catastrophic nuclear exchange could be triggered by a false alarm is fearful, and not fanciful.

2.40 Altogether there are now probably about 3,000 nuclear warheads of the U.S., Russia, France and Britain at launch ready status at any given moment in peacetime, of which around 2,150 are on very high alert in line with the LOW/LOA concept and operational plans (on U.S. and Russian ICBMs, and on Russian SLBMs on submarines at bases).

2.41 In the 1990s the five nuclear-weapon states concluded agreements on de-targeting their strategic forces from each other territories, which was technically implemented through withdrawing flight programs from missiles' on-board computers or inserting zero-flight programs. However this was, and remains, an essentially symbolic gesture, since such software modifications are unverifiable and reversible in minutes.

2.42 Maintaining thousands of nuclear warheads on dangerously high launch-on-warning alert is the ultimate absurdity of nuclear deterrence twenty years after the end of the Cold War, when political, economic and

security relations, at least among the five NPT nuclear-weapon states, render deliberate nuclear attack virtually unthinkable. And it is extremely dangerous, above all because of the risk of human error in the stress of the moment, as noted below. But, as will be discussed further in Section 17 in the context of an action agenda for disarmament, early "de-alerting" is likely to prove much more difficult than might appear at first sight.

SYSTEM VULNERABILITIES

2.43 So far as the five NPT nuclear-weapon states are concerned (although there is some uncertainty about China due to lack of transparency of its command and control systems), it seems possible to conclude that the possibility of unauthorized use of strategic weapons as a result of technical malfunction or human act is very small. In the case of the U.S. and Russia in particular, measures have long been taken to enhance so called negative control: the heads of state are permanently accompanied by communication officers carrying nuclear "football" suitcases, so that in case of emergency the information quickly reaches them for decision on the appropriate reaction and the transmission of a coded signal to strategic command centres, without which the authorization of a weapons launch cannot be received by the relevant land, sea or aircraft based crews. Additional measures are also taken to prevent unauthorized actions at launch control centres and to provide survivability of the national command authorities (NCA) even in a nuclear strike environment (with deep hardened underground command centres, airborne command centres and the like).

2.44 Of much greater concern is the possibility of miscalculation or a decision based on the wrong information by the NCA under the stress of a possible crisis, in particular if strategic doctrine and operational plans require a very quick decision on strategic force employment: the launch-on-warning, postures described above. Added to that is now a very real concern about the new threat of cyber attack (discussed further in Section 4) – likely to get more rather than less real with future technological advances – which might disrupt computerized networks and emulate false alarms or initiate launch command sequence.

2.45 System vulnerabilities are of most concern in the case of the newer states to possess nuclear weapons, or who may acquire them in the future, which are likely to have less reliable early warning information, less maturely-developed command-control systems, less adequate survivability of their delivery systems, and even greater vulnerability to cyber attack. Institutional problems are very much compounded if the internal political situation is unstable and there is a significant possibility of civil war or rebellion. Add to all these considerations the universal problem of potential miscalculation

under stress, there is manifestly no ground at all for complacency about possible catastrophes.

ATTITUDES TO USING NUCLEAR WEAPONS AND DISARMAMENT

2.46 Every nuclear-armed state that has gone on record about its nuclear doctrine insists that it maintains its nuclear arsenal for no other purpose than deterrence. Only China limits this stated role to deterrence against the threat or use by others of *nuclear* weapons: all the others keep open the option, to a greater or lesser extent, of using their nuclear weapons in response to other kinds of threats (in the case of India, from chemical and biological weapons; in the case of the others, these and major conventional threats as well). "No first use" statements have been made, or not made, accordingly – i.e. very clearly in the case of China, with qualifications in the case of India, and not at all in the case of the others. "Negative security assurances" – i.e. pledges not to use nuclear weapons at all against certain non-nuclear-weapon states – have been given by the five nuclear-weapon state NPT members, but with so many qualifications as to make them almost empty.

2.47 The strengths – and weaknesses – of the various arguments advanced in support of the deterrent utility of nuclear weapons are discussed in detail in Section 6. And the important potential role of seriously intended "no first use" and related declarations, and negative security assurances, in limiting the role of nuclear weapons in the future is fully treated in Section 17.

2.48 For present purposes, focusing on the risks associated with the retention of nuclear weapons by any state, the main point to note is that, despite all the emphasis on deterrence, there is no clear watershed in practice between nuclear deterrence and nuclear warfighting. While the point of deterrence is not to have to use the weapons, they have to be capable of warfighting use if the deterrent is to be credible. Even the most destructive strategic nuclear forces carry out their political mission of deterrence specifically through their ability to carry out assigned combat missions, i.e. to destroy certain targets, and nothing else. These missions are embodied in operational plans, target lists and flight programs loaded into ballistic and cruise missiles' onboard computers. These plans provide for the use of weapons, with varying degrees of expected effectiveness, in a first strike, a launch-on-warning or launch-under-attack strike, or delayed retaliatory second strike. Strike options envision massive salvos, limited groupings or single missile nuclear strikes at various combinations of states and targets.

2.49 The "grey area" of no clear distinction between the concepts of deterring and waging nuclear war relates even more to tactical nuclear weapons,

which are viewed both as a means to promote success in a theatre or specific battlefield more rapidly, or to offset an enemy's superiority in conventional forces. It may not make any rational sense to actually use nuclear weapons as instruments of war, but as long as they remain in existence that option will be there.

2.50 Stated attitudes by the nuclear-armed states as to whether nuclear weapons *should* remain in existence also vary quite considerably. Although the five nuclear-weapon state members of the NPT are formally committed to nuclear disarmament (and, indeed, to "general and complete" disarmament as well) under Article VI of the NPT, their attachment to that objective – by all of them some of the time, and some of them all the time – has been seen as less than complete. For example, even in the new and much more optimistic current environment we have described in the opening section of this report, at the special meeting of the Security Council on disarmament and non-proliferation in September 2009, which passed the wide-ranging and important Resolution 1887 on these issues, it did not prove possible to reach agreement on an operative provision explicitly agreeing on the goal of a nuclear weapon free world.

2.51 After a decade of neglect and worse, nuclear disarmament – at least to the extent of major new numerical reductions – has certainly returned to the bilateral U.S.-Russian agenda, and the overall atmosphere is far more conducive than it has been for a long time to embracing, to at least some extent, other nuclear-armed states in the process. But that said, France, the UK and China are not presently planning to accept any legal limitations on their nuclear forces, and are going on with long-term modernization and in some aspects build-up of their nuclear arsenals. Nor are Israel, India or Pakistan apparently contemplating any limitations or reductions in their nuclear forces or development programs. The challenge to achieve further real disarmament progress, let alone the ultimate goal of elimination of all weapons, remains a daunting one.

3. THE RISKS FROM NEW NUCLEAR-ARMED STATES

WHY NON-PROLIFERATION MATTERS

3.1 Ensuring that no new states join the ranks of those already nuclear-armed must continue to be one of the world's top international security priorities. Every new nuclear-armed state will add significantly to the inherent risks – of accident or miscalculation as well as deliberate use – involved in any possession of these weapons, and potentially encourage more states to acquire nuclear weapons to avoid being left behind. Any scramble for nuclear capabilities is bound to generate severe instability in bilateral, regional and international relations. The carefully worked checks and balances of interstate relations will come under severe stress. There will be enhanced fears of nuclear blackmail, and of irresponsible and unpredictable leadership behaviour.

3.2 In conditions of inadequate command and control systems, absence of confidence building measures and multiple agencies in the nuclear weapons chain of authority, the possibility of an accidental or maverick usage of nuclear weapons will remain high. Unpredictable elements of risk and reward will impact on decision making processes. The dangers are compounded if the new and aspiring nuclear weapons states have, as is likely to be the case, ongoing inter-state disputes with ideological, territorial, historical – and for all those reasons, strongly emotive – dimensions.

3.3 The transitional period is likely to be most dangerous of all, with the arrival of nuclear weapons tending to be accompanied by sabre rattling and competitive nuclear chauvinism. For example, as between Pakistan and India a degree of stability might have now evolved, but 1998–2002 was a period of disturbingly fragile interstate relations. Command and control and risk management of nuclear weapons takes time to evolve. Military and political leadership in new nuclear-armed states need time to learn and implement credible safety and security systems. The risks of nuclear accidents and the possibility of nuclear action through inadequate crisis control mechanisms are very high in such circumstances. If this is coupled with political instability in such states, the risks escalate again. Where such countries are beset with internal stresses and fundamentalist groups with trans-national agendas, the risk of nuclear weapons or fissile material coming into possession of non-state actors cannot be ignored.

3.4 The action–reaction cycle of nations on high alerts, of military deployments, threats and counter threats of military action, have all been witnessed in the Korean peninsula with unpredictable behavioural patterns driving interstate relations. The impact of a proliferation breakout in the Middle East would be much wider in scope and make stability management extraordinarily difficult. Whatever the chances of "stable deterrence" prevailing in a Cold War or India–Pakistan setting, the prospects are significantly less in a regional setting with multiple nuclear power centres divided by multiple and cross-cutting sources of conflict.

THE NUCLEAR NON-PROLIFERATION TREATY UNDER STRAIN

3.5 The Nuclear Non-Proliferation Treaty (NPT) is not the only reason more new states have not joined the original five – alliance guarantees and, in the early days at least, technological barriers, were probably just as important, and there have been other factors as well, discussed later in this section, and in more detail in Section 8. But without the NPT there would be considerably more nuclear-armed states than the eight clear-cut cases we have today. The well-remembered prophecy of the U.S. government in 1963, that the following two to three decades would see the emergence of 15 to 25 such states, would have been much closer to reality.

3.6 Concluded in 1968, in force since 1970, and now with 189 member states – effectively the whole world except for India, Pakistan and Israel (and North Korea, assuming its purported withdrawal in 2003 is accepted at face value) – the NPT is built on a three dimensional bargain, whereby those states without nuclear weapons agreed not to acquire them, those with weapons committed themselves to negotiate to give them up, and every state had the "inalienable right" to develop and use nuclear energy for peaceful purposes with cooperation from others. (See Box 3-1). Its value lay, in the words of the UN Secretary-General's High-level Panel on Threats, Challenges and Change in 2004, in "three critical contributions: it bolstered a normative prohibition against the ownership, use and proliferation of these weapons; it ensured that States could benefit from nuclear technologies, but with oversight; and it reassured States about the capacities of neighbours and potential rivals, allowing them to avoid unnecessary arms races".

3.7 The NPT's indefinite extension in 1995 – after 25 years of operation, and with the treaty's own terms giving no guarantee of continuity beyond that – was the high-water mark for the treaty, a triumphant reaffirmation by the international community of its indispensability. But as it now ends its fourth decade, it is in serious need of reinvigoration and strengthening. The NPT is under strain in a number of directions, for at least the six reasons spelt out in the following paragraphs.

BOX 3-1

KEY ELEMENTS OF THE NUCLEAR NON-PROLIFERATION TREATY (NPT)

- The five recognized nuclear-weapon states undertake not to assist any non-nuclear-weapon state to acquire nuclear weapons (Article I);
- Non-nuclear-weapon states undertake not to acquire nuclear weapons or seek assistance to do so (Article II);
- Non-nuclear-weapon states undertake to accept safeguards by the International Atomic Energy Agency (IAEA) on all their nuclear material to verify the fulfilment of their obligations under the Treaty not to divert nuclear energy from peaceful uses to nuclear weapons (Article III);
- The "inalienable right" of all parties is recognized to develop, research, produce and use nuclear energy for peaceful purposes without discrimination and in conformity with Articles I, II and III, and all parties undertake to cooperate in the application of nuclear energy for peaceful purposes (Article IV);
- All parties undertake to pursue negotiations in good faith on effective measures relating to nuclear disarmament, and on a treaty on general and complete disarmament (Article VI).

3.8 **Footdragging on disarmament.** Non-nuclear-weapon states and those outside the NPT have long complained about the evident unwillingness of most of the nuclear-weapon states, most of the time, to even think about giving up their arsenals. Movement forward – like the agreement on "thirteen practical steps" toward disarmament at the 2000 NPT Review Conference – has been followed almost as quickly by movement back, as with the failure to reaffirm that statement in the 2005 Review Conference. Unilateral and negotiated disarmament took a huge leap forward in the early post-Cold War years, then ground to a halt for another decade. Modernization of stockpiles continues and talk of new weapons development –"reliable replacement warheads" and the like – does not go away. There is intense global interest in the renewed U.S.–Russian commitment, in 2009, to lead the way in a serious new disarmament enterprise, but that momentum will have to be sustained, and joined by the other nuclear-armed players, if this crucial cornerstone of the NPT's credibility is not to further crumble away.

3.9 **Verification failures.** The International Atomic Energy Agency (IAEA), while the bulwark of the safeguards system, has been insufficiently

resourced, both in terms of authority and capabilities, to detect clandestine nuclear activities, and a number of serious violations have slipped through the net in recent years, giving both weapon and non-weapon states cause for concern about the foundations of the NPT bargain they signed up to. In 1991, after the first Gulf War, Iraq was found to have developed an undeclared uranium enrichment program and other activities intended for producing nuclear weapons: some of these activities were on sites visited by IAEA inspectors, but not seen by them. In 2002, a dissident group revealed that Iran was developing a clandestine uranium enrichment program: after an extensive investigation, the IAEA was able to determine that Iran had been conducting undeclared nuclear activities for a period of eighteen years. In 2003, Libya was found to have enrichment equipment, supplied by the A.Q. Khan network but not yet functional: this came to light through intelligence activities, rather than IAEA inspections. And in 2007 Israel destroyed a facility in Syria that appears to have been a nearly complete nuclear reactor: investigations by the IAEA in June 2008 revealed particles of manufactured forms of uranium at the site.

3.10 **Compliance and enforcement failures.** North Korea acquired plutonium from its nominally civil energy program while a member of the NPT, only to then walk away from the treaty, and test and make nuclear explosive devices: both UN Security Council resolutions and efforts to negotiate a solution have so far proved fruitless. Iran has asserted Article IV rights under the treaty to continue an enrichment program about whose scope and content it has not been transparent with the IAEA and which, as the agency's Director General stated in June 2009, "gives rise to concerns which need to be clarified to exclude the possibility of military dimensions to Iran's nuclear program". Reference of the Iran's non-compliance to the Security Council has produced sanctions resolutions, but no satisfactory substantive resolution of the problem.

3.11 **Evidence of uncontrolled transfer of sensitive nuclear technology.** Following initial disclosures in 2003 and intense international investigation, including by the IAEA, the former head of Pakistan's enrichment program, A.Q. Khan, confessed in 2004 to having been at the centre of a clandestine international network transferring technology and information to Iran between 1989 and 1991, to North Korea and Libya between 1991 and 1997, and additional technology to North Korea up until 2000. Centrifuge components were apparently manufactured in Malaysia with the aid of South Asian and German middlemen, using a Dubai computer company as a false front. The Khan investigation also revealed how many European companies were defying export restrictions and aiding the Khan network as well as the production of the Pakistani bomb. Dutch companies exported thousands of centrifuge components to Pakistan as early as 1976, and a German company exported facilities for the production of tritium. As

disconcerting as these black market revelations were, even more so has been the absence of accountability and exemplary action since, which has not helped in setting an example to potential violators: domestic political pressures inhibited any harsh punishment of Khan himself in Pakistan, most of his foreign accomplices remain free, and there are still gaps in the international framework of export controls.

3.12 **Under-resourcing of the International Atomic Energy Agency.** The IAEA clearly has insufficient resources, in terms of both money and qualified manpower, for the specifically non-proliferation tasks it must be able to do in addition to its role as a support agency for peaceful uses of nuclear energy. Part of the problem has been the zero-growth policy imposed for many years on the Agency's regular budget by its major contributors. Another factor has been the determination of some state members of its governing board to maintain its focus on the formal objective of its 1956 Statute (long predating the NPT) "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world", giving insufficient weight both to the rider that follows (requiring it to ensure that its assistance "is not used in such a way as to further any military purpose") and the reality that the IAEA-administered safeguards system is crucial to holding the line against proliferation breakout. The scale of the agency's immediate and ongoing resource needs, if it is to perform its role with maximum effectiveness, was well documented in the 2008 report of the independent Zedillo Commission on the Role of the IAEA to 2020 and Beyond.

3.13 **The reality of the "three elephants" outside the NPT.** The NPT's status as *the* international norm-setting regime governing non-proliferation and disarmament continues to be challenged by the three big nuclear-armed states –India, Pakistan and (though undeclared) Israel – which continue to stand outside it. (North Korea, for reasons explained in Section 2, is best considered in a separate category, as neither clearly in or out of the treaty.) Repeated calls for the NPT to become genuinely universal in its membership by these states joining it are wholly understandable but, as much as this Commission would wish otherwise, not realistically achievable for the foreseeable future: the only basis on which they would be admitted by other members is as non-nuclear-weapon states, but this would be manifestly unacceptable to the three (albeit for different stated reasons in the case of Israel). The problem has now been accentuated by the India–U.S. deal, endorsed by the Nuclear Suppliers Group in 2008, to give India access, effectively, to the nuclear cooperation benefits of the NPT while making no significant commitments in return (as discussed further in Section 10).

RISKS OF A PROLIFERATION SURGE

3.14 There have been innumerable expressions of concern that the present situation may not be very much longer sustainable. The UN High-level Panel, quoted above, put it starkly in 2004: "We are approaching a point at which the erosion of the non-proliferation regime could become irreversible and result in a cascade of proliferation". The U.S. Congressional Commission on U.S. Strategic Posture warned that the world is fast coming to a nuclear "tipping point". IAEA Director General Mohamed ElBaradei has warned of a surge in the number of "virtual nuclear weapons states" who can produce plutonium and high enriched uranium, and have the know-how to make nuclear weapons. Others have pointed in this context to the attractions of a "hedge" strategy – not crossing the line in actual weaponization – but being capable of doing so should the occasion arise.

3.15 Most attention in all of this has been concentrated, understandably, on North East Asia and the Middle East, but some has also focused on the possibility of important states in Latin America, Africa, Central and South East Asia and even Europe – some with a record of substantial nuclear programs in the past, and all with at least a "latent" capability to gear them up quickly in the future – being tempted to join in, for reasons of national pride if nothing else, if the dam really started to break.

3.16 In North East Asia, with North Korea purporting to walk away from the NPT, declaring its possession of nuclear weapons, continuing to test long-range missile delivery systems, regularly engaging in erratic and bellicose rhetoric, and only sporadically, if at all, willing to negotiate about anything, it is hardly surprising that some regional nerves have been jangled and that speculation has resurfaced that Japan and South Korea, in particular, might not be willing to resist for much longer the temptation to acquire nuclear deterrents of their own. There is further speculation that South Korea, while being cautious about overreacting to Pyongyang, would be certain to act if Japan did, for fear of its eastern neighbour as much at its northern one. China's huge and growing power, and evident nuclear modernization program, is also inevitably concentrating its neighbours' minds.

3.17 Much more immediate concerns have been expressed about the Middle East, in the context specifically of a break-out by Iran, should that occur, from what appears to be its current "hedge" posture to actual weaponization. Egypt, Saudi Arabia and Turkey are most often mentioned as states who – while being able to live, more or less uncomfortably, with Israel's presumed nuclear status – would find Iran a bridge too far. But with a number of other countries in the region on the road to acquiring major civil nuclear energy capacity, these are not the only ones seen as potential proliferators.

3.18 It is important to keep all these concerns in perspective, and not unduly exaggerate them. Major surges have been predicted before but have not eventuated – in the 1960s (when almost every country of any capacity, including Australia, was exploring the option) and the 1970s (when there may have been less confidence in U.S. security guarantees following its failure in Vietnam). There is nothing automatic or inevitable about a country's decision to acquire nuclear weapons, and multiple factors – five in particular – have in the past, and will in the future, impose a strong sense of caution and restraint.

3.19 First among them is the normative force of the NPT itself, which is why it is so important to maintain and strengthen its effectiveness, a recurring theme of this report. A second, related, consideration is that status and prestige cuts both ways: while this has always been thought to be a factor motivating states to acquire nuclear weapons – to be up there with the Permanent Five globally, and to be a very big dog on the regional block – it may well be that, these days, more respect attaches to a show of restraint, and commitment to international norms or, putting it another way, of good international citizenship. A third, and again related, factor is that domestic public opinion is often a powerful restraining force, as it very much has been – and is likely to continue to be – in Japan: leaders who run against that tide run major political risks.

3.20 A fourth, and very powerful factor, is the existence of strong security guarantees from a credible alliance partner: there can be no doubt that the extended deterrence offered by the U.S. nuclear umbrella has been a major reason over the decades why states in Europe and North East Asia, in particular, have been willing to forego a nuclear weapons option even when perceiving themselves to be very vulnerable to nuclear attack. (Whether there is any justification for a nuclear – as distinct from conventional-weapon umbrella – sheltering allies from non-nuclear threats is a question taken up later in this report.)

3.21 The remaining major consideration is simply technological capability, which is too often glossed over. There is a real gap between possession of a first class nuclear research and civil power generation capability and the development of the technologies to support a full weapons program which should not be underestimated. That is why, for example, one should not make too many easy assumptions about the capacity of countries like Egypt, Saudi Arabia and Turkey to respond quickly to a move by Iran to acquire nuclear-armed status. But that said, crash programs can achieve extraordinary results: Israel was characterized in a recent U.S. Defense Science Board study as having had, in 1960 "Nil Weapons Potential", but within five years had moved up the chart to "Modest", then "High" to "Potential for Serial Production", i.e. full nuclear-armed status.

3.22 On balance this Commission, while not wishing to be unduly alarmist or to exaggerate the extent to which a trickle of break-outs is likely to turn into a flood, is deeply concerned about the present vulnerability of the non-proliferation regime, and believes that it is of paramount importance that it be systemically strengthened, and that this be supplemented by an intelligent and constructive case by case approach to particular problem areas as they now appear, and arise in the future. These will be recurring themes in later sections of this report as policy options are more specifically addressed.

4. THE THREAT OF NUCLEAR TERRORISM

POSSIBLE STATE AND NON-STATE ACTORS

4.1 There is a significant and continuing fear internationally of nuclear terrorism – shared by the public and decision-makers alike. The UN Secretary-General has labelled nuclear terrorism "one of the most serious threats of our time". U.S. President Obama has been equally blunt: "There is no graver danger to global security than the threat of nuclear terrorism, and no more immediate task for the international community than to address that threat."

4.2 That fear is justified. There are terrorist actors in existence – as the whole world has known since Al Qaeda's orchestration of 9/11 – who would, if they could, cause massive and indiscriminate havoc in almost any one of the world's major cities. And there is every reason to fear that they can match that intent with capability. There is quite a high risk that they could produce a "dirty bomb", combining conventional explosives with radioactive material, to devastating psychological effect. The risk is very much smaller that they could produce a far more physically destructive nuclear explosion, given the scale of the technical and logistical problems that would have to be overcome. But it is not negligible. And the possibility of cyber attacks on nuclear command and control centres is growing ever more significant.

4.3 Possible terrorist actors might either be acting independently of state backing, or have state sponsors. Since 1995, there have been several cases that confirm the danger that either group of actors can have access to – and no scruples about using – devices or substances with the potential for mass killings. The Aum Shinrikyo attacks in Tokyo in 1995 and the unsolved anthrax attacks in the United States in 2001 were the first two. Another was the poisoning of Alexander Litvinenko in London in 2006 with Polonium-210, which reminded the world that individuals can obtain a key material for detonating nuclear weapons and smuggle it undetected through the airports of countries on high alert against terrorist threats.

4.4 In the case of a nuclear weapon, it would require a large, well organized and well funded group to build, let alone buy, such a weapon, maintain security at all stages, and successfully transport it to the intended site for detonation. It is now known that Al Qaeda some years ago attempted to obtain enriched uranium, and that senior members of the group had at least

one meeting with two Pakistani nuclear experts. The apparently dispersed and diffuse nature of its current organization and funding, after being under siege for most of the last decade, make the central organization, such as it is, a less likely candidate now than in the past for such a role. But it has offshoots and imitators in many countries.

4.5 The danger posed by any such group would be much enhanced by state backing, whether for nuclear materials or know-how, or simply for the necessary funding. The number of states likely to give deliberate support of this kind would be very small. Even regimes with a long history of, if not irrationality, at least playing by different rules to everyone else, would be unlikely to lend such assistance without first making an assessment of the likely consequences should they be identified – including the possibility of nuclear retaliation (the chances of which would be significantly higher if those states were already nuclear-armed themselves). A more substantial concern is that states with weak or fragile institutions, multiple internal power centres, and imperfect arrangements for securing weapons and dangerous materials, might end up providing such support even in the absence of any explicit government intent or direction to do so.

4.6 It should be borne in mind that the face of terrorism in ten to fifteen years may well be quite different from today's. The politics of war and peace, and of security, may well shift from religion-based terrorism to eco-terrorism. In this scenario, there may be an even greater prospect that scientific and technical personnel from the richest countries will aid eco-terrorist use of nuclear weapons or materials.

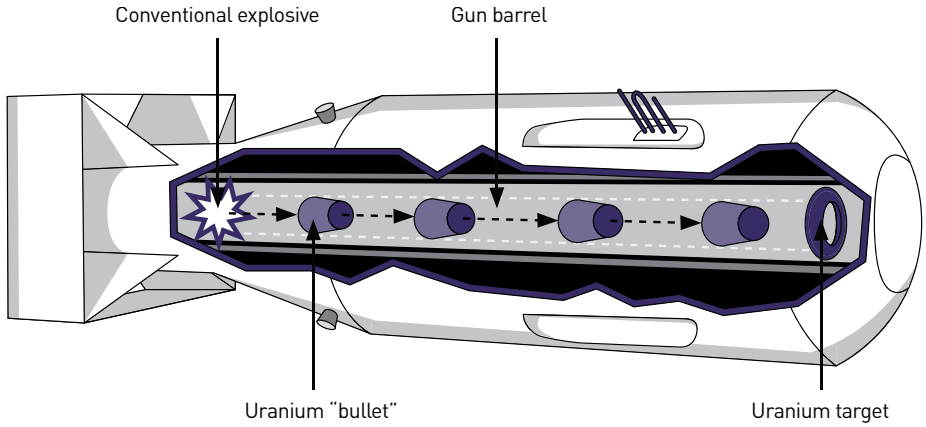
AVAILABILITY OF WEAPONS AND MATERIAL

4.7 **Designing, building and delivering a nuclear weapon.** Unless a terrorist group were to acquire a fully functioning nuclear weapon, it would need to build one. It is widely assessed that such a group would most likely opt for the simpler gun design than the more sophisticated implosion-type (see Box 4-1). The know-how to build a crude nuclear device of the gun-type weapon used to bomb Hiroshima can largely be found on the internet, and the engineering resources required to put it together would not be beyond the capacity of a well-organized and funded group.

4.8 The two major hurdles to be overcome would be acquiring sufficient fissile material, discussed separately below, and the engineering expertise needed to make the device work. The amount of fissile material required for one 15 kt atomic bomb built to a gun-type design (like that used on Hiroshima) would be around 50 kg of weapons-grade high enriched uranium (90 per cent U-235); an implosion-type weapon of the same yield would require far less fissile material – around 5 kg of plutonium or 15 kg

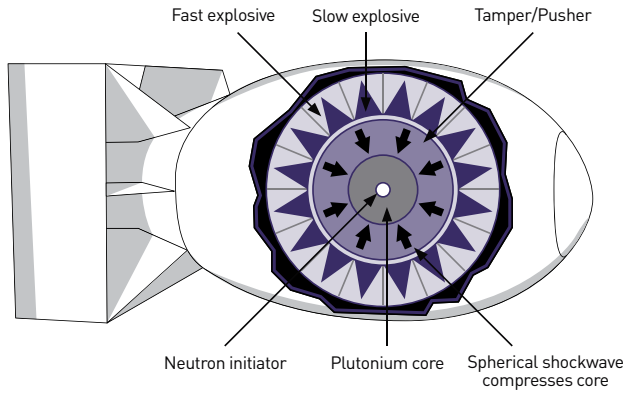
BOX 4-1

BASIC NUCLEAR WEAPON DESIGNS: "GUN" AND "IMPLOSION"



"Gun-assembly" nuclear weapon

A **gun assembly**, which can only work with high enriched uranium (HEU), involves firing one or more shaped pieces of HEU at a shaped HEU target, bringing together enough fissile material to create a super-critical mass. For a proliferator or terrorist, a gun assembly has the advantage of being comparatively easy to design and manufacture, but the disadvantage of requiring much more HEU than an implosion device—depending on the design, around 50 kg.



"Implosion-type" nuclear weapon

An **implosion device** involves compressing a sub-critical sphere of fissile material—plutonium and/or HEU—achieving super-criticality through increasing the density of the material. Compared with a gun assembly, an implosion device is more efficient and requires far less fissile material—around 5 kg of plutonium or 15 kg of HEU for a basic design—but design and manufacture are very complicated, requiring precise processing and shaping of the fissile core and precise firing of the high explosive lenses.

of HEU for a basic design. Engineering the two colliding elements of a gun-type weapon in the exact shape and within the fine tolerances required to produce a super-critical nuclear explosion would be a difficult but not impossible task; building an implosion-type device would be a very much more formidable enterprise.

4.9 Delivery to target would not be an insuperable problem. Weapons of this kind do not have to be dropped from an aircraft, exploding in mid-air, or carried by missile, to cause horrendous damage. For example, a Hiroshima-sized weapon detonated from inside the back of a large van in Trafalgar Square, London in the middle of a working day would cause what have been estimated as 115,000 fatalities and another 149,000 casualties from a combination of blast, fire and radiation poisoning; detonated in population-dense central Mumbai, the figures would be more like 481,000 fatalities and 709,000 other casualties.

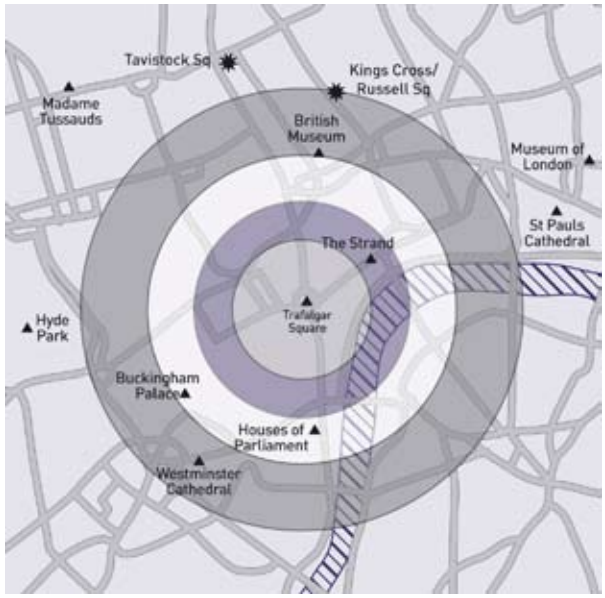
4.10 Maintaining security for an operation as complex as this, for as long as it would take, would obviously be very difficult, and might be a reason for a group building its weapon in a fragile, failing, failed or phantom state where scrutiny might be expected to be less intense than in the target state or city. Air transport would be high risk, but if sea transport to that state were involved, luck might well run in favour of the terrorist group: the U.S. Container Security Initiative is one of many practical demonstrations that it is impossible to exhaustively inspect every container cargo at busy ports. And if truck transport across land borders was involved, rather less luck would probably be needed. Even radiological detection is easier to avoid with nuclear weapons than is the case with "dirty bombs" using (as discussed below), widely available but highly radioactive material.

4.11 **Availability of nuclear weapons and materials: "loose nukes".** It is not impossible that fully assembled weapons could be acquired by terrorist groups in some circumstances, depending on the state of affairs of the nuclear-armed country in question, including the internal political situation, the degree of corruption in civilian and military agencies, the general reliability of the security services, and the means for protection and control over nuclear armaments and materials. But for nearly all practical purposes, the concern is more over the huge world stockpile of uranium of significant degrees of enrichment, as well as plutonium for energy, military, and scientific purposes.

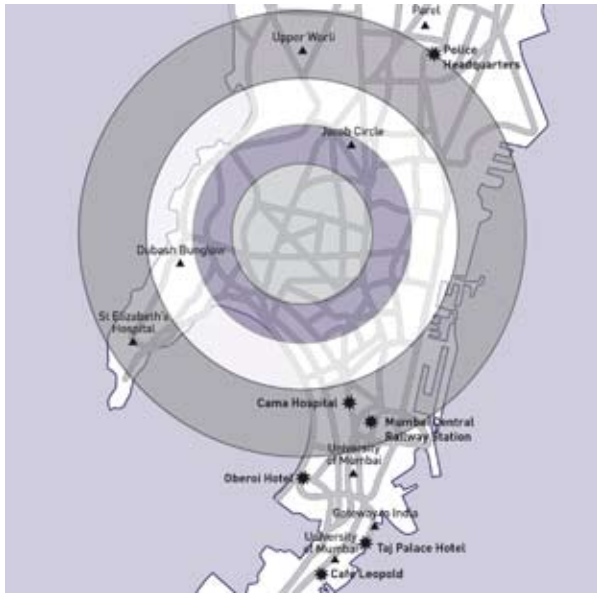
4.12 There are a number of estimates for global stocks of high enriched uranium and separated plutonium. For high enriched uranium they range from 1750 to 1850 tonnes in military programs and 20 to 50 tonnes in civil programs, and for separated plutonium from 155 to 260 tonnes in military programs and 165 to 230 tonnes in civil programs. Most of the military

BOX 4-2

IMPACT OF TERRORIST NUCLEAR EXPLOSIONS IN LONDON AND MUMBAI



Detonation of Hiroshima-size (15 KT) nuclear weapon in Trafalgar Square, London, on a working day.
Estimated Fatalities: 115,000
Estimated Casualties: 149,000



Detonation of Hiroshima-size (15 KT) nuclear weapon in central Mumbai on a working day.
Estimated Fatalities: 481,000
Estimated Casualties: 709,000

- Conflagration – Most people die instantly or over next 24 hours
- Third degree burns and radiation poisoning
- Second degree burns and radiation poisoning
- First degree burns and radiation poisoning
- Location of previous terrorist attacks: London (2006)/Mumbai (2008)

materials (more than 90 per cent) are in the stockpiles of the U.S. and Russia, but even a relatively small amount stored in other countries presents a serious danger, taking into account that, as noted above, as little as 50 kg of high enriched uranium may be enough for manufacturing a Hiroshima-yield crude nuclear explosive device by terrorists.

4.13 These huge stocks of nuclear materials are maintained using extremely varied accounting systems, and the conditions for storing and protecting them from hijacking or sale to criminal elements are far from reliable. It is commonly assumed that the safest are nuclear warheads on deployed strategic forces and centralized storages of the five original nuclear-weapon states. Tactical munitions are less secure when stored at armed forces depots. Weapons grade uranium and plutonium of the five is considered sufficiently well preserved and guarded. Less secure is unirradiated low enriched uranium and civilian plutonium, used in power plants and for other peaceful purposes. Irradiated nuclear fuel containing uranium, plutonium and many other radioactive materials will generally be "self-protecting" against unauthorized removal due to its high radiation level.

4.14 It is harder to make a judgment about the military nuclear stockpiles of the nuclear-armed states outside the NPT. Most probably they are quite safe in India and Israel, but some doubts exist about the situation in Pakistan. As for civilian nuclear materials, their safety differs greatly from state to state, the most secure being non-nuclear-armed states of NATO and the EU, and Japan.

4.15 Access to know-how is clearly no less indispensable than the ability to acquire the necessary material. There have clearly been those willing to trade in nuclear knowledge, such as the A.Q. Khan network in Pakistan and the associated Swiss Tinner family. North Korea has also made its weapons-related know-how available to friendly regimes. International efforts to stem a possible outflow of nuclear scientists and technicians following the break-up of the Soviet Union have been judged largely successful, but this is an area which will require serious ongoing vigilance.

4.16 **"Dirty bombs".** Radiological weapons, or "dirty bombs" are those which use conventional explosives to disperse radioactive materials. No great sophistication is needed to design, build and deliver them. Depending on the amount of explosives, considerable localized damage could be caused by their detonation, and on the nature and quantity of radioactive material used, an extensive area could be rendered inaccessible for an extended period, or require extremely expensive clean-up. The psychological shock experienced by the public from such an attack would no doubt be enormous, and achieve the fundamental terrorist aim of creating widespread terror.

4.17 Much smaller quantities of radioactive materials could be used for a dirty bomb – grams, not kilograms. There is also an enormously wide pool of potential sources to be found in the tens of thousands of hospitals and research schools around the world, not least in countries with less than exacting security and accounting procedures for radiological materials. Apart from in the nuclear fuel cycle (where highly radioactive material abounds, especially in the form of spent reactor fuel rods, but is closely secured, very dangerous to work with, and hard to hide), such materials are found in the civilian sphere in two main applications: as unsealed radiopharmaceutical material, used for the diagnosis and treatment of a range of diseases; and as sealed sources for a wide range of medical, agricultural, industrial and research applications.

4.18 The vast majority of such sources in use around the world are of relatively low radioactivity (e.g. smoke detectors) and do not pose a safety or security threat. However, some applications (such as radiotherapy, or sterilization of medical instruments), require sources of higher activity, and there have been a number of serious radiation accidents where high activity sources have been lost, stolen or abandoned: for example in Brazil, in 1987, when the accidental rupture in a building demolition of the source capsule of an abandoned caesium-137 radiotherapy unit resulted in several deaths, required the monitoring of some 112,000 persons, contaminated some 85 houses, and required a massive cleanup producing some 3,500 cubic metres of waste. Recently the theft was reported in Argentina of a canister of caesium-137 from an oil-drilling operations base, with two armed men overcoming a lone security guard and breaking into an underground bunker.

4.19 One downside for terrorists proposing to use dirty bombs is that, while they may be easier to acquire, assemble and detonate than nuclear weapons, they may be rather more difficult to transport and deploy in terms of avoiding radiological detection. Under the auspices of the Global Initiative to Combat Nuclear Terrorism, spearheaded by the U.S. and Russia, there has been a substantial effort to improve global radiological as well as nuclear detection architecture, including the installation of radiation detection equipment at many major international ports and airports around the world. That said, certain materials – such as the isotope used in the Litvinenko case – are effectively impossible to detect if contained within a minimal form of shielding.

4.20 **Cyber attacks.** Producing and detonating radiological or full-scale nuclear weapons would not necessarily exhaust the would-be nuclear terrorist's repertoire: cyber attacks on the command and control centres of nuclear-armed states must now be acknowledged as a significant threat, notwithstanding the major effort continuing to be made by governments to anticipate and defend against such threats. Jujitsu – turning the opponent's

own effort or resources into the lever of his overthrow – has always had great appeal to sophisticated terrorists, and the risks here, sometimes exaggerated but not impossibly far-fetched, include faking a nuclear attack, faking a command signal to launch an attack, posting false claims of claims of responsibility on accessible government websites, disrupting or corrupting with false information emergency communications within and between governments (including on hotlines established between governments to deal with tense or ambiguous situations), and in the event of a warhead actually being launched, massively disrupting disaster relief operations.

4.21 Nuclear command and control has an inherent weakness in relation to cyber warfare, in that states must retain the capability to launch nuclear weapons in the event of a decapitating strike, which requires in turn mobility and redundancy, i.e., having nuclear weapons spread out in multiple locations. All computers in any way connected to the internet are inherently susceptible to infiltration and remote control. Computers which operate on a closed network may also be compromised by various hacker methods, such as privilege escalation, roaming notebooks, wireless access points, embedded exploits in software and hardware, and maintenance entry points. It is known that multiple attempts have been made in the past to penetrate military systems – for example, by hackers to compromise the extremely low radio frequency once used by the U.S. Navy to send nuclear launch approval to submerged submarines. It simply cannot be assumed that such attempts will never be successful in the future.

4.22 Reflecting the importance this issue is assuming, the UN General Assembly in December 2008 approved creation of an intergovernmental panel of experts on information and telecommunications security. The panel will report to the First Committee of the UN General Assembly in 2010.

ASSESSING THE RISK OF NUCLEAR TERRORIST ATTACK

4.23 Given the enormous range of variables involved, it is virtually impossible to make any reliable estimate of how likely it is that a terrorist group may acquire and use a nuclear weapon, or even a much more readily put together and delivered radiological one, or the timeframe in which this might happen.

4.24 The most pessimistic, and often cited, estimates have been those by Harvard's Graham Allison, who has been arguing since the mid-1990s that a major terrorist nuclear incident is more likely than not, or at least significantly likely, within a foreseeably short time frame, "by end of the decade" or "within the next ten years" as the case may be. He is supported

by many influential and knowledgeable figures like the former head of the Los Alamos National Laboratory, Siegfried Hecker, who says that "the general consensus of nuclear weapons experts is that terrorists would face significant but not insurmountable challenges to build a primitive but devastating nuclear device and that it would most likely be delivered to the intended target by truck, boat, or light airplane."

4.25 Others are much more sceptical, including John Mueller, who concludes that "the likelihood that a terrorist group will come up with an atomic bomb seems to be vanishingly small – perhaps very substantially less than one in a million." A midway position is that of Cass Sunstein, who notes that if there is a yearly probability of one in 100,000 that terrorists could launch a nuclear or massive biological attack, the risk would cumulate to one in 10,000 over ten years and to one in 5,000 over twenty, suggesting that these odds are "not the most comforting."

4.26 Trying to make any credible arithmetical assessment of the odds of a major terrorist nuclear attack is clearly a fruitless exercise. But that does not mean that, because the odds are obviously small, there is no real cause for concern: we are all now familiar, in the aftermath of the global financial crisis, with what are variously called "black swan", "fat tail" or "long tail" events – those which seem impossibly unlikely, but have nonetheless happened. Because the consequences of the event occurring in this case are so catastrophically large, every possible preventive step that can sensibly be taken must be taken. And in doing so it is worth recalling the conclusion of another analyst of the probability of such attacks, Michael Levi, that "It has often been said that defense against terrorism must succeed every time, but that terrorists must succeed only once. This is true from plot to plot, but within each plot, the logic is reversed. Terrorists must succeed at every stage, but the defense needs to succeed only once."

4.27 Strategies to respond to the threat of nuclear terrorism are discussed in Section 13.

5. THE RISKS ASSOCIATED WITH PEACEFUL USES OF NUCLEAR ENERGY

LIKELY SCALE OF THE CIVIL NUCLEAR ENERGY RENAISSANCE

5.1 Governments are reconsidering the role of nuclear power within their electricity generation capacity because of increasing energy demand, pressure to reduce greenhouse gas emissions, rising fossil fuel prices, the potentially improving economics of nuclear power, and the pursuit of security of energy supply. Public opposition to nuclear power remains significant, but is changing. Precise figures are hard to come by, not least because much of the considerable growth planned for the world's nuclear industry involves long lead times, and political and capacity constraints. But even if only a small percentage of the planned growth in the civilian industry sector comes to pass, it will have implications for the world's proliferation controls.

5.2 Today there are some 436 nuclear power reactors operating in 30 countries plus Taiwan, with a combined capacity of over 370 gigawatts (GWe): nuclear power stations have an average capacity of around 1 GWe. In 2007 these provided 2608 billion kilowatt hours (kWh), about 15 per cent of the world's electricity. The World Nuclear Association (WNA) projects possible expansion in world nuclear generating capacity from a base of 373 GWe today to at least 1130 GWe, and up to 3500 GWe, by 2060. The upper projection for 2100 is 11,000 GWe, with the fastest growth in Asia.

5.3 According to the WNA, nuclear power is under serious consideration in around thirty countries which do not currently have it. With 40 plus reactors being built around the world today, more than 130 planned to come online by 2030 and over 200 further back in the pipeline, the global nuclear industry has big plans. Countries with established programs are seeking to replace old reactors as well as expand capacity, and an additional 25 countries are either considering or have already decided to make nuclear energy part of their power generation capacity.

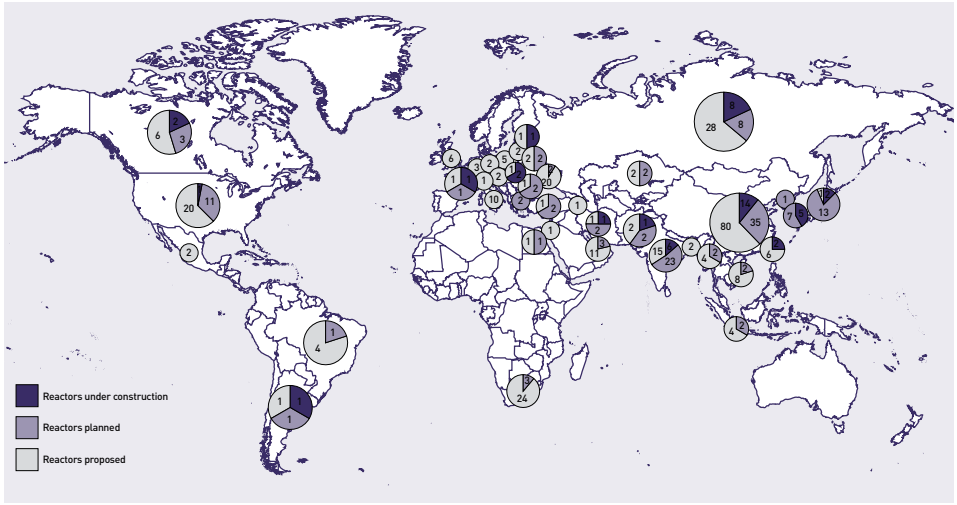
5.4 Despite the large number of these emerging countries, they are not expected to contribute very much to the expansion of nuclear capacity in the foreseeable future. Most of the growth will come in countries where the technology is already well established: 80 per cent of the expansion in nuclear power is forecast in countries already using nuclear power.

Newly-minted nuclear countries are likely to account for only 5 per cent of global nuclear capacity by 2020.

5.5 China, Russia and India will account for the largest increases in new nuclear generating capacity to 2020, though the United States, France and Japan will retain their dominant position, producing 50 per cent of global generating capacity. The non-nuclear power countries which have planned or approved nuclear power generation are Vietnam, Turkey, Indonesia, Belarus and the United Arab Emirates (UAE), although in Indonesia popular opposition may yet prevent plans going ahead. Countries without a present nuclear power capacity which have proposed or intend to use nuclear power are Thailand, Bangladesh, Bahrain, Egypt, Ghana, Georgia, Israel, Jordan, Kazakhstan, Kuwait, Libya, Malaysia, Namibia, Nigeria, Oman, the Philippines, Qatar, Saudi Arabia, Uganda, Venezuela and Yemen.

BOX 5-1

REACTORS PLANNED, PROPOSED AND UNDER CONSTRUCTION 2009



Source: Data sourced from World Nuclear Association, July 2009

5.6 The capacity of the global nuclear industry is the major constraint upon a rapid expansion in nuclear energy. Supply bottlenecks in human resources, heavy forgings and other reactor parts are likely to worsen as demand increases. Other key components such as reactor cooling pumps, diesel generators, and control and instrumentation equipment have long lead times, requiring up to six years to procure and manufacture. Personnel qualified to design, construct and operate nuclear facilities are increasingly difficult to find as present employees approach retiring age,

and a decreasing number of university degrees are awarded in nuclear-relevant fields. Governments and intergovernmental nuclear agencies have introduced measures to encourage students to enter the nuclear field and support nuclear research and development; however the maintenance of power reactor skills and competence has been largely left to industry.

5.7 Other important constraints include the ability of states, especially the newcomers, to finance their nuclear energy plans, and their capacity to develop and finance the necessary regulatory and technical bases to realize them safely. There is fertile ground for increased assistance from established nuclear powers and industry to help develop competence in regulation and effective export controls. But in the present post-global financial crisis economic climate, the ability to finance these costly projects is far from assured.

5.8 Even in the best of economic circumstances, new nuclear power plants continue to be uncompetitive against most other base-load power options, including natural gas, coal and oil. This may yet contain the contribution of nuclear power to world energy to current levels of around 15 per cent of total world electricity output, although the economics of nuclear power may become more favourable if carbon taxes or emission limits are introduced. Construction costs for plants remain very high, with many planned nuclear power plants requiring 100 per cent government loan guarantees or very high subsidies. Some experts predict that given its lack of cost competitiveness, nuclear power may even go backwards, but this is very much a minority view.

ASSESSING THE PROLIFERATION RISKS OF NUCLEAR ENERGY EXPANSION

5.9 The proliferation risk of the nuclear renaissance is determined by three principal factors: whether the expansion takes place in existing nuclear power states or new nuclear power states; the geostrategic contexts of countries acquiring nuclear technology for the first time; and the nature of the nuclear technology acquired.

5.10 Views on whether an increase in the number of power reactors around the world poses an increase in nuclear proliferation dangers differ. Some argue that not even a tenfold increase in power reactors will have a significant impact on nuclear proliferation. They believe the greatest problem to be rogue states determined to develop a nuclear weapons program whatever the barriers, and that their number has not significantly increased in the last ten to fifteen years. Others, including in influential policy circles in the U.S., are concerned that "the rise in nuclear power worldwide, and

particularly within Third World countries, inevitably increases the risks of proliferation."

5.11 Nuclear power reactors themselves, in particular the standard light water reactors (LWRs), are not considered a high proliferation risk because the isotopic content of the spent fuel and the difficulty of separating plutonium from the spent fuel assembly does not make them ready producers of weapons grade fissile material. It is widely acknowledged that the biggest proliferation risk in the expansion of nuclear energy is the expansion of sensitive nuclear technologies (SNTs) – principally enrichment or reprocessing – to non-nuclear weapon states. Proliferation of SNTs can be problematic per se and can increase the risk of fissile material being available for terrorists if facilities are not properly protected.

5.12 The states seeking nuclear power for the first time are concentrated in Africa, the Middle East and South East Asia. All are zones of varying degrees of domestic political instability. The Middle East is strategically unstable and directly affected by the Iranian enrichment program. While South East Asian countries are not directly in the line of North Korean nuclear threats, their security would nonetheless be affected by a deteriorating East Asian strategic environment were Pyongyang's nuclear ambitions to be unchecked, including its possible willingness to proliferate to hard-line regimes like Burma/Myanmar. In all three regions, states have genuine reasons for wanting to develop nuclear power, including growing energy demand and the desire to preserve fossil fuels for export, and in many cases had been interested in acquiring nuclear power prior to the Iranian and North Korean situations arising. Significantly, Vietnam and Indonesia have signalled their intent not to develop an enrichment capacity, as have Bahrain and the UAE.

5.13 While the U.S./UAE agreement is the gold-standard for supply (the UAE having foresworn SNT development such as uranium enrichment and reprocessing) this pattern is not necessarily being followed by other power aspirants in the region, such as Jordan. When some suppliers are prepared to take the minimalist approach to nuclear cooperation, it puts pressure on those supplier countries and companies which want to pursue best practice supply policies to resist the stronger international supply rules that might be needed to stem the proliferation dangers of an expanded civilian nuclear energy sector, especially to new countries.

5.14 Brazil plans to develop a commercial enrichment plant, and – while no additional states currently have such plans – Argentina and South Africa insist on their right to do so in future. While India has announced plans to construct an additional commercial reprocessing plant, currently no other state has such plans – with the U.S. having terminated the commercial

reprocessing plant originally planned as a domestic project under its Global Nuclear Energy Partnership (GNEP).

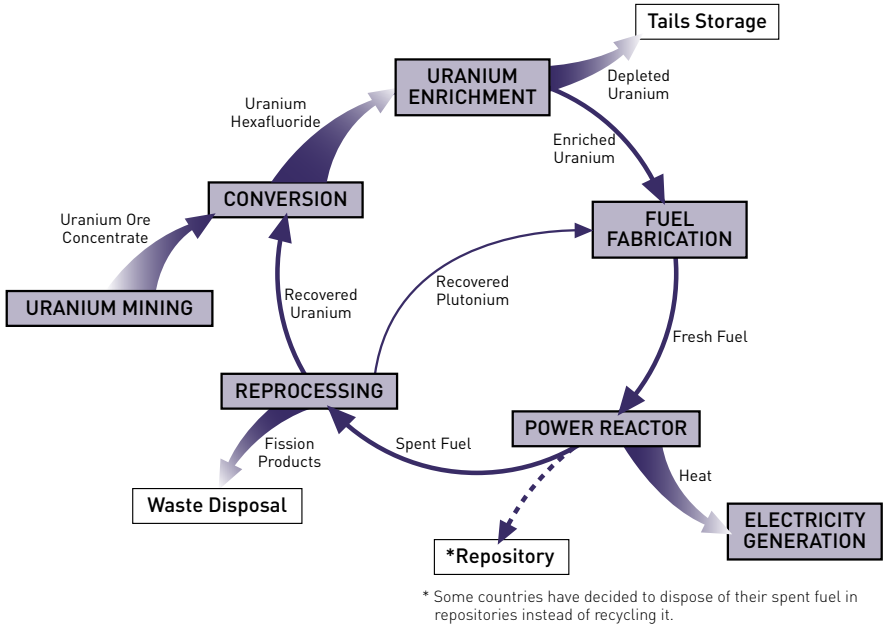
5.15 It is important to recognize that the establishment of even the most basic nuclear infrastructure and expertise may presage later pursuit of a full nuclear fuel cycle, with all that implies – as we are now acutely aware with the examples of North Korea and Iran – about the capacity to move to, or toward, proliferation under cover of the right to develop nuclear technology for civilian purposes. Some have gone so far as to label some recent nuclear cooperation agreements "bomb starter kits".

5.16 Three strategies – technical, commercial and political – suggest themselves to policymakers and industry to mitigate the proliferation risks of the so-called "renaissance". *Technical* solutions (discussed in Section 14) include the development of nuclear reactors less suited to producing weapons grade fissile material, or making it more difficult to access. *Commercial* solutions might include replacing turnkey reactor sales contracts to build-own-operate contracts, or inserting minimum non-proliferation requirement provisions into supply contracts.

5.17 *Political* solutions would include further efforts to achieve universalization of the IAEA Additional Protocol, with nuclear suppliers, through bilateral agreements, making adherence to it a condition of nuclear supply. Further steps would include giving credible assurances of fuel supply free from vexatious or political interference, and placing sensitive stages of the fuel cycle under multilateral control – although, perversely, pressures for multilateralization of the nuclear fuel cycle might accelerate attempts by some countries to develop sensitive nuclear technologies in a hurry. These questions are discussed in more detail in Sections 14 and 15.

BOX 5-2

THE NUCLEAR FUEL CYCLE: BASIC TERMINOLOGY NON-SPECIALISTS NEED TO KNOW



A. NUCLEAR MATERIALS

Uranium

Uranium occurs naturally. To be useable, uranium ore (containing as little as 0.1 per cent uranium, sometimes less) has to be *mined*, then *milled* and processed to produce a uranium oxide concentrate ('yellowcake'). Yellowcake is then *converted* into uranium dioxide which can be used as fuel in some reactors (see "heavy water reactors" below), but for most purposes into uranium hexafluoride gas (UF_6) and then *enriched*. The final step in the process is the fabrication of fuel assemblies (usually ceramic uranium oxide pellets encased in metal tubes).

"Enrichment" means increasing the concentration of the isotope uranium-235, and reducing that of uranium-238. Natural uranium consists primarily of these two isotopes, but only U-235 is capable of undergoing *fission*, the process by which a neutron strikes a nucleus, splitting it into fragments and releasing heat and radiation. ("Isotopes" are forms of the same element differing from each other in relative atomic mass but not their chemical properties, or putting it another way, atoms that have different numbers of neutrons in each nucleus but the same atomic number, i.e. number of protons in each nucleus.)

Low enriched uranium (LEU), used as the fuel (to heat water to steam to drive turbines) in most power generating reactors, involves increasing the natural concentration of U-235 (0.7 per cent) to between 3 and 5 per cent.

High enriched uranium (HEU) is defined (for safeguards purposes) as that in which the percentage of U-235 has been increased to 20 per cent or greater. *Weapons-grade uranium* is usually described as that enriched to 90 per cent or higher U-235.

Plutonium

Plutonium occurs naturally only in minute quantities and is essentially a man-made element. Plutonium is produced by reactors as a normal by-product when some of the neutrons released during fissioning are captured by uranium-238 atoms: some of the plutonium is itself fissioned, but a proportion remains in *spent fuel assemblies* in different isotopic forms (including Pu-239, Pu-240 and Pu-241), which can be extracted and used as a nuclear fuel.

In the case of standard *light water reactors*, the plutonium contained in the spent fuel is typically about 60-70 per cent Pu-239, described as *reactor-grade*; *heavy water reactors*, by contrast, can be used to produce Pu-239 in weapons-grade concentrations (but the brief irradiation required to achieve this is inefficient for power production). *Weapons-grade plutonium* has 93 per cent or more Pu-239.

Fissile Material

This expression usually refers to high enriched uranium (HEU) and separated plutonium (i.e. plutonium separated from spent fuel through reprocessing).

B. ENRICHMENT PROCESSES

These are of four main types:

(1) Gas centrifuge: UF6 gas is pumped into a series of rotating cylinders: the centrifugal force draws heavier molecules (containing U-238) toward the outside of the chamber while lighter U-235 molecules remain in the centre. Standard centrifuge enrichment is easily modified to produce HEU, and the modifications can be concealed.

(2) Gaseous Diffusion: UF6 containing U-235 and U-238 is compressed and fed into a semi-permeable vessel. Since lighter molecules travel faster than heavier ones, molecules consisting of U-235 will escape from the vessel faster than those of U-238.

(3) Electromagnetic enrichment: The different paths of the U-235 and U-238 isotopes as they pass through a magnetic field allow them to be separated and collected.

(4) Laser: A laser of a particular wavelength is used to excite U-235 atoms to the point that they can be separated from U-238 (or vice versa).

C. REACTORS

There are two basic types of fission reactor – "thermal" (in wide use) and "fast neutron" (now limited in number, but expected to be important in the future):

(1) Thermal reactors. These use a *moderator* to slow neutrons to the optimum ("thermal") speed to cause fission, viz. a material that slows neutrons without capturing them. The usual materials are light water, heavy water and graphite:

Light water reactors: The most common reactors in operation today, light water reactors use ordinary water as a coolant and moderator. Because this is a relatively inefficient moderator these reactors require low enriched uranium as fuel. From a non-proliferation standpoint, light water reactors are preferable to heavy water reactors for two reasons: first, removing the fuel (to extract the plutonium by-product) requires shutting down the reactor (easily noticed); secondly, it is difficult to produce plutonium with a high proportion of Pu-239.

Heavy water reactors: These reactors use as coolant and moderator water containing an elevated concentration of "heavy hydrogen" (also known as deuterium) - hydrogen atoms which contain a neutron in their nucleus in addition to the usual proton. This allows the use of natural (non-enriched) uranium as fuel. Heavy water reactors produce significant quantities of plutonium, and are capable (though not in commercial use mode) of producing Pu-239 in weapons-grade concentration.

Gas-graphite reactors: These use gas (CO2 or helium) as the coolant and graphite as the moderator. They can operate on natural or low enriched uranium. Examples include the early "Magnox" reactor, the Advanced Gas-cooled reactor currently used in the UK, and the German-designed "pebble-bed" reactor under development in South Africa and China.

(2) Fast neutron reactors. These use high energy ("fast") neutrons to cause fission. They do not use a moderator, relying instead on fuel of higher fissile density (typically 20-30 per cent plutonium). The coolant is a material that neither absorbs nor slows neutrons, either molten metal (to date, sodium) or gas (helium). The principle is use of high energy neutrons to convert the predominant uranium isotope U-238 to plutonium. Fast neutron reactors can be operated in three modes:

Plutonium burners: these consume more plutonium than they produce.

Equilibrium mode: in these, plutonium production and consumption are in balance.

Plutonium breeders: these produce a surplus of plutonium available for fuelling additional reactors.

Both breeding and equilibrium modes are self-sustaining, in the sense that once operating they provide their own fissile material requirements and only require additional "fertile" material, i.e. natural or depleted uranium.

PART III:

FORMULATING POLICY RESPONSES

6. DISARMAMENT: MAKING ZERO THINKABLE

DELEGITIMIZING NUCLEAR WEAPONS

6.1 If we want to minimize and ultimately eliminate nuclear weapons, the critical need is to change perceptions of their role and utility: in effect, to achieve their progressive delegitimation, from a position in which they occupied a central strategic place to one in which their role is seen as quite marginal, and eventually wholly unnecessary as well as undesirable. To a significant extent this process has already begun, reinforced by the advisory opinion of the International Court of Justice in 1996 that "the threat or use of nuclear weapons would generally be contrary to the rules of international law applicable in armed conflict, and in particular the principles and rules of humanitarian law". It is not a matter of starting afresh, but picking up and taking forward themes and trends, three in particular, that have been evident in the international system for decades, especially since the end of the Cold War.

6.2 First, it is now broadly accepted that nuclear weapons have little or no utility as instruments of warfighting. Early in the nuclear age it seemed possible that militarily advanced states would come to view nuclear weapons as a normal, albeit unusually efficient, form of military firepower available for most contingencies, but that is no longer the case. Nuclear weapons, creating impassable terrains and causing long-lasting environmental damage, cannot rationally be used to take territory. Nor can they sensibly be used in the types of contemporary conflicts in which the international community now finds itself often embroiled, from Afghanistan to the Congo, or against non-state terrorist actors. They lack finesse in a world where advanced militaries increasingly focus on reducing collateral damage and civilian deaths, with the objective – as with smart sanctions – being to target those most responsible for creating the mayhem in question. The weapons of choice in war these days are precise in both targeting and effect.

6.3 Second, there is a strong *taboo* on the actual use, if not possession, of nuclear weapons: a profound normative constraint, as well as a practical one, against using weapons of such indiscriminate and disproportionate destruction. The taboo is so strong today, especially in democracies, that it is only conceivable that it would be broken in the face of a threat genuinely seen as jeopardizing a country's very survival. Nuclear weapons are essentially self-deterring for actors who depend upon public support from their own

populations, their allies, and broader international society. Every time states have come close to their use they have recoiled from the implications. John Foster Dulles, no dove, concluded after being involved in deliberations on using nuclear weapons in Korea, Vietnam and the Taiwan Straits crises, that using nuclear weapons "would surely cost us our allies" and "we'd be finished as far as present-day world opinion was concerned."

6.4 Third, there is a base of delegitimation on which to build: it is a matter of restoring the momentum lost in the last decade, rather than starting from the beginning. The present world stockpile of over 23,000 nuclear warheads, with a destructive potential of some 2,300 MT (million tons of TNT), equivalent to around 150,000 Hiroshima-sized weapons, is alarmingly large. But it was even more alarming at the height of the Cold War, when some 70,000 warheads existed, with a cumulative destructive power peaking at around 25,000 MT or 1,600,000 Hiroshima equivalents! As the Cold War wound down, international tensions eased, arms control treaties were signed, great power arsenals began a period of steady decline, and whole categories of weapons, notably in the shorter-ranges, were abandoned. Countries with nuclear options, such as Belarus, Kazakhstan, Ukraine, Brazil and Argentina, decided not to pursue them, while South Africa discarded its nuclear capability. Whatever their perceived political role, nuclear arsenals no longer occupy pride of place in the security policies of the major powers, and discussions of the circumstances in which their use might be contemplated tend to be more vague and speculative than they were during the Cold War.

6.5 But all that said, there is a very long way to go if nuclear arsenals are to be dramatically further reduced and ultimately eliminated. Nuclear weapons – and in particular perceptions of their usefulness as deterrents – still have a tenacious hold in the security thinking of many policymakers. And perceptions about the inevitability of their continued existence are widely embedded in public opinion, in particular the notion that because nuclear weapons cannot be uninvented they can never wholly disappear. If these perceptions are to change, they have to be tackled head-on, but in a way which recognizes and respects, and does not just ignore, the weight of opposing arguments.

6.6 The underlying thesis of this report is that the risks associated with a nuclear world, spelt out in detail in earlier sections, are unacceptable over the long-term, and that eliminating them requires eliminating nuclear arsenals. There are few who reject this logic outright, yet it is also clear that countries with nuclear arsenals, or members of alliances backed by nuclear guarantees, can both recognize these long-term risks and at the same time fear the short-term impact on their security posed by the processes of disarmament. The necessary commitments to disarmament will not be

achieved by simply denouncing the nuclear-armed states and their allies for being in thrall to false theories and prey to unwarranted anxieties, and appearing to neglect these security concerns. They must be convinced that there is no incompatibility between nuclear disarmament and security.

6.7 Those who advocate elimination need to break the process into manageable steps, countering perceptions that it is a leap into the unknown. That is the approach taken in this report, perhaps too cautious for some, but realistic: the number of diverse states that must cooperate to make nuclear abolition feasible is too great, and the issues too complex, to allow anything but incremental movement. Here as elsewhere in public policy, inertia tends to be the norm, major change the rarity, and sustaining major change extraordinarily difficult. The real alternative to an incremental approach is not more rapid change, but stasis. But doing nothing is not an option.

6.8 The case for action on disarmament was put with stark clarity and simplicity by the Canberra Commission on the Elimination of Nuclear Weapons in 1996, and has been repeated, with minor wording variations, in the international debate many times since. There are many interests and anxieties to be addressed, and arguments to be weighed and balanced as below, but this is the bottom line:

> So long as any state has nuclear weapons, others will want them. So long as any such weapons remain, it defies credibility that they will not one day be used, by accident, miscalculation or design. And any such use would be catastrophic for our world as we know it.

RETHINKING DETERRENCE

6.9 Arguments about the deterrent utility of nuclear weapons recur in many forms, and with varying force. The following paragraphs outline the major deterrence-based arguments for retaining nuclear weapons, and what can be said in response by those wanting to make the case for dramatically further reducing over time the role of nuclear weapons, and ultimately achieving their abolition.

6.10 **"Nuclear weapons have deterred, and will continue to deter, war between the major powers".** It is hard to contest the almost universally held view that the absence of great power conflict since 1945 must be at least in part attributed to the fear of nuclear war. On the face of it, nuclear weapons on the other side will always provide a formidable argument for caution, and it does seem that they generated a degree of mutual respect and careful handling between the U.S. and USSR during the Cold War (and, for that matter, between India and Pakistan since 1998 – although they

did not stop the bloody Kargil heights conflict in 1999). That said, for all the war plans that were undoubtedly prepared, it is not clear that there is any evidence for the view that Soviet leaders, any more than their U.S. counterparts, were determined to actually go to war at any particular time, and only deterred by the existence of the other's nuclear weapons. And for all the careful handling, there were dozens of false alarms on both sides during the Cold War years: the fact that nuclear war did not erupt from technical malfunction, operational stress or decision-maker miscalculation should to an important degree be attributed to sheer luck.

6.11 Particularly instructive in this respect is the information now available about Soviet nuclear weapons deployed in Cuba and on nearby submarines at the outset of the 1962 crisis – of which U.S. commanders were not aware. Tactical nuclear weapons without permissive action links had already been deployed in Cuba, and if the U.S. had invaded – as was to have happened in early November of that year, had the "quarantine" failed – they would have been used: the Guantanamo Bay naval base, notably, was pre-targeted. Nuclear warheads were already on location for a number of the SS.4/SS.5 Intermediate Range Ballistic Missiles, and it would have taken only a matter of hours to attach the warheads to the rockets and launch them. On the "use them or lose them" principle, this could well have happened, had the U.S. – unaware of the situation – bombed or invaded Cuba. In the same period, a Soviet submarine was subjected to U.S. Navy practice depth charges as part of the "quarantine". The submarine, cut off from communication with its command authority, had to decide either to surface or to use its nuclear torpedo. Delegation of use was subject to a joint decision between the three commanding officers of the submarine – and the vote was two against, one for.

6.12 Even if one concludes, nonetheless, that nuclear deterrence did directly prevent war between the two superpowers and cannot be held even partly responsible for any lesser intensity conflict, how confident can anyone be that the luck of the Cold War – in relation to the avoidance of accident or miscalculation on the part of every one of the present nuclear-armed states – will continue in perpetuity? Can the benign effects of the nuclear age, such as they may have been, be enjoyed indefinitely before something goes terribly wrong?

6.13 When the retention of nuclear weapons runs this inherent risk, together with the additional risk (as discussed below) of encouraging proliferation with all the accompanying further dangers of that, there is another question that must be asked: what actually is the reality of the threats from other nuclear-armed states against which each nuclear-armed state wants to maintain its nuclear insurance? What is the real-world likelihood, present and future, of the nuclear powers – the U.S., China, Russia, France, UK,

Israel, or even India and Pakistan – actually committing or threatening such major aggression against each other on a scale such as to even begin to justify breaching the nuclear weapons taboo? The irony is that deterrence may remain notionally effective against those who least need to be deterred from breaching international security, while being least effective against those – like international terrorists – who most need to be.

6.14 Even if retaining nuclear weapons does continue to have some deterrent utility against others minded to use such weapons, this does not in itself make any case against abolition, because the argument for retention is circular. If the only military utility that remains for nuclear weapons is deterring their use by others, that utility implies the continued existence of nuclear weapons and would disappear if nuclear weapons were eliminated.

6.15 **"Nuclear weapons will deter any large scale conventional attacks"**. Factors other than the possession of nuclear weapons or explosive devices can explain why the U.S., Russia, China, the UK, France, India, Pakistan and North Korea have not been subject to large-scale attack. States and societies have learned from the devastation of World War II and the defeat of aggressors in almost every war since then. The enormous costs of war have to be weighed against any potential gains in starting them. Globalization intensifies the costs of territorial aggression as economic interdependence, especially in finance, leaves all states susceptible to isolation by others. While it cannot be proved either way, it does not seem likely that large-scale confrontations would become more likely in the absence of nuclear weapons: there would still be compelling economic, political and military incentives to prevent disputes between major powers escalating into all-out confrontations.

6.16 That said, the recent calls from high places in the U.S. and elsewhere to pursue seriously the vision of a world without nuclear weapons have elicited concerns in Russia, China and other states that such a world would accentuate U.S. conventional military advantages. The U.S. may have neither the intention nor the capability to invade Russia and China, but worst-case analysts in Moscow and Beijing worry that Washington could use its conventional military power to threaten their interests vis-à-vis neighbouring territories. It is clearly the case that without wider-ranging efforts to resolve underlying security dilemmas and to balance non-nuclear military capabilities, the U.S. and Russia and China will be unable to agree on substantially minimizing – let alone abolishing – nuclear weapons. Similar considerations would weigh as between Pakistan and India, and on Israel and North Korea. As we will have occasion to say a number of times in this report, major nuclear disarmament will need to be related to progress in resolving the security dilemmas that shape the interests of all the states that rely on nuclear deterrence.

6.17 Some smaller states have clearly taken the view that possession of nuclear weapons is the ultimate guarantor of national security, and against enforced regime change, even against a much larger, better armed, and indeed even nuclear-armed, state. North Korea may be taking the view that the U.S. would not attack Pyongyang if a nuclear weapon were aimed at Seoul or Tokyo, and others could make similar calculations for the Middle East, South East Asia, Caucasus or elsewhere. But again such assessments are less plausible than they may at first sight appear. Weapons that are not likely to be able to be used in practice, or which it would be manifestly suicidal to use, do not constitute a credible deterrent. The states in question are unlikely to be able to put in place the expensive and sophisticated early warning or guaranteed survivability (e.g. missile submarine) systems needed to keep their nuclear strike capacity more or less intact in the face of a putative "regime change" attack. And even if they were able to be used, a regime which did so against an opponent with overwhelming nuclear, or even conventional, retaliatory capacity would be guaranteeing its own destruction.

6.18 **"Nuclear weapons will deter any chemical or biological weapons attack".** Some nuclear-armed states cite the threat of chemical or biological weapons as necessitating the retention of nuclear weapons. But these weapons do not now have anything like the destructive potential of nuclear weapon. They never will in the case of chemical weapons, and are unlikely to in the foreseeable future in the case of biological weapons, although the risk there is higher. The threat is certainly one that requires effective military deterrence, but this is best provided by the prospect of a crushing conventional response. It is extremely difficult to paint plausible chemical or biological attack scenarios that would threaten destruction on such a scale as to begin to make nuclear, as distinct from conventional, retaliation – with all the downside risks attached to using nuclear weapons – a proportional, necessary, and therefore credible response.

6.19 **"Nuclear weapons will deter terrorist attacks".** Whether or not terrorism can be deterred, or only prevented and defeated, and whether or not terrorist actors are themselves threatening or using nuclear weapons or explosive devices, nuclear weapons are manifestly neither strategically, tactically nor politically necessary or useful for this purpose. Terrorists do not usually have traditional or convenient sites that could be targeted for the use, or threat of use, of nuclear weapons: territory, industry, a population, or a regular army, which could be targets in a strike of retribution. The military challenge in such cases would be to locate the terrorist threat with enough precision and certainty to justify attacks on it. If intelligence were not perfect and a nuclear strike conducted on a wrong target, the backlash would be enormous; and even if high-confidence intelligence did exist, then it is difficult to imagine that non-nuclear means could not be utilized for

the target in question. To conduct nuclear strikes on another state, even one demonstrably complicit in a terrorist attack, would raise exceptionally difficult political, strategic and moral issues.

6.20 **"Extended nuclear deterrence is necessary to reassure allies".** This argument has application to the nuclear umbrella offered by Russia to its allies in the Commonwealth of Independent States Collective Security Treaty of 1992, but arises particularly in the context of the U.S. network of alliances put together in Europe, the Asia Pacific and Middle East in the 1950s. This was constructed, and has continued to this day, on the assumption that the allies in question – including Japan and Australia – were protected by the U.S. nuclear umbrella, not least as a means of ensuring that none of the countries in question were tempted to acquire nuclear weapons themselves. In Europe, Germany, Italy and Sweden all foreswore nuclear weapons capability for this reason among others.

6.21 There seems no doubt that, for the foreseeable future, Washington's own nuclear deterrent will continue to be extended to its allies to protect them against any nuclear attack or threat they might experience. This should be well understood by other international actors and not seen as either destabilizing, or as in itself inhibiting further movement down the disarmament path. But clearly Washington will need to continue to closely consult with its allies as it moves in that direction, reassuring them that they will not be exposed to any greater risk of nuclear attack as a result of its own arsenal being reduced.

6.22 The question more immediately engaging policymakers is whether "extended deterrence" should involve the nuclear component of America's deterrent posture being available for *non*-nuclear threats, be they chemical, biological or conventional in character, or whether rather such threats should be met wholly by non-nuclear means. As discussed later in this report, the issue has yet to be resolved for the U.S. itself, quite apart from its allies. It is currently being addressed in the current Nuclear Posture Review, due for presidential decision early in 2010. A critical question for that Review is whether the U.S. will continue with its current posture of strategic ambiguity, leaving open the possibility of nuclear weapons being used to respond to any class of security threat to itself or its allies, or rather will move toward a declaratory policy that the sole purpose for nuclear weapons, so long as they exist, should be to deter the use by others of nuclear weapons against the U.S. or its allies.

6.23 The issue is a complex and sensitive one. On the one hand there is an overwhelming attraction for all those supporting a nuclear weapon free world, in seeing the U.S. – along with all the other nuclear-armed states – making an unequivocal "sole purpose" declaration, sooner rather than later. This would be a major step forward down the disarmament path, and help

to put at rest the perception – so damaging to the cause of non-proliferation – that the nuclear-armed states regard nuclear weapons as an indispensable, legitimate and open-ended guarantor of their own and their allies' security, which they are born to have but others have no right to acquire.

6.24 On the other hand, some U.S. allies argue that their national survival could be put just as much at risk by the use of biological, chemical or conventional weapons as by nuclear ones, and that so long as any such risk is conceivable they should remain fully protected by the U.S. nuclear umbrella. If the premises of this argument are well-founded, the conclusion is a compelling one. Clearly, again, such allies will need to be very strongly reassured that they will not be exposed to unacceptable risk if the U.S. changes its posture in the way described. The concern for the U.S., and the wider international community, will be that if they are not so reassured some at least will be tempted to build a nuclear deterrent of their own.

6.25 It ought to be possible for that reassurance to be given. Three lines of response suggest themselves. The first is that "extended deterrence" does not have to mean "extended *nuclear* deterrence". United States conventional capability, when combined with that of each of the allies in question, constitutes a deterrent to any conceivable aggressor at least as credible as that posed by its nuclear weapons. Allies will certainly need to be totally confident that anything in the nature of an existential threat to them will be met by the full weight of that capability, but given the intensity of shared values and interests that underlie present alliance commitments they should be readily persuadable. Of course the real need over time is to create so stable and cooperative a security environment in every potentially volatile region, including East Asia, that reliance does not have to be placed by anyone on disproportionate conventional capability (with all the disincentives to nuclear disarmament by others that this tends to bring in its wake, as noted earlier in this section).

6.26 The second response is that nuclear weapons are simply not as useable as those who focus on their ultimate deterrent utility would like to believe they are. Presidents Truman, Eisenhower and Kennedy rejected military advice to use nuclear weapons in the Korean War, the Taiwan Straits crisis, and the Cuban Missile crisis, and the force of the taboo has if anything since grown. As Henry Kissinger wrote recently, "The basic dilemma of the nuclear age has been with us since Hiroshima: how to bring the destructiveness of modern weapons into some moral or political relationship with the objectives that are being pursued. Any use of nuclear weapons is certain to involve a level of casualties and devastation out of proportion to foreseeable foreign policy objectives. Efforts to develop a more nuanced application have never succeeded, from the doctrine of a geographically limited nuclear war in the 1950s and 1960s to the 'mutual assured destruction' theory of

general nuclear war in the 1970s." This does not mean that the need to help allies deter adversaries has disappeared. It merely means that the real role of nuclear weapons in extended deterrence has shrunk much more radically than many people assume.

6.27 A third line of response is that the U.S. and all of the allies to whom it extends nuclear deterrence have obligations under the Nuclear Non-proliferation Treaty to support the total elimination of all nuclear arsenals. At a time when major efforts are being made to reinvigorate the NPT in all its dimensions, when so much depends on reducing the salience of nuclear weapons – or, in the language we have adopted in this report, continuing to delegitimize them – great care must be taken not to allow debate over extended nuclear deterrence to *raise* their salience in national security policies. There is no plausible security threat to NATO or East Asian allies today that would require a nuclear weapons response; to suggest otherwise is to miss opportunities to improve security relationships in Europe and East Asia. Such improvements are not only desirable in their own right but will be crucial in creating conditions for progress toward a world without nuclear weapons.

6.28 **"Any major move toward disarmament is inherently destabilizing".** An abrupt change from a security system based on a balance of power – with nuclear weapons perceived, for better or worse, as a central element in the global, and some regional, power equations – to one based wholly on cooperation and strong international institutions, would require unprecedented levels of trust and mutual confidence and undoubtedly bring with it many instability risks. But an abrupt change is not what most serious advocates of nuclear disarmament propose. What is required is the progressive delegitimation of nuclear weapons, with states working to reduce the role of these weapons in their security policies, focusing first on getting to a minimization point where a global zero will be within reach, and only then on their total elimination, recognizing that each stage will take many years to achieve.

6.29 Later sections of this report will explore in detail the steps involved in working through these stages and will argue, inter alia, that dramatically lower numbers, and significant disparities in numbers, are not inherently destabilizing. For present purposes it is sufficient to make the point that nuclear deterrence – whether or not one accepts that such deterrence is of any actual real-world utility – will be part of the landscape for a long time to come. For the time that will be needed to overcome the political, strategic, psychological and other obstacles to abolition, the retention of nuclear weapons in sufficient numbers and configuration to deter others from threatening or using them is something that policymakers on all sides of the argument are going to have to accept. No nuclear-armed state is going

to agree to eliminate its weapons until it is absolutely confident that its own security environment – and that of its allies – makes that possible. One has to proceed on the assumption that in the case of most, if not all, the nuclear-armed powers, they will go to zero only if and when all the others do the same, and if they are satisfied that robust verification and enforcement measures are in place. The final acts of disarmament will have to involve all nuclear powers and be very carefully choreographed.

6.30 Some will be tempted to invoke fears of abolition to contest deep reductions at the minimization stage, but this resistance would be on weak analytic and political ground. It will be proposed in this report that the world works to reach the point, by 2025, where the number of nuclear weapons is reduced to very low levels, where every state has made a credible commitment to no first use, and where these weapons have receded from the foreground to the background of the international security environment. But even in these circumstances, it will have to remain part of every potential nuclear aggressor's calculation that every other nuclear-armed state, whatever its declaratory policy, could use such weapons if it perceived itself or its allies to be under such a threat.

RETHINKING OTHER JUSTIFICATIONS FOR RETAINING NUCLEAR WEAPONS

6.31 A miscellany of other arguments, not related directly to deterrence, have been advanced to actively support the retention of nuclear weapons or resist pressure for their reduction. They also need to be addressed.

6.32 **"Nuclear weapons cannot be uninvented so there is no point trying to eliminate them".** Of course nuclear weapons cannot be uninvented, any more than any other human invention. But, like chemical and biological weapons, they can be outlawed. The two basic requirements for effective abolition, discussed in detail later in this report, are verification and enforcement procedures capable of detecting and responding swiftly and effectively to moves toward rearmament, and states being convinced that they could protect their vital interests without them. No one denies that satisfying these conditions will be extremely difficult in the case of nuclear weapons, but the fact that knowledge of how to make them will persist is not in itself any reason not to try to achieve their abolition.

6.33 **"Nuclear weapons confer unequalled status and prestige".** While acknowledging the historical force of this argument, it is arguable that the acquisition of nuclear weapons is no longer quite the natural route to political prestige it might once have appeared; nor may be it the case that the mastery of nuclear technology is the mark of an advanced industrial power

to the extent it once may have been, given other – and less expensive – ways to make the same point, for example sophisticated information technology. True, the permanent members of the UN Security Council are all nuclear powers but that is not the case with most of the candidates to join them in a restructured Security Council. And conformity to the NPT – with its clear-cut prohibition on member states acquiring such weapons – tends to be claimed as a badge of honour rather than being criticized as a constraint.

6.34 Equally, leaders of nuclear-armed states rarely acknowledge that they fear they will lose international status if they eliminate these arsenals. Yet it has to be acknowledged that this is clearly a concern in Russia, France and Pakistan, who appear to see a world without nuclear weapons raising the importance of other, currently non-nuclear-weapon, states relative to them. The response must be that as the delegitimation of nuclear weapons proceeds, and the retention of nuclear weapons becomes more and more clearly unacceptable to the rest of the world, and manifestly unnecessary from a security standpoint, then status considerations alone are not likely to prove sufficient to block movement toward minimization and ultimate elimination.

6.35 **"Disarmament is not necessary to advance non-proliferation'.** For many years this has been a mantra for those among the nuclear-armed states who have wanted, usually for good reasons, to stop others acquiring nuclear weapons, but have not been willing to contemplate relinquishing their own. It is a position which not only ignores the NPT obligations of the nuclear weapon states under Article VI, but also the political and psychological reality that adopting perceived double standards is no way to encourage support. And nothing can be achieved in such crucial areas as formally strengthening the terms of the NPT, strengthening the role of the IAEA, achieving the entry into force of the CTBT, and the negotiation of an effective Fissile Material Cut-off Treaty, without the support of a much wider group of countries than just those five nuclear powers. The argument that those who have nuclear weapons continue to need them to deter possible existential threats to their own survival and those of their allies, but that other states who perceive themselves also to face potential existential threats should fend for themselves without the benefit of such a deterrent, is one that is absolutely bound to fall on deaf ears. It is not one that can be put seriously in this day and age.

6.36 The dangers associated with proliferation will be addressed later in this report. But in the context of the deterrence issues discussed in this section, they should be self-evident. The more actors that possess nuclear weapons and are involved in intelligence gathering and decision making about whether and when to use them, the higher is the probability of mistake, miscalculation and risk-taking. The prospects of our Cold War luck running

out will be significantly greater. And the greater the number of nuclear actors, the greater the likelihood that competition among them will not be dyadic like the relatively simple Cold War nuclear stand-off. Proliferation is inherently destabilizing.

6.37 **"Nuclear weapons do not inhibit other security cooperation between nuclear-armed states".** This variation on the previous argument is just as challengeable, at least so long as current force configurations and postures are maintained. A high level of trust and collaboration is manifestly needed for joint military operations against terrorists and states that support and harbour them. It is also needed for common early warning systems for missile launches and the development of joint ballistic missile defence systems; more stringent nuclear and missile export controls; programs to enhance safety and accountability for stockpiles of nuclear weapons and materials, and ultimately the verifiable cessation of production; internationalization of nuclear fuel cycle elements; and eased mutual access to sensitive facilities. It is difficult, to say the least, to imagine such intense cooperation in an environment when the major nuclear-armed states still have thousands of nuclear warheads pointed at one another, with more than 2,000 of them on dangerously high launch-on-warning alert, and while all of them are modernizing their strategic nuclear forces to ensure guaranteed devastating strike capability against each other.

6.38 **"Nuclear weapons cost less than conventional forces".** It is often claimed that nuclear forces cost significantly less than general-purpose forces, and in the military budgets of any given year, this is true: in Russia and the U.S., for example, 10-15 per cent is allocated to strategic nuclear forces, including support systems. But taking into account the cost of a weapon system's entire lifecycle, which for strategic nuclear forces amounts to two to three decades or more, as well as the cost of safely dismantling and utilizing nuclear weapons after they have been withdrawn from service, not to mention the expense of disposing of the uranium and plutonium contained within warheads, then the calculation changes significantly. And what should be brought into the equation also (apart from the obvious point that the risks associated with the retention of nuclear weapons might be thought to outweigh any conceivable financial advantage) is the opportunity cost of maintaining these weapons rather than applying the resources to solve other military and security tasks. Significant intellectual and technological assets capable of being reallocated to other real and important international security needs are being locked up in support of nuclear confrontation.

6.39 **"Nuclear weapons establishments are needed to maintain expertise".** If put crudely this argument has an evidently circular quality, in the sense that if nuclear weapons were eliminated expertise would hardly be required to maintain them. But it is fair to make the point that, even on the most

optimistic disarmament timetable, nuclear weapons will take a long time to abolish completely and systems need to be professionally maintained meanwhile; that real expertise will be needed throughout the minimization and elimination process to ensure effective verification and other security measures; and that it is important accordingly to ensure the continuing training of new specialists in this area. Acknowledging this reality – and also having governments take steps to identify compelling alternative missions for nuclear weapons laboratories and relevant services as their present roles wind down – may help to defuse some of the interest group political pressures that traditionally come from these areas and make significant disarmament hard to politically deliver.

7. DISARMAMENT: A TWO-PHASE STRATEGY FOR GETTING TO ZERO

WHY A TWO-PHASE APPROACH IS NECESSARY

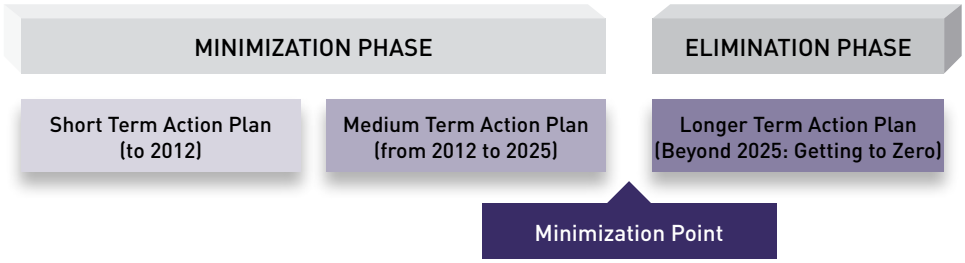
7.1 It is critically important to keep alive and in sharp focus the ultimate objective, which must remain the absolute elimination of nuclear weapons. We are confident that this task is achievable, but are also conscious that the complexities and challenges of eliminating all nuclear weapons are extraordinarily great. The most productive way forward is a two-phase process – "minimization" and "elimination" respectively – beginning with the achievement of a world in which the roles and numbers of nuclear weapons are dramatically reduced, though they have not yet completely disappeared. Many of the verification and enforcement quandaries associated with complete abolition would not have to be solved in order to reach a minimization point. States that have relied, for better or worse, on the war-deterring effects of nuclear weapons – and who have hostile or sceptical constituencies to persuade of the case for their reduction – are more likely to be willing to shift nuclear weapons from the foreground to the background of international politics if they feel they have time to test the stability of security relationships while nuclear weapons are not yet completely absent.

7.2 We propose in this report, as a detailed guide to what needs to be accomplished through both the minimization and elimination phases, a comprehensive action agenda, embracing the short term to 2012, the medium term to 2025, and the longer term beyond 2025 (see Box 7-1, and Sections 17–19). Even giving disarmament the priority we do in the short and medium term, we know that it will not be easy to get to what we describe as the "minimization point" by the end date for the first phase, 2025. Many conditions will need to be satisfied to get to where we want to be in terms of overall numbers of warheads, the security doctrines that govern their use, the necessary technical infrastructure, and the whole non-proliferation framework. Quite apart from all the other nuclear-armed states, there are serious transparency problems even as between the U.S. and Russia. After decades of arms control negotiations, there is still no accessible inventory of their respective "tactical" nuclear weapons, let alone any understanding of how they would be verifiably accounted for and dismantled. But for all the obstacles and uncertainties, we believe it is conceptually possible, and politically useful, to set a specific time-bound target for the minimization phase.

7.3 We might wish there were a straight-line continuum between the world as it now is and a nuclear weapon free world, such that if real momentum is generated in the minimization phase it could be expected to carry over into the elimination stage, making it possible to set a specific target date for the achievement of "global zero". But we have to acknowledge the reality that there will be very large psychological confidence barriers to overcome before all nuclear-armed states are willing to give up all their nuclear weapons, and that given the need to satisfy a number of geopolitical and technical verification conditions, about all of which there is great uncertainty, setting a specific target date for elimination is not likely to be credible or helpful.

BOX 7-1

THE COMPREHENSIVE ACTION AGENDA: TIMELINES



THE MINIMIZATION PHASE

7.4 The reason this phase can and should be pursued with a specific end target date in mind is that its feasibility does not depend on eliminating the whole range of political, security and technical barriers that make the feasibility of complete abolition of nuclear weapons so difficult to see today. We have chosen 2025 – fifteen years on from the 2010 NPT Review Conference – as the end date to aim for in this respect. This is certainly still ambitious given the scale of what has to be achieved, but not impossibly so by the standards, at least, of past nuclear and other arms control agreements, which have taken an average of less than three and a half years to negotiate and sign (albeit rather longer to implement), and not so distant as to be disheartening for those trying to energize the necessary political will.

7.5 The central objectives of the minimization phase, broadly expressed, should be to move nuclear weapons from the foreground of international affairs to the background, in terms of their roles in deterring conflict, providing cover for coercion of others, and as perceived sources of status and prestige; to reduce the numbers of nuclear weapons to very low levels;

to minimize risks that they could be unleashed by accident, unauthorized actors, or time-pressed decisions to "use-to-not lose'; to set real constraints on the ability of nuclear-armed states to easily reverse course on any of these fronts; and to demonstrate real commitment to eliminating the dichotomy between nuclear "haves" and "have-nots" which has done so much to impede the necessary strengthening and enforcement of non-proliferation rules.

7.6 More specifically, there are three core features of the "minimization point" which we should be striving to achieve no later than 2025 – relating respectively to numbers of warheads, nuclear doctrine, and force posture. The following paragraphs sketch in outline the position taken by the Commission on each: Sections 17 and 18 address in much more detail the complexities involved, and discuss the process by which, and timeframe within which, each objective might be achieved.

7.7 It must be emphasized, here as elsewhere, that there is an inextricable connection between disarmament and non-proliferation objectives. The minimization point we envisage will not be reachable without the achievement of all the basic non-proliferation objectives described in following sections. They include strengthening NPT compliance, verification and enforcement in a variety of important ways; resolving present uncertainties in Iran and North Korea; and putting in place two crucial building blocks for both non-proliferation and disarmament, viz. bringing into force the Comprehensive Nuclear-Test-Ban Treaty, and negotiating an effective Fissile Material Cut-off Treaty. Most of these objectives ought to be achievable much earlier than 2025, and hopefully indeed by 2012 (what we describe in our action plan as the "short term"), and priority effort should be devoted to accomplishing this.

7.8 **Numbers of warheads.** The primary defining characteristic of the minimization point – although not its only one – will be a massive reduction in the number of nuclear warheads of all types still in existence. The objective must be to cut not only strategic but all classes of weapons, and not only deployed weapons but those in storage and those awaiting destruction (but still capable of reconstitution and deployment) as well. A very ambitious, but not wholly unrealistic, target for 2025 in this respect is a global total of no more than 2,000 such weapons – more than a 90 per cent reduction as compared with the more than 23,000 now in existence (and much greater still as compared with 70,000 that existed at the height of the Cold War arsenals).

7.9 Among the many questions that need to be addressed in examining the feasibility of this, and any similar, reduction target are how numbers of weapons (as distinct from delivery systems) are to be counted and verified; how the deterrent effectiveness, such as it is, of nuclear weapons can be maintained at low numbers (something of particular concern to U.S. and Russian policymakers); how issues of asymmetry and proportionality can

be managed at low numbers (given the vastly greater number of weapons possessed by the two major nuclear powers); how many warheads can physically be destroyed in the time-frame in question; and the timing and sequencing of all the necessary steps along the way. It will also be necessary, if a multilateral disarmament process is to advance, for there to be early agreement on an appropriate negotiating process, with the Conference on Disarmament in Geneva – of which all nuclear-armed states are members and which presently includes discussion of nuclear disarmament generally in its program of work – probably being the most appropriate forum.

7.10 **Nuclear doctrine.** Just as critical as reaching agreement about dramatically lower numbers of warheads will be achieving agreement among the nuclear-armed states about how those weapons could ever be used. As discussed in Section 2 of this report, there is presently no common position among these states on the overall role of nuclear weapons in national security, defence and foreign policy strategy, and on whether nuclear weapons should ever be available to respond to non-nuclear threats (i.e. on "no first use" and "sole purpose" issues). And at best there is merely lowest common denominator agreement among the Permanent Five states on not using their nuclear weapons against non-nuclear NPT members (i.e. on the issue of "negative security assurances").

7.11 The objective must be, during the minimization phase but hopefully much earlier than its 2025 end-point, to reach substantive agreement on these issues and – as stated below – to back declaratory statements with changes to actual force posture of a kind which will make them credible in practice. This Commission believes it is crucial that, at the very least, every nuclear-armed state be unequivocally committed to the principle that the sole purpose of possessing nuclear weapons – until such time as they can be eliminated completely – is to deter others from using such weapons against that state or its allies. We would prefer that sooner rather than later, such declaratory "sole purpose" statements be hardened into unequivocal "no first use" commitments, but acknowledge that there has been an issue in the past as to whether such commitments have been seriously attended. We also believe that clear, meaningful and unequivocal "negative security assurances" should be given by all the nuclear-armed states in relation to non-nuclear-armed states.

7.12 **Force Posture: deployment and alert status.** If doctrinal declarations are to be taken seriously they must be accompanied by appropriate changes to force posture, which in this context primarily means where and how weapons are deployed, and with what degree of launch readiness. The basic objective must be to ensure that, while remaining demonstrably survivable to a disarming first strike, nuclear forces are not instantly useable, with stability maximized by these postures being transparent – well known and understood by friend and potential foe alike.

7.13 The issue here that most urgently needs to be addressed is the very large number of U.S. and Russian warheads – over 2,000 on land based ICBMs, and on some Russian SLBMs on submarines in bases – still now kept on as "launch-on-warning" (LOW) or "launch-under-attack" (LUA) status, i.e. which have to be launched very quickly on receiving information about an opponent's perceived attack in order to avoid possible destruction, giving just a few minutes for political leaders to make the final decision.

7.14 It is probably unavoidable that, as a demonstrably survivable retaliatory force, some weapons – essentially those on missiles on submarines at sea – be kept intact and useable at short notice (though not requiring instant decision-making in the same way as those deployed on launch-on-warning status): if a state does not have manifestly survivable weapons, there will be a major incentive for it to contemplate its own first strike in a perceived "use them or lose them" situation. But in a world in which there really was a genuine commitment to no first use, it would be possible for the overwhelming majority of remaining weapons to be not only taken out of active deployment, but at least partially dismantled as well, significantly lengthening the time between decision-to-use and actual use.

7.15 A number of other factors will impact on nuclear force posture decision-making both at the minimization and elimination stages including, it must be acknowledged, perceptions about the effectiveness of missile defence systems, the potential deployment of weapons in space, and – particularly – major disparities in conventional force deployments. Here as elsewhere, it will be crucial to build a cooperative rather than crudely competitive environment between the major players – finding common ground in addressing challenges from terrorists and outlaw states, and not premising force structure decisions only on worst case assumptions about each other. Only in that larger context of evolving mutual confidence will any major changes from the status quo be possible.

THE ELIMINATION PHASE

7.16 If the Commission thought that setting a specific date for abolition would in fact create the political will to overcome the myriad political, security, and technical obstacles to getting to zero, we would do so. But quite apart from the difficulty of identifying a specific target date when there are so many variables in play that are almost impossible to quantify, we are concerned that embracing such a date may in fact make it more difficult to minimize, and then ultimately eliminate, nuclear dangers, giving critics easy opportunities to excite fears that would impede progress to minimize nuclear dangers through the steps described in this report. These steps should be debated on their own merits, not in the false terms of a leap into a dangerous unknowable world without nuclear deterrence.

7.17 We nonetheless strongly believe that to help build political support for many of the measures necessary to reach such a vantage point, and to keep in mind the ultimate objective of eliminating the dangers of nuclear war, the goal of a nuclear-weapon-free world must remain visible, and be seen as achievable. The mountain top might be a long way away from what the four U.S. statesmen have called the "vantage point" or "base camp" (essentially what we describe as the "minimization point") but it is essential that it shine as a beacon in the sunlight, not be left shrouded in mist. That means spelling out in some detail the various conditions – as best we can now assess them – that will need to be satisfied if states are going to be persuaded to take the final steps to abolition, and we attempt that task in Section 19 below. Once the world becomes accustomed to maintaining security at the minimal level we describe, it should become clearer and easier to define and meet those conditions than it is now. But even if the ultimate elimination phase is decades away, it is not too soon now to begin detailed analysis and international debate, to help motivate and inform the work that must generate and sustain momentum for change for many years to come.

Recommendations on Overall Disarmament Strategy

1. Nuclear disarmament should be pursued as a two-phase process: with "minimization" to be achieved no later than 2025, and "elimination" as soon as possible thereafter. Short (to 2012), medium (to 2025) and longer term (beyond 2025) action agendas should reflect those objectives. [7.1–5; see also Sections 17, 18, 19]
2. Short and medium term efforts should focus on achieving the general delegitimation of nuclear weapons, and on reaching as soon as possible, and no later than 2025, a "minimization point" characterized by:
   (a) low numbers: a world with no more than 2,000 warheads (less than 10 per cent of present arsenals);
   (b) agreed doctrine: every nuclear-armed state committed to no first use of nuclear weapons; and
   (c) credible force postures: verifiable deployments and alert status reflecting that doctrine. [7.6–15; see also Sections 6 (on delegitimation) and 17–18]
3. Analysis and debate should commence now on the conditions necessary to move from the minimization point to elimination, even if a target date for getting to zero cannot now be credibly specified. [7.15–16; see also Section 19]

8. NON-PROLIFERATION: CONSTRAINING DEMAND AND SUPPLY

LIMITING THE DEMAND FOR NUCLEAR WEAPONS

8.1 The risks for the world involved in any new state now becoming nuclear armed were spelt out in Section 3. In meeting those risks two broad, and complementary, sets of strategies must be pursued. On the supply side, the task is to make it as difficult as possible for states to buy or build weapons, through a variety of policies designed to inhibit access to the necessary materials and technology: these strategies are summarized later in this section, and addressed in more detail in subsequent ones. On the demand side, on which this section focuses, the task – in many ways even more important to get right – is to persuade states they do not need or want nuclear weapons in the first place.

8.2 **Why states have not acquired nuclear weapons.** Most states do not in fact need either more constraints or more persuasion to be comfortable with their non-possession of nuclear weapons. There are a number of reasons – which tend to be mutually reinforcing – why the demand to acquire them is likely to remain limited. They can be summarized as normative, practical and political respectively.

8.3 *Normative* considerations – the concern simply to do, and be seen to be doing, the right thing – should never be underestimated in international affairs. Most states have, as a basic governing principle, a strong sense of commitment to their treaty obligations generally. Reinforcing that in this case is the particularly strong normative force of the Nuclear Non-Proliferation Treaty (NPT) which is premised on the principle – even if some weapon states would prefer not to be reminded of it – that nuclear weapons are simply wrong: their acquisition is forbidden, their use taboo, and their indefinite continued possession unacceptable. It is critically important in this context that the NPT's normative force be maintained, which means – as we have insisted throughout this report – constant attention to ensuring that its disarmament clause is taken seriously, and that its non-proliferation provisions are strong and effective in practice.

8.4 *Practical* realities, for a start, are that most of the world's 194 independent states simply lack the financial, technical and human resources to be able to even contemplate a nuclear weapons program. But beyond that, most have

never felt the need to as a practical matter because – while they may or may not have security concerns about some of their neighbours – they do not perceive any direct nuclear threat, or any other existential threat of a kind which could conceivably be deterred by possessing nuclear weapons.

8.5 There are an important group of states who *have* felt the need to consider acquiring nuclear weapons in the face of what they have seen as possible nuclear or other existential threats, and who have had the capacity to do so, but who have chosen not to because their practical security needs in this respect have been met by an "extended deterrence" umbrella provided by an alliance partner. As we noted in Section 3, there can be no doubt that the extended deterrence offered by the U.S. nuclear umbrella has been a major reason over the decades why states in Europe and North East Asia, in particular, have been willing to forego a nuclear weapons option even when perceiving themselves to be very vulnerable to nuclear attack. And as discussed in Section 6, in constraining the demand for nuclear weapons it will continue to be very important for allies benefiting from such extended deterrence to feel confident that their security is guaranteed (although it does not necessarily follow from this that a nuclear response should be available for *non*-nuclear threats: narrowing and limiting the role of nuclear weapons is a crucial step on the path to disarmament).

8.6 A further practical consideration that has inhibited at least some states from acquiring nuclear weapons is that they have perceived this as likely to encourage other states in their own region to do so, which would in turn not only tend to neutralize any strategic advantage gained, but generally make the neighbourhood more dangerous.

8.7 *Political* considerations – usually linked to normative and practical ones – have their own weight, both domestically and internationally. For some states – not least Japan, where the memory of the horror of Hiroshima and Nagasaki remains strong – domestic public opinion is so strongly opposed to nuclear weapons it is almost inconceivable that it could be ignored.

8.8 Internationally, notwithstanding the traditional perception that much status and prestige is associated with the possession of nuclear weapons, and a significant factor motivating their acquisition – with the fact that all Permanent Five members of the Security Council are nuclear-weapon states being seen as no coincidence – it is now becoming apparent that at least as much, and possibly more, international political respect attaches now to restraint on this front, and an overt commitment to being a good international nuclear citizen. Most of those countries, for example, with serious aspirations to become permanent members of a reconstructed Security Council – like Brazil, Mexico, South Africa, Nigeria, Germany and Japan – have not seen a move to acquire nuclear weapons as being in any way helpful to that cause.

And the emergence of the G-20 as a global policy-making forum of real significance has helped to further diminish the decades-old nexus between possession of nuclear weapons and the exercise of real institutional power.

8.9 **Why states should not acquire nuclear weapons.** So long as some states have nuclear weapons, however, there are other states who will be tempted to follow that path. Limiting their demand for nuclear weapons means understanding why they might think they need or want them; assessing whether any of their concerns have an objectively rational and defensible foundation; being as responsive as possible to those that do; and meeting those that may not with persuasive arguments that the would-be proliferator would be either no better off, or significantly worse off, going down that track.

8.10 What is involved in being responsive to legitimate security concerns will vary with each situation, and require case by case assessment of both legitimacy and response options. The latter include diplomatic and other support for conflict prevention and resolution, positive security assurances (that the state in question will be supported by allies, a regional organization or immediate reference to the UN Security Council in the event of an attack upon it) and negative security assurances (guarantees of non-intervention generally, or – as discussed in Section 17 – the non-use of nuclear weapons specifically).

8.11 The main arguments to be deployed (already noted in Section 6 in the context of persuading states to disarm) may be summarized briefly as below. Some are more powerful than others, and none of them – as with any negative proposition – can be easily proved. But together they make a compelling case, particularly when the inherent risks involved in possessing nuclear weapons – physical and reputational – are brought into the equation.

8.12 *Nuclear wars cannot be won.* It is now almost conventional wisdom among military commanders that nuclear weapons are effectively useless as instruments of warfighting. Their application simply cannot be calculated and controlled in the same way as conventional weapons, they lack any kind of targeting finesse, reciprocal damage is likely to be immense, and "victory" unlikely to be meaningful.

8.13 *Nuclear weapons are not indispensable in preventing or defeating large-scale conventional attack.* The downside risks of waging aggressive war in a globalized interdependent world are seen today as outweighing almost any conceivable benefit. Security concerns of states that still feel vulnerable can be better met by positive security assurances and conventional force-balancing measures – as well as serious efforts to resolve issues generating tension.

8.14 *Nuclear weapons are not indispensable in deterring chemical or biological attack.* The destructive potential of these weapons is not in the same class as nuclear weapons, and the prospect of a crushing conventional response is as much military deterrence as is required.

8.15 *Nuclear weapons cannot guarantee protection against forcible regime change.* A regime relying on a handful of nuclear weapons to immunize itself against such attack would be seriously miscalculating. If it actually used such weapons in pre-emptive or other defence against an opponent with overwhelming nuclear, or even conventional, retaliatory capacity it would be guaranteeing its own complete destruction. And, unless it could afford the sophisticated and expensive defensive systems needed to keep its nuclear strike capacity intact, it would not in practice have any weapons to use.

8.16 *Nuclear weapons are not a cheaper means of security than general-purpose forces.* While an established nuclear force may cost less to maintain annually than comparable combinations of conventional forces, the calculation changes when the system's whole life-cycle – including the expense of safe dismantlement and disposal – is taken into account.

LIMITING THE SUPPLY OF WEAPONS, MATERIALS AND TECHNOLOGY

8.17 The measures needed to stop, or at least dramatically limit, the supply of weapons, material and technology to would-be proliferators, are discussed extensively in later sections of this report. All are important, but none should be pursued in isolation from demand side strategies, designed to address the legitimate security concerns of states that feel themselves vulnerable (with both positive security assurances, as mentioned above, and negative security assurances in relation to the non-use of nuclear weapons, as discussed in Section 17, being centrally important tools in this respect). Nor – to repeat a central theme of this report – is much traction likely to be gained for these supply-side measures if major efforts are not simultaneously made to ensure that those with nuclear weapons move toward disarmament. For present purposes, the main supply-side strategies can be briefly summarized as follows.

8.18 *Strengthening the Nuclear Non-Proliferation Treaty.* The critical non-proliferation (as distinct from disarmament) needs here, discussed in detail in Section 9, are to make more effective the safeguards and verification, and compliance and enforcement, provisions of the treaty, and to strengthen the associated institutional machinery of the International Atomic Energy Agency.

8.19 *Strengthening non-proliferation disciplines outside the NPT.* As discussed in Section 10, this means appropriate support for, and strengthening where necessary, of the myriad of proliferation-related institutions and arrangements not premised on NPT membership, including informal mechanisms like the Nuclear Suppliers Group and Proliferation Security Initiative. It also means finding ways of bringing the NPT non-members into a framework of equivalent obligations and commitments.

8.20 *Banning testing.* The critical need here, as discussed in Section 11, is to bring the treaty finally into force and guarantee the continuation of the informal moratorium that has been generally observed since 1998.

8.21 *Limiting the availability of fissile material.* The immediate priority here, as discussed in Section 12, is to negotiate and bring into force a treaty to verifiably ban the further production of high enriched uranium and plutonium for weapons purposes.

8.22 *Securing loose weapons and material.* As discussed in Section 13 in the context of counter-terrorism – but with application also to basic non-proliferation objectives – the objective here is to achieve complete implementation as soon as possible of the cooperative threat reduction and other programs that have been designed, with worldwide reach, to secure from theft or other unauthorized access dangerous weapons, material and technology.

8.23 *Nuclear energy management.* The objective here, as discussed in Sections 14 and 15, is progressive achievement of multilateralized fuel cycle arrangements, proliferation-resistant technologies, and other measures designed to reduce the proliferation risks potentially associated with the expansion of civil nuclear energy.

Recommendations on Overall Non-Proliferation Strategy

4. Nuclear non-proliferation efforts should focus both on the demand side – persuading states that nuclear weapons will not advance their national security or other interests – and the supply side, through maintaining and strengthening a comprehensive array of measures (addressed in following recommendations) designed to make it as difficult as possible for states to buy or build such weapons. [8.9–16; see also Sections 9–15]

9. STRENGTHENING THE NUCLEAR NON-PROLIFERATION TREATY

IMPROVING SAFEGUARDS AND VERIFICATION

9.1 Non-nuclear-weapon states party to the Nuclear Non-Proliferation Treaty (NPT) accept an obligation, under Article III of that treaty, not to divert nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devises. To enable verification that they are fulfilling that obligation, they are obliged to conclude a safeguards agreement with the International Atomic Energy Agency (IAEA). Safeguards have an essential role, both in deterring diversion through the risk of detection, and through providing timely warning of diversion, to enable the international community to intervene. The credibility of the safeguards system depends on confidence in two respects: verification capability, and the enforcement actions that are taken on verification findings. These issues, and the closely related question of the institutional effectiveness of the IAEA, are discussed successively in what follows.

9.2 **Traditional safeguards.** The standard comprehensive safeguards agreement (formerly known as "fullscope") requires non-nuclear-weapon states to declare all nuclear material and facilities to the IAEA, to maintain nuclear accounting records, and to report changes; the IAEA in turn conducts inspections and other verification activities (e.g. operation of cameras, application of seals, environmental sampling) at nuclear facilities to confirm the correctness of the state's declarations, records and reports.

9.3 This "traditional" safeguards system was primarily focused on verifying *declared* nuclear materials and activities. It was assumed that development of fuel cycle capabilities independent of declared facilities would be beyond the resources of most states, and in any event would be readily detectable, and therefore if proliferation did occur, it was likely to involve diversion of nuclear material from declared facilities. The discovery of Iraq's clandestine nuclear program in the early 1990s – and other clear verification failures in Iran, Libya and Syria – have demonstrated that these assumptions are no longer valid.

9.4 Since then, IAEA and supporting states have been working to strengthen the safeguards system, focusing particularly on establishing the technical capabilities and legal authority necessary for detection of

undeclared nuclear activities. Central to these efforts is the effective use of information – involving collection and analysis of information that can enhance the IAEA's knowledge and understanding of nuclear programs – and providing more extensive rights of access to nuclear and nuclear-related locations, including for the resolution of questions arising from information analysis.

9.5 The IAEA's technical skills are increasing – but it cannot be expected to find undeclared nuclear activities unaided. Member states have given the agency vital assistance in development of and training in equipment, detection technologies (such as sensors and satellite imagery) and so on. But more is needed in the area of information-sharing. States have substantial information, including intelligence ("national technical means") and data on nuclear-related exports (encompassing both items supplied and items denied). So too, from time to time, do industry vendors who may, for example, receive supply enquiries giving reasonable grounds for suspicion. Detecting undeclared nuclear activities – or providing credible assurance of their absence – requires an active partnership between them and the IAEA and states, and to the extent possible with relevant industry sectors as well.

9.6 **Additional Protocol.** Underpinning the program to strengthen safeguards is the Additional Protocol – a (voluntary) legal instrument complementary to safeguards agreements, introduced in 1997, which establishes the IAEA's rights to more extensive information (on nuclear-related activity in manufacturing, exports and imports and the like) and wider access rights by inspectors (at nuclear sites, nuclear-related locations, and anywhere in a state to investigate "questions and inconsistencies" arising from information analysis). Of the 62 non-nuclear-weapon state NPT Parties with significant nuclear activities, 45 have an additional protocol in force and 11 have signed an Additional Protocol or had one approved by the IAEA Board – a total uptake of 90 per cent of such states.

9.7 This degree of acceptance demonstrates that the combination of a comprehensive safeguards agreement and an Additional Protocol represents the contemporary standard for NPT safeguards. It is of serious concern, however, that six non-nuclear-weapon states party to the NPT with significant nuclear activities (Argentina, Brazil, North Korea, Egypt, Syria and Venezuela) have yet to adopt the Additional Protocol, and that in addition Iran, which applied its Additional Protocol on a "provisional" basis from December 2003, has suspended cooperation under it since 2005. The Commission believes that, in order to encourage universal take-up of the Additional Protocol, all states should make acceptance of it by the recipient state a condition of their nuclear exports.

9.8 **"Weaponization" activities** An area of major importance concerns the IAEA's rights to investigate the range of possible nuclear activities, other than the acquisition of fissile material, necessary for the manufacture of a nuclear weapon or explosive device. Examples are the conversion of fissile material into metallic form and particular shapes; the development of high-explosive lenses, high-energy electrical components or high-flux neutron generators; implosion testing; and acquisition of certain non-nuclear materials significant in this context such as beryllium, polonium, tritium and gallium. Arguments about this arise because many of these activities may be dual-use. On a conservative view, the IAEA can only investigate activities where there is a "nexus" with nuclear material. The question is, what is a sufficient nexus? Since weaponization activities indicate intended, if not actual, diversion of nuclear material, they are clearly encompassed by the IAEA's responsibility under the NPT to provide timely warning of diversion. To the extent there may be doubts about the limits of the IAEA's mandate in this area, these should be addressed by the IAEA and member states and the necessary action taken to resolve them, as next discussed.

9.9 **"Additional Protocol Plus".** Concerns of this kind have led to suggestions that the current form of the additional protocol would benefit from further strengthening as to both reporting and access. On information, the Additional Protocol provides for amendment of its technical annexes by the IAEA Board of Governors on the advice of an open-ended group of experts. Inclusion of relevant dual-use items is one area that requires attention in this respect, and another is for states to report to the IAEA on export denials as well as export approvals. On further access, the issues include shorter notice periods, and the right to interview specific individuals: regarding the latter point there is a sound argument that this is already provided for in the IAEA's Statute, but this should be put beyond doubt. At a minimum, the Additional Protocol's annexes should be updated along the lines discussed here, and a strengthened version of it should be applied in cases of non-compliance, if necessary mandated by the Security Council.

9.10 **Changing the culture.** More is necessary than formal legal change if safeguards are to be effectively strengthened: changes in attitude and behaviour, in essence something of a cultural change, will be necessary on the part of both states and the IAEA. A key area to be addressed is the attitude of states to cooperation. It can no longer be considered appropriate for states to regard safeguards as an imposition, with cooperation kept to the minimum. Safeguards are an essential international confidence-building measure. As the IAEA is now expected to provide more qualitative conclusions – the absence of undeclared nuclear activities – a state's cooperation and transparency to the agency assume greater importance. The IAEA will need broader information, including access to locations and persons of interest. Denying access will simply serve to heighten international suspicions that

the state has something to hide. States need to look on safeguards as a mechanism they can use to demonstrate to others their commitment to non-proliferation.

9.11 While safeguards have been moving from a mechanistic to an information-driven system, cultural change is also required in the way that information is used. Information-sharing is increasingly important. This involves not just a greater preparedness of states to share information, including intelligence information, with the IAEA, but sharing of information by the agency itself – greater transparency of its own processes, and a re-evaluation of its longstanding practice that information provided to it is confidential. This practice is in marked contrast to more recent treaties, such as the Chemical Weapons Convention and the CTBT, where there is substantial sharing of information with the states parties.

9.12 IAEA safeguards may need to be complemented by confidence-building measures that enhance transparency amongst states. Such measures could have an important role in particular regions. Mechanisms could include collaborative nuclear projects, and bilateral or regional safeguards arrangements such as the Argentine–Brazilian Agency for Accounting and Control of Nuclear Materials (ABACC).

Recommendations on NPT Safeguards and Verification

5. All states should accept the application of the Additional Protocol. To encourage universal take-up, acceptance of it should be a condition of all nuclear exports. [9.7]

6. The Additional Protocol and its annexes should be updated and strengthened to make clear the IAEA's right to investigate possible weaponization activity, and by adding specific reference to dual-use items, reporting on export denials, shorter notice periods and the right to interview specific individuals. [9.8–9]

7. With safeguards needing to move from a mechanistic to an information-driven system, there should be much more information sharing, in both directions, on the part of both states and the IAEA, with the agency re-evaluating its culture of confidentiality and non-transparency. [9.10–11]

IMPROVING COMPLIANCE AND ENFORCEMENT

9.13 The NPT is notable for having no executive machinery: in particular, no decision-making mechanism for determining compliance with the treaty. Effectively, this function is entrusted to the IAEA, through the agency's conclusions regarding compliance with safeguards agreements. The IAEA and its processes bear directly on the effectiveness of the NPT, in that – whether or not this is usually articulated in so many words – a finding of non-compliance with a comprehensive safeguards agreement amounts inherently to a finding that the state is in violation of Article III of the NPT (creating the obligation to accept safeguards), and also, depending on the evidence, Article II (not to seek or acquire nuclear weapons or explosive devices).

9.14 **Determining compliance.** Under the IAEA's Statute, safeguards inspectors have the responsibility of determining in the first instance whether a state is in compliance with its safeguards agreement. They are required to report any non-compliance to the IAEA's Board of Governors (consisting of 35 of its 150 member states, meeting five times a year), and if the Board finds that non-compliance has occurred, it is required to report the non-compliance to the Security Council. Confidence in the security guarantees afforded by the NPT depends to a large extent on how well compliance problems are addressed by this system. A basic problem is that a finding of non-compliance almost inevitably involves both technical and political dimensions: it appears for example that concern about the possible adverse consequences of a non-compliance finding led in the case of Iran to the finding being delayed for three years, with significant risk to the integrity and credibility of the IAEA's processes.

9.15 It is important, if that credibility is to be maintained, that the IAEA confine itself essentially to technical criteria, applying them with consistency and credibility, and leaving the political consequences for the Security Council to determine. Issues of standard of proof become relevant here, and the IAEA has not helped itself by in practice setting the bar higher than its own standard safeguards agreements, which provide, for example, that a state may be found in non-compliance if the agency is not able to verify that there have been *no* diversions.

9.16 **Enforcing compliance.** It is for the Security Council to decide on measures to enforce compliance, but so far it has shown itself to be either unable or very reluctant to take strong action. In the case of North Korea, for example, the Security Council was unable to reach a decision, and the matter was referred to the Six-Party Talks. In the case of Iran, key states have been reluctant to apply sanctions or other measures with any real bite. It is entirely appropriate that the Security Council exercise its own judgment in

these cases, and be able to refrain from taking punitive action if it thinks there is a better chance of the matter in question being satisfactorily resolved thereby. But it conveys an unfortunate message if the starting assumption among Council members is apparently one of a degree of indifference to at least some kinds of safeguards violations. In this respect it is important, for the future integrity of the system, that the Security Council takes reporting violations and, in particular, failures to respond satisfactorily to requests for information, just as seriously as evidence of physical diversion of nuclear material.

9.17 **Withdrawal from the NPT.** A particular aspect of compliance and enforcement concerns the right given in the NPT for a state party to withdraw from the treaty. The concern is that a state might be withdrawing for the very purpose of diverting in future a civil nuclear program to production of nuclear weapons, and escaping in the process from having its treaty obligations enforced – because of the way current NPT safeguards agreements are drawn they, and the application of IAEA safeguards, lapse if the state in question withdraws from the NPT. Put another way, the concern is that a state might "shelter" under the NPT, apparently in compliance with its obligations, but preparing all the while – with its NPT-permitted production of fissile material – to divert that capability to military purposes after a subsequent pain-free withdrawal.

9.18 To date there has been only one (purported) withdrawal, by North Korea in 2003. Many NPT parties question the validity of this withdrawal, on the basis that Article X of the treaty provides that a Party may withdraw only "if it decides that extraordinary events, related to the subject matter of this Treaty, have jeopardized the supreme interests of its country", and that North Korea has not demonstrated satisfactorily that there were any such "extraordinary events". A slightly more compelling practical reason for hanging on to this rather slender procedural reed is that hopes continue to be held out that a negotiated return to compliance with the NPT may be possible, and that path might be easier to take if a formal withdrawal had not been accomplished; moreover, this interpretation would not require the renegotiation of any safeguards agreement that would lapse on actual withdrawal.

9.19 There is a formal right of state parties to withdraw from the NPT under Article X, but circumstances today – with the near-universality of the NPT and the increasing international concern to achieve progress with nuclear disarmament – argue for this no longer being considered an available option. Certainly there can be no question of accepting a state withdrawing from the NPT in order to escape the consequences of previous violations of the treaty, nor should a state be able to do so in order to use, for military

purposes, the fruits of peaceful nuclear cooperation. Three basic responses have been proposed, all of which the Commission supports.

9.20 The first is for the UN Security Council (to which the NPT requires notice of withdrawal be given) to severely discourage such withdrawals by making it clear that withdrawal will be regarded as prima facie a threat to international peace and security, with all the punitive consequences that may follow from that under Chapter VII of the UN Charter.

9.21 A second response would be a declaration by the NPT Review Conference that a state withdrawing from the NPT is not free to use for non-peaceful purposes nuclear materials, equipment and technology acquired while party to the NPT, and that any such material provided before withdrawal should so far as possible be returned – with this being enforced by the Security Council. The basis for this would be the principle in the international law of treaties that withdrawal does not absolve a party from performing any obligations that accrued prior to a valid exercise of its right to withdraw. There is an international expectation that nuclear material and items acquired by a state while party to the NPT, certainly from another state where there is a peaceful use expectation on the part of the supplier, will be used only for peaceful purposes.

9.22 To put at rest any legal doubt on this, a protocol to IAEA comprehensive safeguards agreements could be developed which applies safeguards in perpetuity to all existing nuclear material and facilities if for any reason the safeguards agreement ceases to apply. All states with comprehensive safeguards agreements could be asked to conclude such a protocol with the IAEA (of the content of which there is already an example in a provision of the IAEA/Albania safeguards agreement). In the case of states found in non-compliance, this could be mandated by the Security Council.

9.23 A third response to the withdrawal problem would be for states to make it a condition of nuclear exports that the recipient state agree that, in the event it should withdraw, safeguards shall continue with respect to any nuclear material and equipment provided previously, as well as any material produced by using it.

Recommendations on NPT Compliance and Enforcement

8. In determining compliance, the IAEA should confine itself essentially to technical criteria, applying them with consistency and credibility, and leaving the political consequences for the Security Council to determine. [9.15]
9. The UN Security Council should severely discourage withdrawal from the NPT by making it clear that this will be regarded as prima facie a threat to international peace and security, with all the punitive consequences that may follow from that under Chapter VII of the UN Charter. [9.20]
10. A state withdrawing from the NPT should not be free to use for non-peaceful purposes nuclear materials, equipment and technology acquired while party to the NPT. Any such material provided before withdrawal should so far as possible be returned, with this being enforced by the Security Council. [9.21–22]
11. All states should make it a condition of nuclear exports that the recipient state agree that, in the event it should withdraw from the NPT, safeguards shall continue with respect to any nuclear material and equipment provided previously, as well as any material produced by using it. [9.23]

STRENGTHENING THE INTERNATIONAL ATOMIC ENERGY AGENCY

9.24 **Authority.** An effective IAEA means in the first instance one with the necessary legal authority – this requires universalizing the Additional Protocol, and strengthening its provisions as discussed above. States must be prepared to take further steps to strengthen the agency's authority when deficiencies are identified. As a corollary of this, the IAEA must be prepared to make full *use* of the authority available to it. An illustration of reluctance to do so is the lack of use of special inspections, available where it considers that information provided by the state is not adequate for the agency to fulfil its responsibilities, a procedure which was last invoked in 1993. Failure to use the full authority available not only compromises safeguards effectiveness, but is discriminatory against the great majority of states that are in full compliance with their safeguards commitments.

9.25 **Staffing.** The IAEA suffers from the same drying up of the pool of nuclear expertise as other components of the global nuclear sector, civil

and military. Much of the workforce of nuclear scientists, engineers and managers is approaching retirement, and for nearly thirty years the career entry channels have nowhere kept up with replacement requirements. The growing interest in nuclear subjects in China and India is beginning to compensate, and the memories of Three Mile Island and Chernobyl that have discouraged interest elsewhere are fading. But significant expansion of the IAEA skills base is going to require more readiness on the part of national authorities and commercial firms to second their staff, more budgetary support to ensure positions offered are competitive, and more training opportunities through collaborative arrangements with universities and research centres around the world. It is simply not acceptable or safe that international assurance of non-proliferation is ultimately dependent on a handful of ageing experts, their numbers capped by artificial ceilings and geographical recruitment quotas and their conditions limited by zero growth formulae.

9.26 **Funding.** The IAEA must have appropriate funding to ensure necessary staffing and equipment, and also requires support from states in developing equipment, methodologies and training. As civil nuclear programs grow, and more states take up nuclear power, the IAEA's work grows commensurately, and it may be entrusted with new responsibilities in other areas – for example verification of fissile material released from military programs as a consequence of disarmament – which will also need to be sufficiently, and reliably, resourced. The IAEA's funding arrangements, with many governments continuing to insist on zero real growth, must be broken out of the UN agency mould.

9.27 The adequacy of the overall budget is the biggest single issue here, and – recognizing the crucial importance for international peace and security of its works – the Commission endorses the detailed recommendations in this respect in 2008 of the independent Commission on The Role of the IAEA to 2020 and Beyond, chaired by President Ernesto Zedillo, which proposed, inter alia, a one-off increase to refurbish the agency's Safeguards Analytical Laboratory, and a growing regular budget, estimated as needing to perhaps double by 2020. It is unacceptable that a function of such fundamental importance as nuclear security continues to be treated largely on an extra-budgetary basis. States of course are entitled to ask for full substantiation of any claims made, and the agency itself needs to assist the budget process through rational decisions on internal prioritization.

9.28 **Organizational culture.** The reasons for safeguards failures need to be carefully addressed and not just attributed to resource shortfalls, insufficient internal capabilities and inadequate information supply: there is a need to consider if systemic factors are involved, going to the whole organizational culture of the institution. Linked to this is the need for greater transparency in the IAEA's internal processes, how judgments are reached and decisions

taken in the safeguards area especially, and – as discussed earlier in this section – a new approach to information sharing, in which states and the agency work together as partners. An external review of these issues by the Zedillo Commission, or a successor panel, might be helpful in encouraging a rethink of entrenched institutional attitudes and practices.

Recommendations on Strengthening the IAEA

12. The IAEA should make full use of the authority already available to it, including special inspections, and states should be prepared to strengthen its authority as deficiencies are identified. [9.24]

13. If the IAEA is to fully and effectively perform its assigned functions, it should be given, as recommended in 2008 by the Zedillo Commission:

    (a) a one-off injection of funds to refurbish the Safeguards Analytical Laboratory;

    (b) a significant increase in its regular budget support, without a "zero real growth" constraint, so as to reduce reliance on extra-budgetary funding for key functions;

    (c) sufficient security of future funding to enable medium to long term planning; and

    (d) support from both states and industry in making staff secondments and offering training opportunities. [9.25–27]

14. Consideration should be given to an external review, by the Zedillo Commission or a successor panel, of the IAEA's organizational culture, in particular on questions of transparency and information sharing. [9.28]

10. STRENGTHENING NON-PROLIFERATION DISCIPLINES OUTSIDE THE NPT

NON-NPT TREATIES AND MECHANISMS

10.1 While the Nuclear Non-Proliferation Treaty (NPT) is the cornerstone of the global non-proliferation regime, it is absolutely not the whole structure. A large and growing number of inter-related and mutually reinforcing legal instruments, institutions, programs, initiatives and arrangements complement the NPT and its associated IAEA safeguards system. Although most them rarely if ever make news or capture the attention of high-level political leaders, and they vary in their individual effectiveness, these instruments and arrangements collectively make a major contribution to the non-proliferation cause. Part of their significance is that the great majority of them are of universal, or potentially universal, application, and therefore embrace, or are capable of embracing, those states who remain outside the NPT (See Box 10-1).

10.2 Most of the treaties and mechanisms relevant here are discussed separately elsewhere in this report, notably the Comprehensive Nuclear-Test-Ban Treaty (CTBT) (Section 11), the proposed Fissile Material Cut-off Treaty (FMCT) (Section 12), specific measures focused on securing nuclear weapons, materials and technology from both potential terrorists and would-be state proliferators (Section 13), measures aimed at reducing or eliminating the proliferation risks associated with the expansion of civil nuclear energy (Sections 14 and 15), nuclear weapon free zones and associated measures designed to reinforce the non-proliferation norm in particular regional settings (Section 16), and – more indirectly – measures like the Missile Technology Control Regime focused on limiting the availability of certain delivery systems (Section 2). Two additional mechanisms not discussed elsewhere, however, deserve attention here: the Nuclear Suppliers Group and the Proliferation Security Initiative.

10.3 **Nuclear Suppliers Group (NSG).** Much of the day-to-day multilateral implementation of non-proliferation norms falls to this informal arrangement of 46 nuclear supplier states that seeks to prevent, through the coordination of national export controls, the transfer of equipment, materials and technology that could contribute to nuclear weapons programs in states other than those recognized as nuclear-weapon states in the framework of the NPT.

10.4 Built on the foundations laid by an earlier informal group, the Zangger Committee (named after its inaugural Swiss chairman), which continues to maintain a "trigger list" identifying nuclear-related strategic goods, the NSG was founded in 1974 in response to the Indian nuclear test earlier that year, which demonstrated that certain non-weapons specific nuclear technology could be readily turned to weapons development, and showed the need to further limit the export of nuclear equipment, materials and technology. The NSG rules forbid nuclear trade with a country which is not party to the NPT, apart from the highly controversial "India exception" agreed by the NSG in September 2008 pursuant to the U.S.–India agreement, discussed below.

10.5 The NSG has critics as well as supporters. One criticism – frequently voiced since the India agreement – is that members may be driven by commercial incentives to be less rigorous in their approach to countries not applying comprehensive safeguards or not party to the NPT. Another more longstanding complaint is that the NSG restricts legitimate trade with states which are in full compliance with the NPT: similar criticisms are made of other export control groups such as the Australia Group in the chemical and biological weapons context. Another concern, from a different perspective, is that the NSG depends on the voluntary application of the export controls of its members, and that its decisions are made by consensus: these factors are seen as limiting capacity for agreement on both the countries which should be denied exports, and measures by members (in practice more or less limited to diplomatic pressure) to enforce compliance. Given its important role in the overall non-proliferation regime, it is important that the NSG heed these criticisms and do its utmost to maintain both its effectiveness and credibility.

10.6 **The NSG-India Agreement.** The NSG's credibility has been put most at risk by its decision in September 2008 to exempt India from rules barring nuclear cooperation with states outside the NPT that do not accept international safeguards on all of their nuclear facilities. The United States and India instigated this change, strongly encouraged by France and Russia, which welcomed the opportunity for nuclear commerce with India. Any one of the NSG's 46 member states could have blocked the exemption, because the group operates by consensus. Several wanted to, but none did, due largely to commercial interests in India and political pressure from the United States.

10.7 The main substantive problem with the deal is that it removed all non-proliferation barriers to nuclear trade with India in return for very few significant non-proliferation and disarmament commitments by it. The view was taken that partial controls – with civilian facilities safeguarded – were better than none. But New Delhi was not required, for example, to commit to sign the CTBT or to undertake a moratorium on production of fissile

BOX 10-1

MAJOR NON-PROLIFERATION MEASURES COMPLEMENTING THE NPT

Limits on nuclear weapons testing and production of fissile material

- Comprehensive Nuclear-Test-Ban Treaty (CTBT)
- Proposed Fissile Material Cut-off Treaty (FMCT)

Nuclear export controls

- Restraints on the supply of sensitive nuclear technology, largely coordinated by the Nuclear Suppliers Group (NSG)

Cooperative law enforcement

- Coordination of national activities, including through the Proliferation Security Initiative (PSI)

Information and intelligence sharing

- National intelligence activities, and information-sharing between governments and with the IAEA

Security measures designed to prevent terrorism and proliferation

- Convention on the Physical Protection of Nuclear Material 1987 and its 2005 amendment
- Security Council Resolution 1540 of 2004, requiring all states to criminalize the proliferation of WMD to non-state actors, apply strict export controls on sensitive technologies and secure sensitive materials

Measures designed to eliminate proliferation risks associated with the expansion of civil nuclear energy

- Development of proliferation-resistant fuel cycle technologies
- Endeavours to multilateralize key stages of the nuclear fuel cycle

Nuclear weapon free zones

- Establishment and further development of weapons of mass destruction free zones and associated regional and bilateral arrangements

Other security and arms control arrangements

- Including endeavours to curb missile proliferation like the Missile Technology Control Regime (MTCR)

materials for nuclear weapons, either unilaterally or even upon reciprocation by Pakistan and China. This accommodation of India has tended to generate resentment among many states over the special treatment afforded to one, and to encourage others, including North Korea and Iran, to believe they should or would be forgiven if they acquire nuclear weapon capabilities. And within the NSG, the experience of relaxing enforcement for India over the objections of non-proliferation bureaus has weakened confidence in the integrity and enforceability of the non-proliferation regime.

10.8 Pakistan and Israel would no doubt want the same terms New Delhi received in any cooperation deal with them. This could be possible if the NSG were to develop a criteria-based approach to cooperation with states that never signed the NPT: what would be involved would not be an exemption from old rules, but the establishment of new ones. Beyond ratification of the CTBT and being willing to end unsafeguarded fissile material production, such criteria could include a strong record of securing nuclear facilities and materials and maintaining controls on nuclear-related exports; rigorous sustained efforts to prevent terrorists from operating on their soil and to cooperate with international counter-terrorism activities; and a demonstrable economic need for peaceful nuclear cooperation.

10.9 Pakistan and Israel could choose to meet these criteria at any time and become eligible for nuclear cooperation. If they preferred rather to wait until all other states had implemented these measures, or their regional security environment had markedly improved, they could do so understanding they would not receive nuclear cooperation meanwhile. The U.S., Russia, France and other states could in the meantime urge India to ratify the CTBT and end fissile material production for weapons. If and when India did so, the standards set for India, Pakistan and Israel would be the same, and the distortion created by the NSG-India deal would be corrected.

10.10 **Proliferation Security Initiative (PSI).** This was launched by the U.S. in May 2003, with the purpose of interdicting ships, aircraft and vehicles suspected of carrying nuclear and other weapons of mass destruction, ballistic missiles and related technologies to or from countries of proliferation concern. Participating states – now numbering over 95 – claim a right to detain and search suspect shipments as soon as they enter into their territory, territorial waters or airspace, but it remains unclear just how far some of them support the initiative in general terms, as distinct from specific interdictions which interest them. Support is particularly weak in Asia. With the U.S. usually unwilling to share relevant intelligence, and interdictions usually cloaked in secrecy, there is little objective way to measure success or failure.

10.11 A number of states question the legal validity of the PSI, particularly cases where the goods being transported are dual use items which have peaceful civilian, as well as possible WMD, uses. China, for instance, argues

that the PSI is in direct contravention of the UN Convention on the Law of the Sea which guarantees the free transit or "innocent passage" of ships on the high seas. Since trading in WMD is not directly prohibited by international law, it is not possible to equate ships carrying such goods with pirate vessels or slave ships which *can* be stopped and boarded under international law. U.S. officials have tended to respond to these concerns with general assertions that current national and international laws provide a sufficient basis for the initiative, and by saying that the longer term objective is, in any event, to have all countries enacting and strictly enforcing export control laws so as to make the PSI unnecessary. Others have suggested putting the matter beyond doubt through a UN Security Council resolution expressly permitting the interception of WMD shipments in international waters or airspace.

10.12 Bringing the PSI into the UN system and providing a budget for it would rectify many of its perceived shortcomings and in the long run improve its effectiveness. The PSI's reach and effectiveness could also be improved by eliminating double standards, increasing transparency, and establishing a neutral organization to assess intelligence, coordinate and fund activities, and make recommendations or decisions regarding specific or generic interdictions— of a kind perhaps modelled on the committee set up to oversee implementation of UN Security Council Resolution 1540 (discussed in Section 13).

Recommendations on Non-NPT Treaties and Mechanisms

15. The Nuclear Suppliers Group (NSG) should develop a criteria-based approach to cooperation agreements with states outside the NPT, taking into account factors such as ratification of the CTBT, willingness to end unsafeguarded fissile material production, and states' record in securing nuclear facilities and materials and controlling nuclear-related exports. [10.3–9]

16. The Proliferation Security Initiative (PSI) should be reconstituted within the UN system as a neutral organization to assess intelligence, coordinate and fund activities, and make both generic and specific recommendations or decisions concerning the interdiction of suspected materials being carried to or from countries of proliferation concern. [10.10–12]

APPLYING EQUIVALENT OBLIGATIONS TO STATES NOW OUTSIDE THE NPT

10.13 One of the greatest challenges to creating a world free of nuclear weapons is the non-signature by India, Pakistan and Israel of the NPT and, their non-subjection as a result to the legal obligations and commitments of either nuclear-weapon states or non-nuclear-weapon states under that treaty, and their production of unsafeguarded fissile material – and nuclear weapons. The rest of the world calls for these three states to join the NPT as non-nuclear-weapon states and thereby make the treaty universal (treating North Korea for this purpose as a lapsed rather than non-member). But they are unwilling to join the NPT on this basis and cannot be forced to do so. Nor is there any constituency for them joining as nuclear-weapon states: the procedures for amending the NPT to allow such a change almost guarantees that this will not happen.

10.14 Given this stalemate, the practical question is how to induce these three states to uphold non-proliferation and disarmament norms and practices at least as rigorous as those accepted by nuclear-weapon states under the NPT, even though they will not formally receive the legitimacy of the recognized nuclear-weapon states. India, Pakistan and Israel each have different motivations and decision-making considerations, but for the purposes of strengthening the global nuclear order it is important that they commit themselves to internationally recognized standards in relation to non-proliferation, and become no less committed to disarmament than the original five nuclear-weapon states.

10.15 In the absence of a solution in the foreseeable future for the NPT stalemate, one way of bringing the "three elephants" into the same room as everyone else might be to start again from the beginning with a new, comprehensive treaty arrangement, that would set both non-proliferation and, as relevant, disarmament commitments for all states irrespective of their status under the NPT. But while a new all-embracing "Nuclear Weapons Convention" of this kind has, as discussed elsewhere in this report, many attractions, and will clearly be a necessary accompaniment to the final stages of any move to a nuclear weapon free world, those attractions do not extend to the ease or speed with which its terms will be able to be negotiated. The need for the three to become integrated into the global nuclear order to the greatest extent possible is too urgent and important to wait upon that process.

10.16 The only available option, given these realities, is to multiply the number of parallel instruments and arrangements, alongside the NPT, in which the three participate. For the great majority of the treaty and other mechanisms described or referred to above – including centrally important

ones like the CTBT and FMCT – membership in the NPT is not a requirement, and non-membership of that treaty not an obstacle. India, Pakistan and Israel could and should demonstrate their commitment by going down this path. Israel already exercises stringent controls over its nuclear materials, technology and know-how and has signed relevant international conventions on these issues; it has also signed (though not ratified) the CTBT, unlike India and Pakistan. There is widespread speculation that it has already ended fissile material production, but equally it may be no less reluctant than India and Pakistan to close off this option without seeing major improvements in its security environment: either way, it should be put under pressure to do so.

10.17 It is not unthinkable, as part of this general approach, that bilateral or multilateral agreements be signed with any of the three allowing them access to nuclear materials and technology on the same basis as any NPT member *provided* they satisfied certain objective criteria showing their general commitment to disarmament and non-proliferation, and signed up to specific future commitments in this respect. As discussed above, the India-U.S. agreement, as subsequently endorsed by the NSG, is a very unfortunate precedent in this respect. While it is highly unlikely that the NSG will now agree to a similar deal for Pakistan and Israel, if one were to be contemplated the Indian agreement will make it considerably more difficult to extract stronger terms than those won by India. But the NSG should insist on nothing less, including ratification of the CTBT, and moratoria on unsafeguarded production of fissile materials pending negotiation of a fissile material production cut-off treaty.

10.18 The most feasible way to integrate India, Pakistan and Israel into the international non-proliferation order may in fact be through a global disarmament process of the kind discussed later in this report, in Sections 17 and 18: this strategy can be pursued independently of formal NPT forums that exclude India, Pakistan and Israel, but is consistent with the ultimate objectives of the treaty. By definition, global nuclear abolition will not occur unless and until these three states have disarmed. And these three states will not eliminate their nuclear deterrents unless and until China, the U.S. and others have done so, and concerns like those generated by the situations in Iran and North Korea have been eliminated. From the perspective of a realistic nuclear disarmament strategy, it makes no more sense to single out India, Pakistan or Israel and demand that they will disarm unilaterally than it does to expect that the U.S., Russia or China will do so. Conversely, it *is* reasonable to expect these three states to participate in multilateral nuclear disarmament negotiations and processes undertaken by the other nuclear-armed states.

Recommendations on Extending Obligations to Non-NPT States

17. Recognizing the reality that the three nuclear-armed states now outside the NPT – India, Pakistan and Israel – are not likely to become members any time soon, every effort should be made to achieve their participation in parallel instruments and arrangements which apply equivalent non-proliferation and disarmament obligations. [10.13–16]

18. Provided they satisfy strong objective criteria demonstrating commitment to disarmament and non-proliferation, and sign up to specific future commitments in this respect, these states should have access to nuclear materials and technology for civilian purposes on the same basis as an NPT member. [10.17]

19. These states should participate in multilateral disarmament negotiations on the same basis as the nuclear-weapon state members of the NPT, and not be expected to accept different treatment because of their non-membership of that treaty. [10.18]

11. BANNING NUCLEAR TESTING

IMPORTANCE OF THE COMPREHENSIVE NUCLEAR-TEST-BAN TREATY

11.1 It is difficult to overstate the importance of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) as a crucial building block for both non-proliferation and disarmament. It sets, in effect, a qualitative cap on the capacity of both existing weapons possessors and potential new ones to develop new nuclear weapons. In doing so, it complements and reinforces the role of the other crucial building block, the still-to-be-negotiated treaty cutting off the production of fissile material for weapons purposes, discussed in the next section, which sets a quantitative cap.

11.2 Before the treaty's conclusion in 1996, the world had conducted 2,044 nuclear explosions, roughly one every nine days for 50 years. Although the CTBT is still not yet in force (because it requires ratification from 44 specifically identified states – those with nuclear reactors at the time – nine of whom are still holding out), an informal moratorium has been in effect since then, with the only tests subsequently carried out being those by India and Pakistan in 1998, and by North Korea in 2006 and 2009. But the moratorium remains fragile so long as the CTBT and its monitoring regime are not in formal legal effect, and bringing the treaty into force – with the U.S. needing to play a leadership role in this respect – must be a central short term priority.

11.3 The CTBT was a long time coming. First proposed by Indian Prime Minister Nehru in 1954, against the background of both the U.S. and USSR carrying out hydrogen bomb tests which produced major radioactive fallout and spurred worldwide protest, negotiations led initially to the signature by the U.S., the USSR and the UK of a Partial (or Limited) Test Ban Treaty (PTBT) in August 1963, which banned nuclear tests in the atmosphere, in space and under water. A bilateral Threshold Test Ban Treaty (TTBT), which banned underground nuclear weapons tests with a yield of more than 150 kt, was signed by the USSR and the U.S. in 1976, although it entered into force only in 1990.

11.4 Following the end of the Cold War, the USSR, U.S. and UK announced a moratorium on nuclear testing, and the Conference on Disarmament in Geneva, after three years of negotiations from 1994–96, finally produced an

agreed CTBT text, though could not reach consensus on its transmittal to the UN General Assembly. Australia then took the initiative of introducing the treaty at the General Assembly, which in September 1996 overwhelmingly approved it, 158–3, with only India, Bhutan and Libya voting against.

11.5 In the twelve years since the treaty was opened for signature and ratification, 182 states have signed, of whom 151 have ratified. Of the nine ratifications still required to bring it into force, six are from countries which have signed (China, Egypt, Indonesia, Iran, Israel and the U.S.) and the remaining three are from, to date, non-signatories (India, Pakistan and North Korea). The biggest setback to the treaty's progress was the failure of the U.S. Senate in October 1999 to vote for ratification, in a 48–51 party-line vote that failed to even secure a majority, let alone the necessary 67 votes. Two substantive questions dominated the U.S. debate, then as now – whether there could be reliable detection of anyone breaking the treaty, and whether the reliability of the U.S. arsenal could be guaranteed in the absence of periodic explosive testing. There is now much more information available to answer those questions affirmatively, as explained below, than was the case for the Clinton administration in 1999. But despite the stated determination of President Obama in his April 2009 Prague speech to "immediately and aggressively pursue U.S. ratification" of the treaty, no-one doubts that this will still be a formidably difficult political task.

11.6 Of the remaining holdout states, there is strong basic support for the treaty in China and Indonesia. Indonesia has announced it is proceeding with ratification, and China's ratification can certainly be expected if the U.S. moves. The Middle East trio of Egypt, Iran and Israel are more problematic, with all supporting the treaty in principle, but each inclined to make ratification conditional at least on that of the others (and with Egypt, for one, insisting that Israel has to first join the NPT): in breaking out of that circle, much will clearly depend on how the current Iran issue is resolved, but movement on a wider regional peace front may also be a precondition.

11.7 In South Asia, Pakistan is likely to take its cue from India, which – despite longstanding general support in principle – has never found the time ripe for acceptance in practice, in the absence of significant movement on disarmament by the original nuclear-weapon states. India's current position is that it will reconsider its position "if the world moves categorically toward nuclear disarmament in a credible time frame", which – if international momentum continues to build in the way described and recommended in this report – gives some hope for a more accommodating stance. Whether North Korea will ever join the treaty clearly depends on the resolution of the current much broader dispute about its nuclear aspirations and behaviour.

11.8 What is clear is that U.S. ratification would be a circuit-breaker, having an immediate impact on the other CTBT hold-out states, and creating much new momentum in itself for the broader non-proliferation and disarmament agenda. What the non-nuclear-armed states have long argued for – along with those like India and Pakistan reluctant to accept formal NPT and other treaty disciplines – is an evident sense of seriousness on the part of the inner core of nuclear-weapon states that they really do want to move toward a nuclear weapon free world, and U.S. ratification of the CTBT would provide real evidence of that. It becomes extremely important, again, in this context, to fully answer the concerns which have been articulated about verification effectiveness and ensuring stockpile reliability in the absence of testing: doing so may not be a sufficient condition for garnering 67 Senate votes, but it is certainly a necessary one.

ADDRESSING VERIFICATION AND STOCKPILE RELIABILITY CONCERNS

11.9 **Verification.** Even though the CTBT is not in force, a great deal of progress has been made in developing the complex verification infrastructure it provides for – the International Monitoring System (IMS). A functioning treaty organization, albeit with a transitional name, the "Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization", is alive and well and living in Vienna, with a budget of $111 million, and universally known as the CTBTO. The IMS will involve, when complete – and it is close to 80 per cent ready now (with the major remaining task being to improve coverage in the West Asia area) – 337 monitoring stations on land and at sea worldwide, applying four distinct technologies: seismic, radionuclide, hydro-acoustic and infrasound. Those stations already send a constant flow of information via satellite to a sophisticated International Data Centre (IDC), which monitors and analyses the data, and makes it available to states parties to the treaty, both in distilled and raw form. Many states, in turn, operate national data centres (NDCs) to identify and further analyse events that are of interest and possible concern to them, using where applicable their own "national technical means".

11.10 The treaty provides for a state party to demand on-site inspection (OSI) in the event of a suspicious event being detected, and this is approved by 30 of the 51 members of the treaty's Executive Council. This would be particularly useful in situations where the evidence is ambiguous or incomplete, for example with seismic but no radionuclide data. The CTBTO has held field exercises – including a very major one at the former Soviet test site at Semipalatinsk in Kazakhstan in 2008 – to test the technologies involved, including visual ground inspection, over-flights, local seismic networks, radionuclide monitoring and ground-penetrating radar.

11.11 Concerns were expressed from the outset, and particularly in the U.S. Senate debate in 1999, that the proposed IMS would, for all its complex coverage, be unable to detect low-yield underground tests: the originally anticipated detectable yield of around 1 kiloton was seen as too high. But innovations in monitoring technologies over the years mean that the system can detect an explosion of as little as 0.1 kt in most parts of the world, and a 0.01 kt (i.e. equivalent to 10 tons of TNT) explosion in many critical regions. Although the North Korean underground test in 2006 had an estimated yield of only around 0.5 kt, it was detected by 22 IMS seismic stations, including one 7,000 km away. And a gas from the test, xenon-133, emitted in minute quantities from ground fissures, was detected twelve days later by a radionuclide station in Canada. The May 2009 North Korean test, somewhat larger, was picked up by 61 seismic stations. Very small nuclear explosions – smaller than those now readily detectable, or which will be when the full complement of monitoring stations is in place – are generally thought to be beyond the capacity of any country without significant nuclear test experience, and to have in any event no strategic value.

11.12 The CTBT presents a model for verification that is unlike other multilateral arms control instruments. It provides that responsibility for analysis of verification data, and judgments on compliance, lies with states parties. As preparations have been made for the treaty's entry into force, focus has naturally fallen on the development of the CTBTO-developed and operated infrastructure just described – and clearly an effective and adequately resourced CTBTO will be crucial in effectively implementing the treaty's detection mechanisms. But individual states also have to establish their own national data centres, and there is much that many of them can do with their own information gathering resources. More attention needs to be paid to developing cooperative arrangements for the further integration of all these components.

11.13 **Stockpile Reliability.** While the CTBT is interpreted to allow for non-explosive (or sub-critical) tests, its ban on nuclear test explosions clearly significantly restricts, as it is meant to do, one major avenue of scientific enquiry. The question – particularly resonant in the U.S., not least its Senate – is whether this inhibits the capacity to discover and resolve potential problems that might affect weapon safety or reliability. The short answer is that it does not, on the basis of analysis and experience so far in the U.S. and elsewhere, but the issue will no doubt continue to generate lively debate. An authoritative contribution to finally resolving the issue seems likely to be made by the National Academy of Sciences Committee on International Security and Arms Control (NAS-CISAC) which has been tasked by the Obama administration to review and update its earlier 2002 study, widely regarded as definitive.

11.14 The last U.S. test was in 1992, and in the years since it has relied on a combination of computer simulation, non-nuclear explosive testing and scientific research, referred to as the Stockpile Stewardship Program (SSP). This SSP has involved the re-manufacture of some weapons components to overcome effects of ageing, but has not altered the design of the nuclear explosive package at the centre of a weapon. It has also investigated the longevity of current weapons, and has usefully assuaged concerns about, for example, the deterioration over time of the plutonium core. Technical assessment of the success of the SSP for extending the life of current weapons has been positive.

11.15 Whether life extension activities are sufficient for the long term (twenty or more years in the future) continues to be questioned, however, by those who see a wider role for the SSP, including the development and deployment of new weapon designs. The concept of a Reliable Replacement Warhead (RRW) – though shelved by the Obama administration – continues to surface in debate as a means of modernizing U.S. nuclear weapons, ensuring their long term reliability without nuclear explosive testing. Even if the CTBT were not directly breached, it would raise questions about its value – and certainly undermine the presentational impact worldwide of U.S. ratification of it – if new weapon designs could be developed, especially ones with a new military role.

11.16 It may be, however, that this dilemma can be navigated. The 2009 report of the Congressional Commission on the Strategic Posture of the United States – headed by two former Defense secretaries of rather different outlooks on these matters, William Perry and James Schlesinger – notes that there is a third position available between the two ends of the spectrum ("the pure remanufacturing of existing warheads with existing components at one end, and complete redesign and new production of all system components at the other"), viz. "various options to utilize existing components and design solutions while mixing in new components and solutions as needed." Given the success of life extension under the SSP, it seems likely that judicious use of new components and design solutions, as they may become necessary, could continue to give assurance about safety and reliability over the long term, but minimize the risk of international reaction associated with the development of a new design.

11.17 The other nuclear-weapon states that have ratified the CTBT have substantial stockpile stewardship programs without significant concerns being expressed about the constraints imposed by the treaty. The UK continues to conduct active research and other activities though its Atomic Weapons Establishment to maintain its nuclear weapons, clearly premised on no nuclear testing, as does the French Atomic Energy Commission which tests the country's nuclear arsenal through simulations using advanced

equipment. Stockpile stewardship in Russia is managed through the state corporation Rosatom, which pools the institutions working on military programs, the research institutes and nuclear safety agencies.

Recommendations on Banning Testing

20. All states that have not already done so should sign and ratify the CTBT unconditionally and without delay. Pending entry into force, all states should continue to refrain from nuclear testing. [11.1–8]

21. All signatories should provide the necessary financial, technical and political support for the continued development and operation of the CTBTO, including completing the global coverage of its monitoring systems, facilitating on-site inspection when warranted, and establishing effective national data centres and information gathering systems. [11.9–12]

12. LIMITING THE AVAILABILITY OF FISSILE MATERIAL

THE PROPOSED FISSILE MATERIAL CUT-OFF TREATY

12.1 **Role and importance of the treaty.** The proposed treaty to verifiably ban the production of further quantities of fissile material for use in nuclear weapons is as important a building block for both non-proliferation and disarmament as the CTBT. But, given current differences of perceived national interest between those nuclear-armed states which have a sufficiency or surfeit of fissile material (the U.S., Russia, France and UK) and those who seem to wish to preserve the freedom, at least for some time, to add to their stocks (India and Pakistan, and possibly China), and taking into account North Korea's current intransigent position, it is likely to prove no less difficult than the test ban treaty to quickly negotiate and bring into force.

12.2 The fissile materials in question are basically high enriched uranium (HEU) and separated plutonium. For present purposes HEU is usually defined as uranium enriched to 20 per cent or more in the isotope uranium-235, from which a nuclear explosive device could theoretically be made, but in practice this is likely to require enrichment to 70 per cent or more U-235, and weapons grade HEU is usually defined as 90 per cent or more. For safeguards and general non-proliferation purposes a conservative approach is taken, erring on the side of caution on the basis that HEU at the lower end of the range has potential as a feedstock for higher enrichment.

12.3 The plutonium of interest in the present context is "separated" plutonium, because this essentially man-made element, produced by irradiating uranium fuel in reactors, is not available for use in nuclear weapons until separated from spent fuel by reprocessing. Weapons grade plutonium is usually defined as containing a low proportion of the isotope Pu-240 as compared with the isotope Pu-239 (no more than 7 per cent of the former, and a correspondingly high percentage of the latter) which requires reactors to be designed and operated in a particular way which is inefficient for power production. Spent fuel from the normal operation of power reactors contains only "reactor grade" plutonium, which typically contains 25 per cent or more Pu-240, and a correspondingly lower proportion – 60-70 per cent – of Pu-239. Again, however, for policy purposes a conservative definitional approach is taken, given at least the theoretical possibility of producing a nuclear explosive device from reactor grade plutonium.

12.4 Non-nuclear-weapon states party to the NPT have already given a commitment, verified by IAEA comprehensive safeguards, not to produce fissile material for nuclear weapons. The essential purpose of the proposed Fissile Material Cut-off Treaty (FMCT) is to apply a similar commitment – including appropriate verification – to the nuclear-weapon states and the non-NPT parties, in a new non-discriminatory treaty of universal application. A moratorium on the production of the relevant material is being observed by four of the five NPT nuclear-weapon states, but possibly not by China, apparently not by India and Pakistan outside the NPT (Israel's position is unclear), and certainly not by North Korea. Making the moratorium a legal obligation of general application through an FMCT would help to stabilize the general security environment, reducing the prospects of future arms races and contributing to the irreversibility of nuclear disarmament measures. An FMCT, with verification provisions emphasizing state accounting for and control of fissile materials, should also contribute positively to the strengthening nuclear security, reducing the possibility of dangerous material falling into the hands of non-state actors.

12.5 Efforts to get negotiation started on an FMCT began in 1995, when it was hoped that the Conference on Disarmament (CD) would move on to this immediately after it concluded its work on the CTBT. The "Shannon Mandate" of that year, named for the then Canadian CD ambassador, appeared to signal agreement on negotiation of a treaty that would be non-discriminatory, fully multilateral, and internationally and effectively verifiable, but that turned out to be a mirage. The CD wasted fourteen years struggling to agree on a negotiating mandate, until – with the U.S. reversing opposition to verifiability which it had maintained during the previous administration – something of that kind was finally adopted in June 2009. But endless further possibilities remain for disagreement on matters of agenda, specific work program, meeting schedules and the like, not to mention the very substantive issue of existing stocks, discussed separately below.

12.6 The principal issue that needs to be settled in the negotiations is the proposed treaty's scope – the materials and facilities that will be covered. At a minimum it should apply to new production (i.e. post the treaty's entry into force) of fissile material, with verification arrangements applied to newly produced fissile material to ensure it is not used for nuclear explosives, and enrichment and reprocessing facilities to ensure that all new production is declared.

12.7 **Verification.** A crucial issue will be how verification is implemented. In this regard, there is already a well-established system directly relevant to FMCT objectives, i.e. IAEA safeguards. Every state relevant to FMCT already has a safeguards agreement with the IAEA, albeit of more limited scope in the nuclear-weapon states and the non-NPT states. Building on the existing

IAEA safeguards system, supplementing existing safeguards agreements as necessary, makes sense in technical (existing expertise), economic (rational use of scarce human resources) and political acceptability terms. Difficult as they will be, the verification issues are not in themselves insuperable, since the inspections would not require access to nuclear warheads and their associated facilities.

12.8 FMCT safeguards should be non-discriminatory, in contrast to the NPT regime. HEU enrichment and processing facilities, reprocessing and plutonium-separation facilities should come under a regime which treats nuclear-armed and non-nuclear states in the same way. But, as with the NPT, issues of enforcement would need to be referred to the UN Security Council.

12.9 As part of implementing verification in a cost-effective manner, a state-level approach could be developed, building on experience being gained with the state-level approach in IAEA safeguards. With a state-level approach, the technical verification objectives and parameters will be the same for all states, but decisions on verification intensity could take account of state-specific factors.

12.10 A major challenge will be implementing verification approaches in old facilities not designed with verification convenience in mind, i.e. enrichment and reprocessing plants in the nuclear-weapon states. These are likely to require intensive verification effort, and the more of these facilities that can be shut down and decommissioned, the more manageable the verification task will be. A further particular challenge will be establishing appropriate verification arrangements against diversion of fissile material used for non-prescribed non-peaceful purposes – i.e. naval reactor programs.

12.11 The greatest verification challenge will be addressing the possibility of undeclared fissile material, i.e. nuclear material and activities that are required to be declared under the FMCT. This would be a substantial departure from the current situation, where the nuclear-weapon states and non-NPT parties have nuclear material and facilities outside any safeguards coverage. Under the FMCT, these states will continue to have some unsafeguarded material (in particular, in the form of nuclear weapons) and locations where this material is stored and processed (e.g. processing for stockpile stewardship). However, it will be essential to provide for verification activities to counter, and to investigate, possible undeclared production of fissile material, which clearly would be a violation of the FMCT.

12.12 **Irreversibility.** The key provisions of the FMCT should be irreversible, meaning for a start that if a state were to withdraw from the FMCT, safeguards agreements would not automatically lapse as a consequence. The FMCT should also contain provisions for the dismantling of existing fissile-material

production facilities, somewhat along the lines of the Chemical Weapons Convention. It is one thing to stop the production of HEU and weapons-grade plutonium by mothballing corresponding facilities which can rapidly resume their activity; it is quite another to destroy the ability to durably prevent uranium enrichment and plutonium extraction.

12.13 It has to be acknowledged that dismantling fissile material production facilities is a lengthy and costly process, although somewhat quicker and cheaper in the case of HEU enrichment facilities, than for reprocessing plants. In the French experience, the dismantling of the military enrichment capability in Pierrelatte has been achieved in around a decade at a cost of under 1 billion euro; the comprehensive build-down of the military reprocessing facility in Marcoule is a multi-decade enterprise (with long cooling-off periods) at an estimated cost of some 5 billion euro. These costs would have to be multiplied to eliminate the much larger similar facilities in the U.S. and Russia.

12.14 **Other Issues.** The entry-into-force section of the treaty will also pose issues for negotiators. In order to reach agreement, there may be a temptation to make entry into force conditional on ratification by specified states, as is the case with the CTBT. The nuclear-weapon states, for example, even though most if not all of them clearly have all the fissile material they could possibly need, may not be willing to enter a formal commitment unless the non-NPT states do likewise. But there will be, equally, a reluctance to make commencement of the treaty hostage to one or two hold-outs.

12.15 Given the suspicion that tends to accompany treaty negotiations of this kind, that one's rivals will drag out the negotiations to preserve maximum freedom of action for themselves for as long as possible, it would be desirable to make a general voluntary moratorium on fissile material production a first priority, extending the present commitment of the present four states to all the others, and it would be helpful if other key states in the international community could encourage that course. But it has to be acknowledged that this issue is bound to be caught up with larger ones about regional and global strategic tensions and balances, and may not be any easier to reach agreement on than the text of the FMCT itself.

PRE-EXISTING STOCKS

12.16 While it is important that the FMCT negotiations focus on putting in place as soon as possible a regime cutting off future production of fissile material for use in nuclear weapons, some consideration of the issue of what to do about pre-existing stocks – i.e. holdings of fissile material pre-dating the FMCT's entry-into-force – cannot be avoided.

12.17 The difficulty of making the treatment of stocks a formal part of the treaty negotiations now starting – such that the objective would, in effect, be an "FMT" (Fissile Material Treaty) rather than an FMCT – is that this would be a far more complicated exercise, needing altogether more intrusive and sensitive verification arrangements, involving close scrutiny of military facilities. The stocks issue will certainly have to be addressed as disarmament proceeds: if significant fissile stocks remain free of any constraints, they could be drawn on to produce additional nuclear weapons, and there would be concerns about the durability of quantitative warhead limits agreed in disarmament negotiations. Certainly it is inconceivable that any final move to zero would be possible without this issue resolved.

12.18 While the FMCT's governance, compliance and safeguards system can and should be crafted in a manner which subsequently may facilitate the negotiation of a FMT, and it should be understood from the outset that a cut-off treaty cannot be the end of the exercise, the appropriate approach to adopt is a phased one, making the first priority setting a cap on production, and only then proceeding to stock reduction, with the objective being to ensure that all fissile material other than in weapons would become subject to irreversible, verified non-explosive use commitments, and that as weapon reductions and dismantlement are agreed, fissile material released through dismantlement is also brought under these commitments.

12.19 The Commission supports, as an interim step, the idea proposed by Robert Einhorn for a "Fissile Material Control Initiative" (FMCI), under which nuclear-armed states would voluntarily make regular declarations of their fissile material stocks; apply the highest standards of physical protection and accountancy to those stocks; regularly declare amounts of fissile material they regard as excess to their weapons needs; place such excess material under IAEA safeguards as soon as practicable; and convert excess material as soon as possible to forms that cannot be used for nuclear weapons.

FISSILE MATERIAL IN CIVIL PROGRAMS

12.20 The FMCT as presently conceived will not prohibit outright the production of all fissile material, provided this is under verification. But since fissile materials generally are of proliferation and terrorism concern, it is highly desirable for their availability to be limited, and their use should be phased out as viable alternatives are established.

12.21 Nuclear materials at or near weapons grade are unusual in civil programs. High enriched uranium is not used in power reactors, but it does remain in widespread use in research reactors. Since 1978 there has been an

international program – Reduced Enrichment for Research and Test Reactors (RERTR) – to convert HEU-fuelled reactors to low enriched uranium fuel, or to shut them down, and to return HEU fuel to the U.S. or Russia who have supplied most of the research reactors involved. World-wide, to date 62 research reactors have been dealt with in this way, but some 130 research reactors or critical assemblies in over 40 countries are still operating on HEU fuel – totalling some 20 tonnes of HEU. Clearly the completion of this program and the withdrawal of HEU from civil programs remain high priorities.

12.22 Weapons grade plutonium is not normally produced and used in civil programs, except in the case of fast breeder reactors, which are very limited in number. If alternative fast neutron reactor designs prove viable, the production of weapons grade plutonium can and should be avoided (as addressed in Section 14, in the discussion of proliferation-resistant technology).

12.23 The most important need, in the case of plutonium, given that it can only become available in any form for nuclear weapons by separation from spent fuel through reprocessing, is to move away from any technology which can separate pure plutonium: as also discussed in Section 14, the optimal solution is to use it for reactor fuel, but without entirely separating it at any stage from highly radioactive materials.

12.24 For the present, however, developments are moving the other way. "Closed" recycling of plutonium for further use as reactor fuel in fast neutron reactors is attracting increasing interest on efficiency grounds, because this dramatically reduces the quantities of uranium consumed and radioactive waste produced. But the present technology still involves separation of pure plutonium from other materials along the way, and if the proliferation and terrorism risks are to be minimized this will have to change. This is the objective of Generation IV research discussed in Section 14.

12.25 Currently a number of countries – principally the UK and France, and also Russia, Japan and India – reprocess power reactor fuel to recycle recovered plutonium as MOX (mixed oxide) fuel in thermal reactors, mostly light water reactors. MOX fuel has been in regular use for over twenty years, and currently is used in some 30 reactors in Europe, with a total of around 40 reactors licensed. Japan proposes to license sixteen reactors to use MOX fuel. World-wide, it now provides around 2 per cent of annual nuclear fuel requirements.

12.26 Strict security standards are specified for the processing, transport and handling of MOX fuel. To date these have proven effective, and there have been no significant incidents of loss or theft of MOX. However, the larger the number of countries and facilities involved, the greater the risk of incident. If new technologies for spent fuel treatment are established, avoiding

current forms of reprocessing altogether, use of conventional ("aqueous") reprocessing plants and use of MOX fuel can be phased out. Meanwhile, it is essential to ensure that use of MOX fuel continues to be tightly regulated and covered by rigorous security measures.

12.27 A related issue concerns disposition of plutonium recovered from nuclear weapon dismantlement. Such plutonium must be held under strict conditions of security and verification, and rendered unsuitable for nuclear weapons as quickly as possible. One way of doing this is to use the plutonium as reactor fuel. However, since by definition plutonium from warheads is weapons grade, it is absolutely essential to ensure its protection against theft by terrorists or proliferant states. MOX fuel made with weapons grade plutonium should not be considered equivalent to normal MOX – weapons grade plutonium should be protected at a similar standard as nuclear weapons, so the use of such plutonium in reactors must remain under close government control.

Recommendations on Limiting the Availability of Fissile Material

22. All states should negotiate to an early conclusion in the Conference on Disarmament a non-discriminatory, multilateral, internationally and effectively verifiable and irreversible Fissile Material Cut-off Treaty (FMCT), banning the production of fissile material for nuclear weapons or other nuclear explosive devices. [12.1–14]
23. All nuclear-armed states should declare or maintain a moratorium on the production of fissile material for weapon purposes pending the entry into force of such a treaty. [12.15]
24. On the question of pre-existing stocks, a phased approach should be adopted, with the first priority a cap on production; then an effort to ensure that all fissile material other than in weapons becomes subject to irreversible, verified non-explosive use commitments; and with fissile material released through dismantlement being brought under these commitments as weapon reductions are agreed. [12.18]
25. As an interim step, all nuclear-armed states should voluntarily declare their fissile material stocks and the amount they regard as excess to their weapons needs, place such excess material under IAEA safeguards as soon as practicable, and convert it as soon as possible to forms that cannot be used for nuclear weapons. [12.19]
26. The use of HEU in civil research programs should be ended as soon as possible, and the availability and use of separated plutonium in energy programs phased out as viable alternatives are established. [12.20–27]

13. SUSTAINING AN EFFECTIVE COUNTER-TERRORISM STRATEGY

COUNTER-TERRORISM STRATEGY GENERALLY

13.1 Effectively countering terrorism of any kind involves a complex mix of protection, policing, political, peacebuilding and psychological strategies, coordinated both nationally and internationally. Most immediately important in dealing with the threat of nuclear terrorism outlined in Section 4 (and generating most activity internationally, as described below) are the first two strategies on this list. "Protection" strategy involves airline travel, border protection and all the rest of the familiar homeland security measures, and both at home and abroad it means measures to deny potential access by terrorists to the materials they need. "Policing" embraces everything necessary for the detection and apprehension of those planning or carrying out terrorist attacks, from intelligence gathering to, in very extreme cases, military operations.

13.2 But these strategies must be supplemented by the other three "P"s if not only the immediate manifestations but the underlying causes of terrorist behaviour are to be seriously addressed. Having a "political" strategy means paying serious attention to familiar political grievances which are a significant part of the motivations of at least some categories of terrorists: if not changing the minds of some violent extremists, at least changing the atmospherics of the communities in which they have to survive. "Peacebuilding" in this context means essentially helping states develop the capacity to prevent and deal with terrorism more effectively themselves – and certainly avoiding the emergence or continuation of failed states which can harbour or nurture terrorist groups. And having a "psychological" strategy means not only trying to change the outlook of would-be terrorists at the micro level – in the way that has been done with some success in Indonesia, for example – but creating a normative environment at the global level in which attacks on civilians anywhere, for any purpose, will come to be seen as absolutely indefensible in the 21st century as slavery and piracy became in the 19th.

13.3 The need to set very clear normative guidelines, to have the maximum possible degree of policy integration across national borders, and to continually share information and best practices, has been better recognized and followed up in the nuclear area than most others, with the two major nuclear powers, the U.S. and Russia, playing a necessary and important

leadership role. A good example is the *Global Initiative to Combat Nuclear Terrorism (GICNT)* announced by Presidents Bush and Putin in July 2006 during the G8 Summit in St Petersburg. A follow-up to the Global Partnership against the Spread of Weapons and Materials of Mass Destruction agreed by the G8 in 2002, it aimed essentially at kick-starting more practical action to implement agreements reached bilaterally and multilaterally over the preceding three or four years. Amongst other things, it has sought to identify shortcomings in national capabilities, legal and regulatory authorities, and partnership capacity to combat nuclear terrorism, and to develop means of covering those gaps. Thirteen countries endorsed the original statement of principles in 2006, but the initiative now has 76 state partners, with the IAEA, EU and Interpol as observers.

BOX 13-1

PRIORITY ISSUES FOR THE 2010 NUCLEAR SECURITY SUMMIT

- Ratification and early entry into force of the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material.
- Early adoption of the most recent IAEA nuclear security guidelines.
- Renewed commitment to effective implementation of Security Council Resolution 1540 on the domestic regulation of sensitive nuclear material.
- Stronger commitment to prosecute violators of nuclear security and export control laws.
- Achieve accelerated implementation of the cooperative threat reduction and associated programs designed to secure dangerous nuclear weapons, materials and technology worldwide.
- Commitment to appropriate funding of nuclear security measures.
- Commitment to greater international sharing of information and experience on nuclear security.
- Support for an intelligence clearing house to provide a mechanism both for sharing intelligence, and assisting other states in interpreting and dealing with it.
- Commitment to international capacity building, especially through expansion of the Global Initiative to Combat Nuclear Terrorism and G8 Global Partnership.
- Commitment to cooperation on measures to secure, monitor, convert and dispose of fissile materials, including HEU in civil programs.

13.4 A major opportunity to take stock of progress under this initiative, and the many other international treaties and arrangements relating to nuclear security discussed below, will be the *Global Summit on Nuclear Security* to be hosted by U.S. President Barack Obama in April 2010. This will seek new agreement on steps towards securing all vulnerable nuclear materials worldwide within four years, breaking up black markets in atomic goods, detecting and intercepting materials in transit, using financial tools to disrupt illicit trade in nuclear materials, minimizing the civil use of high enriched uranium to the extent feasible, and encouraging the sharing of best practices as a practical way to strengthen nuclear security. Box 13-1 identifies some implementation-focused issues – most of which are further discussed below – that should get priority attention at this summit and in subsequent follow-up activity.

SECURING LOOSE WEAPONS AND MATERIAL

13.5 The problem of "loose nukes" – securing weapons and material that, by virtue of the way in which it is manufactured, transported or stored, may be vulnerable to apprehension by terrorist groups – requires a variety of solutions. Many of the general non-proliferation measures discussed elsewhere in this report are squarely relevant in this respect, including the Nuclear Suppliers Group and Proliferation Security Initiative (Section 10), the proposed Fissile Material Cut-off Treaty (Section 12), and the development of proliferation-resistant technology (Section 14). To the extent, also, that some classes of small nuclear weapons might be capable of misuse by terrorist groups if they could ever get their hands on them, the implementation of the disarmament strategy discussed in other sections of this report would be another important contributor to nuclear security.

13.6 For present purposes, we describe below some of the more important other specific nuclear security measures that have been taken, and still need to be taken or further strengthened, in the form of binding UN resolutions, treaties, and other programs, arrangements and initiatives. International standards for nuclear security were first introduced in the 1970s, applying through guidelines developed by the IAEA and at a treaty level through the Convention on the Physical Protection of Nuclear Material. These measures, based on the principle of layered defence-in-depth, focused initially on protection of nuclear material, then broadened to detection of material crossing national boundaries, recovery of material in unauthorized hands, and protection of nuclear facilities.

13.7 **IAEA Role.** The IAEA has an important continuing role in developing recommendations and standards related to nuclear security, including threat-based risk assessment methodologies needed for member states to

develop and implement effective integrated nuclear security plans. The IAEA's Nuclear Security Guidelines (document INFCIRC/225), first issued in the 1970s, are of fundamental importance. Although not mandatory, they are adopted by most states with significant nuclear activities, and have been made a requirement through a number of bilateral agreements. The IAEA guidelines have been updated a number of times, and a further revision (number 5) is expected to be concluded in early 2010. The IAEA also operates an advisory and peer review service available to member states on request.

13.8 The IAEA's *Illicit Trafficking Database Program (ITDB)*, involving the voluntary notification by government authorities of illicit trafficking incidents, with some 100 member states participating, provides a valuable source of information that helps the agency and member states to better understand threats, vulnerabilities and appropriate responses. Information reported to the ITDB has shown a persistent problem with the illicit trafficking in nuclear and other radioactive materials, thefts, losses and other unauthorized activities. Of the 1340 confirmed incidents as of December 2007, 303 involved unauthorized possession and related criminal activity, 390 involved theft or loss of nuclear or other radioactive materials, and 570 involved other unauthorized activities.

13.9 **Convention on the Physical Protection of Nuclear Material and Nuclear Facilities (CPPNM) (1987 on).** The Convention of 1987, with 142 states party and a further 45 signatories, requires states to implement measures to prevent theft, diversion or sabotage of nuclear material while being transported internationally. A 2005 Amendment extends the scope of the Convention to material in domestic use and storage, and (reflected in a change to the Convention's name) to protection of nuclear facilities from sabotage, but this has not yet entered into force, with 32 states (including China and Russia but not some major Western states) so far ratifying of the 95 needed. The major possible weakness in the amended CPPNM is the lack of any peer review mechanisms, as exist under the IAEA safety conventions, with Russia arguing that national security matters in issue here could not be the subject of international review.

13.10 **Cooperative Threat Reduction Programs (CTR) (1993 on).** At least as important as any international convention or binding UN resolutions has been this set of U.S.-backed programs – better known as "Nunn-Lugar" after the two U.S. Senators who initiated them – introduced in the wake of the Cold War to help the countries of the former Soviet Union destroy nuclear and other weapons of mass destruction and associated infrastructure, for the express purpose of reducing the chance of nuclear materials falling into the hands of terrorist groups, or nations that sanction terrorism.

13.11 Under the programs nuclear weapons and their means of delivery continue to be dismantled under agreed procedures; bomb-making materials have been transported to central storage sites and blended down to generate electricity (including in the U.S.!); security perimeters around sensitive sites have been upgraded, and personnel reliability screening for personnel at such sites improved; and monitoring devices placed at border crossings and ports. These programs have subsequently expanded beyond the former Soviet Union, including to Pakistan, and there have also been a number of similar programs carried out by countries other than the U.S., including the EU which has developed a separate bilateral assistance program with Russia.

13.12 There are some critics of CTR: on cost-benefit grounds; on the basis that the principal remaining tasks, including disposal of plutonium, are no longer achievable because the Russians no longer appear to share the same priorities; and even on the basis that these programs are, by reducing numbers, increasing the value of the deadliest, indiscriminate weapons in the hands of extremist states and individuals. But this Commission has no doubt that these programs have made a hugely positive contribution in securing the elimination of significant quantities of nuclear materials otherwise potentially available to would-be proliferators and potential nuclear terrorists, in encouraging strong habits of international cooperation and transparency in this extremely sensitive area, and in generally reinforcing non-proliferation and disarmament norms.

13.13 **UN Security Council Resolution 1540 (2004).** This was aimed at preventing WMD and related material from entering black market networks and falling into the hands of terrorists, and followed an earlier resolution (UNSCR 1373 of 2001) adopted in the immediate wake of the 9/11 terrorist attacks and relating to information-sharing in the suppression of acts of terrorism generally. UNSCR 1540 (and renewing resolutions 1673 (2006) and 1810 (2008)) expressly requires that all states prevent non-state actors obtaining access to nuclear, chemical or biological weapons and their delivery systems; adopt laws prohibiting such access; and establish other related domestic controls. It imposes strict reporting requirements on states, but few have fully met them. Technical assistance by developed states should be encouraged in this regard, and channelled through not only individual countries but also regional and sub-regional organizations. Consideration should be given to making the Committee set up by UNSCR 1540 permanent, with expanded staffing and funding, to enable it to more effectively consolidate and promote the physical protection of nuclear facilities around the world.

13.14 **International Convention for the Suppression of Acts of Nuclear Terrorism (2005).** This was adopted by the UN in 2005, with Russia and the United States the first to sign. It followed Resolution 1540 and provides

for broad areas of cooperation between states for the purpose of detecting, preventing, suppressing, and investigating acts of nuclear terrorism. It has been signed by 115 states, and 60 have ratified it to date.

13.15 **Nuclear Personnel.** Preventing the unauthorized transfer of nuclear expertise through the movement of trained personnel, including those in retirement, requires further international effort. There is not an insignificant risk of such personnel being recruited by terrorist groups, and not only from countries of the former Soviet Union. Possible measures to counter such efforts might include assistance in redeployment or reasonable pensions; development of a shared database of personnel known to be involved in nuclear programs in those countries; identification of their activities should they travel abroad; preventing, or at worst monitoring, any contacts between them and representatives of states or non-state groups of proliferation concern; and even possibly their interdiction or arrest should they appear to be heading for a country of proliferation concern. Some progress has been made in some of these areas, including through the work of the International Science and Technology Centre which has for fifteen years been promoting programs for alternative employment for scientists from the Russian WMD establishments, but more needs to be done. More intrusive measures will be uncomfortable, and may be unacceptable, for developed Western nuclear powers, but if support is wanted for such measures concerning the scientists of other countries, some middle ground will need to be found that shows that all nuclear scientific communities are subject to similar constraints.

13.16 **Private sector engagement.** Continuing attention needs to be paid to engaging the private sector in addressing the inherent security risks associated with exporting advanced technologies, equipment, and materials, to ensure that the security standards for nuclear facilities and materials are robust and that best security practices are discussed, shared in the form of codes of conduct, and implemented across the world. The World Nuclear Association has been partially engaged in this enterprise, and recently joined by the more specifically-focused World Institute for Nuclear Security (WINS), founded in Vienna in 2008, which aims to share information and experience among industry nuclear security professionals, promote training and, particularly importantly, develop peer review systems.

"DIRTY BOMBS": IMPROVED CONTROL OF RADIOACTIVE MATERIAL

13.17 The use of radioactive material for terrorist purposes is proscribed at the international level by the 2005 International Convention for the Suppression of Acts of Nuclear Terrorism, noted above, but most attention in recent times has focused on measures of a practical kind to limit the availability of the

huge range of radioactive material now in medical, research and commercial use which could be misused for such purposes, as described in Section 4.

13.18 In response to a number of serious radiation accidents in earlier years resulting from high activity sources that have been lost, stolen or abandoned, there was initially developed, through the IAEA, the Code of Conduct on the Safety and Security of Radioactive Sources in 2000. At that time, "security" was regarded as the prevention and mitigation of thefts in ignorance of the hazard, such as persons stealing objects for scrap metal resale. High activity sources were thought to have a degree of "self-protection", and the drafters of the Code gave no consideration to the possible deliberate acquisition of radioactive sources for malicious use. Following 9/11, and the recognition of the role that "dirty bombs" or radiological weapons could play in the hands of terrorists – even if more as "weapons of mass disruption" than mass destruction – proposals for strengthened controls which had received little support in 2000 were embraced. The 2003-revised Code, to which 95 states have so far made a commitment, includes new provisions relating to national registers of high-activity sources; the international trade in radioactive sources; strengthened security requirements; confidentiality of information; and the prompt notification to potentially affected states of incidents of loss of control of sources, or incidents with potential trans-boundary effects.

13.19 Since that time, international and national programs have concentrated on assisting states to implement the Code, with the IAEA, the United States, the European Union, Australia and others having run active programs in this regard. There have been no major accidents involving radioactive sources since the adoption of the revised Code, which may be evidence that it, and the international programs supporting its implementation, are having an impact. However, there are no grounds for complacency in this regard. Disused and abandoned – or "orphan" – sources are still being discovered in many countries, developed and developing alike. Many states are still striving to develop, implement and sustain a systematic and comprehensive regulatory system for the control, safety and security of high activity radioactive sources. But there is also a need for a commitment by users of high activity sources, by regulators and by national governments to providing appropriate resources and assigning appropriate priority to the safety and security of those sources.

13.20 Disused and orphan sources pose particular continuing challenges. International best practice requires licensees to either send disused sources back to the manufacturer or to send them to a licensed recycling or waste management facility. For states with nuclear fuel cycle facilities or facilities undergoing decommissioning, disused sources will form only a small fraction of the overall volume of waste to be managed, and their disposal should

therefore not present significant problems. However, for states without nuclear fuel cycle facilities, the public acceptance, financial and technical issues related to the siting of waste disposal facilities may be significant, and requires government commitment and leadership to achieve.

13.21 Some have suggested that the Code of Conduct be converted into a legally binding Convention. But when comparing the Code with the conventions adopted under IAEA auspices in recent years – including those on Nuclear Safety, and the Physical Protection of Nuclear Material – it is apparent how much more detailed and prescriptive is the Code. This has been of great value to those charged with its implementation, and is probably not replicable in a binding convention. The Commission agrees with those professionals who say that the priority must continue to be the unglamorous work of assisting states in revising or updating their legislation and licensing practices, promoting awareness among users and other stakeholders, implementing and sustaining adequate and appropriate safety and security provisions throughout the lifecycle of radioactive materials, and engendering good safety and security culture.

NUCLEAR FORENSICS

13.22 Most governments are well aware of the risks of nuclear terrorism, and the need for effective policing at both the domestic and international levels, but there has been very variable performance in translating that basic awareness into action. Information and intelligence remains the key to effective police action, but despite the requirements of the Convention for the Suppression of Acts of Nuclear Terrorism, the willingness of states to share nuclear-related information is at best minimal. Efforts should continue to be made to establish an intelligence clearing house which would provide a mechanism by which countries might be willing not only to share their intelligence, but also provide the know-how for other countries to interpret and deal with it.

13.23 In the meantime, however, every effort should still be taken to encourage such sharing, with the Nuclear Suppliers Group possibly the best available vehicle. Annual reporting, even at a broad level, to the UN and national parliaments on the nuclear terrorist threat could be one vehicle for raising the profile of the issue. More immediately useful, however, might be the creation of a second-track process involving security officials and nuclear scientists of many countries in which the aim would be the development of a common ethos of prevention and early warning without the imposition of strict and impractical surveillance requirements.

13.24 One of the most important and encouraging recent developments in the area of police detection is the emergence of the science of nuclear

forensics, still in its relative infancy but deserving encouragement from the ground up. This involves the analysis of nuclear materials recovered from either the capture of unused materials, or from the radioactive debris following a nuclear explosion, so as to identify the sources of the materials and the industrial processes used to obtain them. In the case of an explosion, nuclear forensics can also reconstruct key features of the nuclear device.

13.25 The ability to identify and trace specific nuclear materials and techniques would have a strong deterrent function both generally and in respect of nuclear terrorism. The Nuclear Smuggling International Technical Working Group should be provided with adequate resources to greatly expand the work it has been doing since 1995 to significantly improve international cooperation in both developing nuclear forensics as a science and pursuing nuclear forensic investigations. The concept of a shared international database, with relevant states contributing "fingerprints" of their nuclear materials, warrants active consideration. Individual governments also need to make the necessary effort to improve their own nuclear forensics capabilities.

Recommendations on Nuclear Security

27. All states should agree to take further measures to strengthen the security of nuclear materials and facilities, including early adoption of the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM) and the most recent international standards, accelerated implementation of the Cooperative Threat Reduction (CTR) and associated programs worldwide, and greater commitment to international capacity building and information sharing. [13.1–16, 22–23]

28. At the Global Summit on Nuclear Security in April 2010, and in subsequent follow-up activity, priority attention should be given to the implementation-focused issues identified in Box 13-1. [13.4]

29. On the control of material useable for "dirty bombs", further efforts need to be made to cooperatively implement the Code of Conduct on the Safety and Security of Radioactive Sources, with assistance to states in updating legislation and licensing practice, promoting awareness among users, and generally achieving a safety and security culture. [13.17–21]

30. Efforts should continue to be made to establish an intelligence clearing house which would provide a mechanism by which countries might be willing not only to share their intelligence, but also provide the know-how for other countries to interpret and deal with it. [13.22]

31. Strong support should be given to the emerging science of nuclear forensics, designed to identify the sources of materials found in illicit trafficking or used in nuclear explosions, including through providing additional resources to the Nuclear Smuggling International Technical Working Group. [13.24–25]

14. RESPONSIBLE NUCLEAR ENERGY MANAGEMENT

SHARING THE BENEFITS OF NUCLEAR ENERGY

14.1 One of the three cornerstones of the Nuclear Non-Proliferation Treaty (NPT) – along with the disarmament and non-proliferation – is its recognition, in Article IV, of the "inalienable right" of all parties to use of nuclear energy for peaceful purposes, in conformity with their other treaty obligations, and the need of all parties to cooperate in its provision: assisting states in this respect is part of the International Atomic Energy Agency's core mission. The Commission is well aware that there is not universal support, particularly in civil society, for this pillar of the NPT, but it is inconceivable that states' commitment to non-proliferation could be maintained, let alone strengthened, without it.

14.2 There are also very good reasons in their own right for supporting, as this Commission does, the cooperative sharing of the benefits of nuclear energy. In a world ever-anxious about energy security, an increase in the share of nuclear energy to reduce dependence on imported oil and gas has many attractions for many states. And, more importantly still, while situations vary from country to country, it is almost impossible now to argue, from a global perspective, that civil nuclear energy is anything other than an indispensable element of the energy policy mix. The global recognition of the need for suppression of greenhouse-gas emissions significantly increases the attractiveness of nuclear power as the only low-carbon electricity generation technology with proven capability for large-scale supply – expensive up front, but economical in the long-run. Whether nuclear energy will increase its total share of electricity generation in a period of major and continuing demand increases may be questioned, but simply maintaining it would by itself be a major contribution to climate policy.

14.3 Beyond energy generation, nuclear technologies and techniques are demonstrably valuable for improving human well-being, especially in fighting disease, helping to grow food, addressing food security and safety, and managing safe water and other natural resources. In health care, nuclear medicine and radiation therapy will continue to be important in providing earlier, more accurate diagnoses and safer, more effective treatments. In food security and safety, nuclear techniques have also contributed significantly in integrating pre- and post-harvest pest-control measures such as food irradiation and area-wide application of the Sterile Insect Technique (SIT)

to protect crops and livestock from pests. Techniques for diagnosing trans-boundary animal diseases will be increasingly important for early and rapid detection in both the laboratory and the field. And nuclear techniques have a significant role to play in hydrology, important as the growing scarcity of water resources and the dramatic lack of sustainable access to water and sanitation in developing countries become major impediments to sustainable development, wealth creation and the eradication of poverty. The Commission supports additional resources for the IAEA's Technical Cooperation Programme, to assist developing states to take full advantage of peaceful nuclear energy for human development.

THE THREE Ss: MANAGING SAFEGUARDS, SECURITY AND SAFETY

14.4 If peaceful nuclear energy is to play the role it should, it is critical that it be managed in a way that reduces, and does not add to, the world's problems. The first indispensable dimension of that effective management is *safeguards* (i.e. ensuring that there is no diversion of nuclear material from civil to military purposes, fully discussed in Sections 8, 9 and 10 above, and again in Part IV). The second is *security*, which has been discussed in Section 13 above in the context of counter-terrorism strategy, where it is most immediately relevant, and the third is *safety*, discussed briefly in the following paragraphs. These are not the only factors involved in long-term effective management – others, discussed later in this section and in Section 18, are the development of proliferation-resistant technology, stronger industry–government cooperation and efforts to multilateralize the fuel cycle. But they are the three most immediately important. At the 2008 Hokkaido Toyako G8 Summit an initiative for international cooperation on nuclear energy infrastructure was launched with a view to raising awareness of the importance of the three Ss worldwide and assisting countries concerned in developing the relevant measures.

14.5 As the Chernobyl disaster in 1986 showed, a nuclear accident anywhere is a nuclear accident everywhere. If the number of nuclear power plants around the world is to grow substantially without increasing the total risk of a nuclear accident, the risk of an accident at any given reactor must continue to be reduced. As additional countries build nuclear power plants, it is essential that they establish strong safety measures, including competent, effective, and independent national regulators and the global safety regime that emerged after Chernobyl is being maintained and continuously improved.

14.6 The IAEA develops and publishes crucially important safety standards, recommendations, and guides: it serves as the depository for nuclear safety

conventions, and helps to develop new instruments as necessary; it organizes international reviews of the safety of particular facilities at the request of member states, which have led to major improvements in safety at many facilities; it helps coordinate assistance to member states in improving safety measures and exchanges of best practices, experience, and lessons learned; it collects and analyzes a wide range of international data important for safety; and it organizes studies and discussions of key safety issues.

PROSPECTS FOR PROLIFERATION-RESISTANT TECHNOLOGY

14.7 Proliferation resistance involves establishing impediments or barriers to the misuse of civil nuclear energy systems to produce fissile material for nuclear weapons. There is no magic bullet to eliminate all proliferation risk. No presently known nuclear fuel cycle is completely proliferation proof: proliferation resistance is a comparative term. But a combination of institutional and technical measures can give needed robustness to non-proliferation and counter-terrorism efforts. Most attention in this respect tends to focus on the *institutional* measures, dealt with fully elsewhere in this report: treaty-level peaceful use commitments, principally through the NPT; verification of performance of these commitments, especially by IAEA safeguards; national controls on supply of nuclear materials, equipment and technology, including those coordinated through the Nuclear Suppliers Group; and possible new ways of multilateralizing the fuel cycle. In this part of the report we will focus on possible new *technical* barriers.

14.8 The objective of technical measures, as with institutional ones, is to increase the difficulty, time and cost of misuse and the likelihood of detection, both as a disincentive, and to provide sufficient delay for the international community to have timely warning and opportunity for intervention. These measures include avoiding production of weapons grade material, and introducing technical barriers to producing such material; ensuring fissile material is difficult to access (e.g. through high radiation levels), increasing the difficulties of diversion by states and theft or seizure by terrorists; and avoiding plutonium separation processes that result in a pure plutonium product or a product from which plutonium can be readily purified.

14.9 The basic issue can be stated as follows: can a fuel cycle be developed which produces nuclear fuel without using enrichment, and enables plutonium recycle without plutonium separation? As to *enrichment*, the necessity for this can be avoided altogether by the use of reactors fuelled by natural uranium, but those available today are "on-load refuelling" designs that can be used to produce weapons grade plutonium. In principle, another route for avoiding the need for enrichment is the thorium fuel cycle, but

this is not as straightforward as it might seem. Thorium reactors depend on recycle of uranium-233, which with current reactor types must be separated from spent fuel by reprocessing, and which (albeit with some difficulty) can be used in nuclear weapons. Further, a thorium reactor requires enriched uranium (or plutonium) for the initial operating cycles, and more efficient operation requires enriched uranium or plutonium "driver fuel" in addition to recycled uranium-233.

14.10 Enrichment is not required for fast neutron reactors, which are fuelled through plutonium recycle, and can be operated to produce more plutonium than they consume. However, for most of this century the light water reactor is likely to remain the predominant reactor type, possibly supplemented by high temperature gas-cooled reactors (such as the pebble bed reactor), so there will be a continuing – indeed, growing – need for uranium enrichment. Proliferation risk can be reduced by limiting the number of states with enrichment programs, and operating enrichment programs on a multilateral rather than wholly national basis.

14.11 As to *reprocessing*, this can be avoided altogether through using the "open" or "once-through" fuel cycle. However, the "closed" fuel cycle, based on plutonium recycle using fast neutron reactors, is attracting increasing interest from a number of states. Fast neutron reactors offer substantial advantages for efficiency of uranium utilization and management of spent fuel and radioactive waste. They can also, however, present potential proliferation and terrorism-risk challenges. The currently used "fast breeder" model involves production of plutonium, which happens to be of weapons grade, in a "breeder blanket" surrounding the core, and separation of plutonium through reprocessing. Both these characteristics give ground for concern from both non-proliferation and counter-terrorism perspectives.

14.12 Proliferation resistant approaches now under consideration for fast neutron reactors include new designs with an integrated core and no breeder blanket, and the introduction of new processing technologies that avoid separating pure plutonium. Eliminating the blanket and producing all plutonium in the reactor core ensures that it will all be "high burn-up", well outside the weapons grade range. New reprocessing technologies include "electro-metallurgical processing" (formerly known as pyro-processing), by which spent fuel is melted in molten salts and a number of fission products and most of the uranium are removed by electrolysis. The plutonium from the spent fuel is not purified, but remains in a mix with minor radioactive elements and some fission products. This ensures that the plutonium cannot be used for nuclear weapons without further, conventional, reprocessing. The radioactivity of the associated fission products increases the difficulty of diversion, and protects the plutonium mix from theft. At this stage the costs of these new technologies are not clear, and not using a blanket will

have an efficiency penalty. But they are seen as moving in the right direction, and further international research is being coordinated by the Generation IV International Forum. Also, new blanket designs which will produce plutonium well outside the weapons grade range are being studied.

14.13 As already noted, the predominant reactor type for the foreseeable future, and for most states, is expected to be the light water reactor. This design is difficult to misuse to produce weapons grade plutonium, so is considered to have good proliferation resistance. However, in the interest of non-proliferation, international measures such as spent fuel take-back arrangements by fuel suppliers, are desirable to avoid increasing spent fuel accumulations in a large number of states. Particular attention should be paid in this respect to take-back of fuel from initial core loads, where the short irradiation time results in the contained plutonium being closer to weapons grade.

14.14 A proliferation-resistant method of recycling spent fuel is the DUPIC process, being developed by South Korea, Canada and the U.S. The basis of DUPIC is that the fissile content of spent PWR (pressurized water reactor) fuel – residual U-235 and produced plutonium) is well suited for use in heavy-water moderated CANDU reactors. It involves direct re-fabrication of spent PWR fuel into reactor fuel, thereby reducing natural uranium requirements and the overall quantity of spent fuel. Dry thermal-mechanical processes are used to reduce spent PWR fuel to a fine powder, which is subject to high temperature to drive off volatile fission products (around 40 per cent of total fission products), pressed into pellets, and fabricated into CANDU fuel bundles. Since there is no plutonium separation, DUPIC is inherently proliferation resistant. However, its potential application is limited to situations where suitable numbers of both PWRs and CANDUs are available (currently only South Korea, India and China)

14.15 Other proliferation-resistant concepts include reactor designs that reduce access to the reactor core by the operator. For example, new designs are under development that will extend the period between refuelling, or even have life-time cores, with the reactor being replaced by the supplier when refuelling is required. These developments will contribute to assurance that an expansion in the use of nuclear energy can proceed without adding to proliferation risk.

INDUSTRY AS A NON-PROLIFERATION PARTNER

14.16 Until now it has been more or less accepted wisdom that the issue of nuclear non-proliferation is a political and security matter for government. Industry's view, broadly shared by most governments, is that the nuclear power industry has no direct responsibility for nuclear weapons proliferation.

Industry feels it is already highly controlled and regulated. However much of the world's nuclear industry is multinational, with significant public/private cross-ownership where commercial interests, non-proliferation interests and national strategic interests can overlap or collide. And proliferation has in the past been bad for the development of civil nuclear industry, with the Nuclear Suppliers Group having been successful in ensuring peaceful nuclear trade was conducted only with countries that had made internationally binding non-proliferation commitments – at least until it approved the 2008 agreement between the U.S. and India.

14.17 More than ever, the issue of how to manage the civilian nuclear agenda is not just a problem about how some states may be making inappropriate use of their rights under Article IV of the NPT: it is about responsible stewardship of a system under strain which at the same time is experiencing a revived interest, despite current financial constraints. In short, the role of the world's nuclear industry in mitigating the proliferation risks of a growing civilian nuclear sector world wide will need to grow, requiring more intense government-industry collaboration than has hitherto been the case.

14.18 The nuclear industry already cooperates with governments to fulfil its non-proliferation obligations, abiding by export controls and their safeguards inspection and reporting requirements. Industry has been engaged in Generation IV reactor activities in the U.S. and other countries to develop proliferation safe reactor designs. Beyond their formal obligations and R&D cooperation, the industry contribution to non-proliferation has tended to be minimal, with operators primarily focused on safety and security issues. Non-proliferation values are, however, contained in the WNA Charter of Ethics and Principles of Uranium Stewardship.

14.19 Industry knows how fragile public support remains and how the slightest mishap can set things back for it. The World Association of Nuclear Operators (WANO), formed in May 1989 in response to the Chernobyl accident to improve safety standards at nuclear power plants world wide, shows how industry initiatives to improve the safety record of nuclear operators have surpassed the minimum safety standards imposed by national legislation and have facilitated more uniform safety standards internationally. The recently-established World Institute for Nuclear Security (WINS) intends to bring together representatives from government, industry, academia and think tanks in an effort to share best practices on nuclear security, in a similar model to WANO. A commitment to nuclear safety is a very common corporate social responsibility principle for companies operating nuclear reactors. The sharing of best practices, performance indicators and peer reviews are mechanisms that could be transposed into the non-proliferation arena, as WINS is attempting to do for nuclear security.

14.20 Industry can contribute to global efforts to raise the political, financial and commercial costs of proliferation, raise the barriers, and raise the standards. Its technical and practical expertise, and unique networks within industry and with government as well as civil society, make it a valuable partner in the promotion of nuclear non-proliferation. Industry's pragmatic and market driven approach could take the politics out of this matter, and can help underpin the non-proliferation regime.

14.21 As noted elsewhere in this report, new rules of the game are being considered which may have real impact on the development of the industry, most notable among them proposals to multilateralize the nuclear fuel cycle; to limit the spread of sensitive nuclear technologies; and to change NSG rules to insist that countries not exercise the right to develop sensitive technology as a condition of supply, as well as making the adoption of the Additional Protocol – or some more technologically up to date version – a mandatory condition of supply.

14.22 Industry is also at the front line of the development and spread of dual-use nuclear technology and has the capacity to prevent, limit or place conditions upon the spread of that technology, as well as report it, and to influence the type of nuclear technology that is developed in the future. Industry reporting of sales could assist the IAEA in assessing the completeness of member-state declarations.

14.23 Large nuclear companies can exert considerable pressure upon their national governments in their nuclear policy choices. Therefore an industry which makes non-proliferation a priority may also help reinforce the non-proliferation commitments of government. Making a commitment to non-proliferation part of the corporate brand might in fact deliver practical benefits for companies, helping to cultivate better relationships with regulators and non-proliferation advocates, and dispel the poor image created by the anti-nuclear lobby. Of course there are limits to the pressure that even larger nuclear companies can exercise when they are publicly owned and where broader national security and strategic concerns come into play.

14.24 Industry-wide initiatives to stem proliferation would require a harmonisation of business practices, ensuring that no company was disadvantaged for being more proactive on proliferation and thereby discouraging the first mover. More generally, industry should be an active partner with governments in the drafting of regulations and treaties that affect their activities, to ensure that they make operational sense and to encourage compliance.

Recommendations on Nuclear Energy Management

32. The use of nuclear energy for peaceful purposes should continue to be strongly supported as one of the three fundamental pillars of the NPT, along with disarmament and non-proliferation. Increased resources should be provided, including through the IAEA's Technical Cooperation Programme, to assist developing states in taking full advantage of peaceful nuclear energy for human development. [14.1–3]
33. Support should be given to the initiative launched at the 2008 Hokkaido Toyako G8 Summit for international cooperation on nuclear energy infrastructure, designed to raise awareness worldwide of the importance of the three Ss – safeguards, security and safety – and assist countries concerned in developing the relevant measures. [14.4–6]
34. Proliferation resistance should be endorsed by governments and industry as an essential objective in the design and operation of nuclear facilities, and promoted through both institutional and technical measures – neither is sufficient without the other. [14.7–8]
35. The increasing use of plutonium recycle, and the prospective introduction of fast neutron reactors, must be pursued in ways which enhance non-proliferation objectives and avoid adding to proliferation and terrorism risks. In particular, a key objective of research and development on fast neutron reactors should be to design and operate them so that weapons grade plutonium is not produced. [14.9–15]
36. International measures such as spent fuel take-back arrangements by fuel suppliers, are desirable to avoid increasing spent fuel accumulations in a large number of states. Particular attention should be paid in this respect to take-back of fuel from initial core loads. [14.13]
37. New technologies for spent fuel treatment should be developed to avoid current forms of reprocessing altogether, and as they are established, use of MOX fuel in thermal reactors, and conventional reprocessing plants, can be phased out. [12.26]
38. Nuclear industry, and government-industry collaboration, will need to play a greater role in mitigating the proliferation risks associated with a growing civilian nuclear sector worldwide. Industry should become a more active partner with governments in the drafting of regulations and treaties that affect its activities, to ensure that they make operational sense and to encourage compliance.[14.16–24]

15. MULTILATERALIZING THE NUCLEAR FUEL CYCLE

THE ARGUMENT FOR MULTILATERALIZATION

15.1 Multilateralizing the nuclear fuel cycle – through the kinds of measures discussed in this section, viz. assurances of supply, fuel banks, or multilateral management of facilities – aims to discourage additional states acquiring sensitive nuclear technologies (SNTs), and thereby to help maintain confidence in the NPT, and the international community's ability to effectively monitor non-proliferation compliance. The idea is to take off the table the "security of supply" and economic reasons for constructing national facilities, ideally also decreasing the number of new facilities constructed, decreasing the number of states in possession of enrichment and reprocessing technology, and ensuring that all these remaining facilities are under safeguards.

15.2 The term "multilateral" is used here in its broadest sense, incorporating "multilateral" in its usual sense (the broadest and most flexible term, referring to the participation of more than two actors), "multinational" (implying several actors from different states), "plurilateral" (used usually for like-minded multiple actors), "regional" (several actors from neighbouring states) and international" (actors from different states or international organisations, such as the IAEA).

15.3 The concept of fuel cycle multilateralization was first raised in 1946 in the Acheson-Lilienthal report, but did not receive serious consideration until the 1970s, as a solution to concerns over the future proliferation hazard posed by the plutonium stocks that would result from a projected large increase in civil nuclear power generation with a closed fuel cycle. These concerns ebbed in the 1980s with the unanticipated slowdown in civil nuclear construction and the drop in natural uranium prices that made a closed fuel cycle uneconomic. Ideas for multilateral control, this time focusing on the front end of the fuel cycle, surfaced anew in the late 1990s.

15.4 A vocal advocate for fuel cycle multilateralization, IAEA Director General Mohamed ElBaradei convened an Expert Group on Multilateral Approaches to the Nuclear Fuel Cycle in 2004, prompted by a perceived trend towards the weakening of the non-proliferation regime, as exemplified by the crises in Iran and North Korea. The Expert Group's findings, reported in 2005, have had a strong influence on the numerous multilateralization proposals subsequently put forward, discussed below.

15.5 All current proposals take – essentially as an acknowledgment of present political realities – an incentive-based rather than regulatory approach to multilateralization. In order to succeed, such an approach must attract the participation of states that would otherwise consider developing national enrichment or reprocessing facilities and therefore must address the reasons why states would want to develop such facilities: energy security, a desire to participate in the profits of enrichment, national prestige and a possible desire to leave open the nuclear weapon option for the future. Most of the proposals focus upon energy security and profits, and some attempt to deal with national prestige by facilitating the participation of non-technology holders in multilateral facilities.

15.6 No one who supports multilateralization in any of its forms is challenging the "right" for states to acquire what they need to use nuclear energy for peaceful purposes. Rather, the question is whether there ought to be other arrangements that guarantee states in good standing within the non-proliferation system access to the needed materials without them having to embark on the problematic course of producing their own. Most of the proposals to date have been put forward by supplier states and have received lukewarm support from customer states. Those with stable supply relationships are content with present market arrangements; and those with concerns about the risk of politically motivated interruptions to the supply of fuel tend to argue that the proposals now on the table fail to adequately address their concerns, at least in the short to medium term.

15.7 The proposals, most of which would, as just noted, deny access to multilateral fuel cycle services if the state making the request is not in good standing with IAEA safeguards (such as Iran) or is outside the NPT, have had, unsurprisingly, little or no traction with the states of most current proliferation concern. And proposals requiring states to forego national facilities as a precondition of participation, such as the U.S. fuel bank, are politically unpalatable for many developing states and unlikely to succeed in limiting the spread of sensitive technologies. The issue has become closely tied to the perception that controlling access to nuclear technology in the interests of non-proliferation further consolidates the relative status of the nuclear haves and have-nots, and deflects from the primary objective of nuclear disarmament. One downside concern in the whole debate is that, if not carefully implemented, multilateralizing the fuel cycle could create new proliferation dangers by accelerating the early deployment of high-risk technology by states not already possessing an enrichment or reprocessing capability, or promoting its unwarranted transfer to them.

15.8 The extent to which multilateralization realises the benefits and mitigates the risks outlined above depends upon the design of the initiative itself. Discussed below are the twelve proposals currently under serious

consideration, most of which deal exclusively with the front end of the fuel cycle. As no one proposal will provide adequate incentives for all states, and some proposals are more ambitious and have longer lead times than others, a flexible, layered and incremental approach to multilateralization may be required. Simpler proposals may lay an important foundation for the realization of more ambitious proposals, particularly in terms of political will and logistics. While we look at the current proposals individually, it is important to consider them as mutually reinforcing steps towards a layered multilateral fuel cycle management regime.

ASSURANCE OF SUPPLY PROPOSALS

15.9 Existing market arrangements for the supply of uranium may be backed up by fuel assurances offered by industry, supplier states or the IAEA, activated in the case of a disruption in supply to a particular state. Non-political disruptions to supply have been uncommon in the past and are unlikely in the future, and reactor operators have well-developed mechanisms in place to deal with them, so assurances would need to focus on political disruptions to supply. If the details are agreed upon, they can be implemented relatively quickly. However they only address the security of supply motivation, rather than economic incentives to enrich, and they are only as effective as the credibility of the guarantees offered. Putting the conditions of supply bar high enough to prevent proliferation but not so high that it puts off the customer is a particular challenge.

15.10 *World Nuclear Association (WNA) Proposal* (2006). The WNA developed an assurance of supply concept that consists of three tiers of supply assurances: the existing market mechanisms; collective guarantees by existing uranium enrichment companies supported by commitments from governments and the IAEA; and government stocks of enriched uranium product. The second tier would be invoked only if there was a politically motivated disruption to supply unrelated to proliferation, at which point the IAEA would be informed, evaluate the customer state's claim and direct the enrichment companies to provide a back-up supply of fuel. The enrichment companies' commitments would be written into supply contracts with eligible states. If the enrichment companies could not meet these obligations, states could resort to the third tier, government stocks of enriched uranium. States would need to be in full compliance with IAEA safeguards and have renounced the development, building or operation of enrichment facilities in order to be eligible.

15.11 The proposal is distinctive in that enrichment companies will collectively and equally supply enriched uranium in the case of a disruption. The intergovernmental process for implementing the proposal is relatively

straightforward, requiring agreement at the IAEA and formalization in an IAEA Information Circular, but would require numerous agreements between uranium enrichers and their national governments if the assurances mechanism is to be swiftly activated. The security of supply offered by the proposal may be insufficient for some states, especially those lacking a good relationship with an enricher country, as the second and third tier assurances could be impeded by national government export controls. Fuel fabrication also poses a problem as such facilities are usually located in the same countries as reactor vendors and enrichment providers, making the assurances ineffective unless alternative fuel fabrication providers can be sourced or constructed in the customer state. The requirement that companies be adequately compensated for the cost of providing assurances may make the proposal costly. The eligibility requirement that states forego the development of enrichment capabilities remains unacceptable for many states.

15.12 *Six-Country Proposal* (2006). Also known as the "Reliable Access to Nuclear Fuel" proposal, this modified version of the WNA proposal was made by the six governments offering commercial enrichment services on the global market: France, Germany, the Netherlands, Russia, the UK and the U.S. States need not forego the development of enrichment capabilities in order to receive assurances, but must not currently have such facilities; must have a safeguards agreement and Additional Protocol in place with the IAEA and have no outstanding issues under those agreements; adhere to international safety standards; and be a party to the Convention on the Physical Protection of Nuclear Materials and Nuclear Facilities. While otherwise functioning the same way as the WNA proposal, this proposal replaces the second tier with government guarantees to permit exports of enriched uranium and guarantees to not oppose such exports from other enricher countries. The third tier of assurance, enriched uranium stock, would be held by a supplier state, but rights to control use could be transferred to the IAEA to provide greater assurance of supply.

15.13 This proposal provides more credible assurances as such assurances are governmental commitments and by not requiring each enrichment company to provide an equal share of the shortfall in supply in the event of a disruption, it is a more flexible assurance than those offered under the WNA proposal and is therefore more likely to be both reliable and effective. Yet while not requiring states to forego enrichment technologies, it imposes such stringent eligibility requirements that few eligible states would have difficulty accessing the global market anyway. There is also a strong possibility that most of the six states would have a similar attitude to a particular customer state, undermining the reliability of back-up arrangements.

15.14 *IAEA Standby Arrangements System* (2006). Japan has proposed the establishment of an IAEA-administered database in which member states register their nuclear fuel supply capability, including uranium ore, reserves, conversion and fuel fabrication as well as enrichment, which would assist the IAEA and its members in identifying and preventing market failure. In the event of a disruption in supply, the IAEA would act as an intermediary in order to match the customer state with a new supplier. All states in compliance with an IAEA safeguards agreement are eligible.

15.15 This complements the Six-Country Proposal in allowing all states with front-end fuel cycle capabilities to act as suppliers in the event of a disruption, softening the distinction drawn between suppliers and customers in the Six-Country Proposal. This inclusiveness could, however, be seen to be encouraging the spread of enrichment and reprocessing capabilities. It is unique among the assurance proposals for including fuel fabrication services. Its focus upon monitoring and improving the transparency and functioning of the nuclear fuel market is intended to "reduce the incentive to develop uncompetitive, small-scale enrichment and/or reprocessing capabilities within their [states'] national borders" by highlighting the economic benefits and security of supply offered by the international market. Despite this, it is unlikely to greatly enhance the incentives for states to rely upon the international market, even if operating in conjunction with the Six-Country proposal.

15.16 *UK Nuclear Fuel Assurance Proposal* (2007). This sets out one mechanism by which the Six-Country Proposal export assurances could be practically implemented. The bond would consist of an agreement between a supplier state government, recipient state and the IAEA, and would preclude the supplier government from preventing exports of enriched uranium to the recipient state if in accordance with international law and non-proliferation criteria. The IAEA would determine whether or not the conditions had been met to allow the export of enriched uranium, and the supplier state would be obliged to comply with its decision. To be eligible for a bond, a recipient state would have to have a comprehensive safeguards agreement and Additional Protocol in place with the IAEA, be in compliance with both, and make commitments as to the peaceful use, no retransfer and physical protection of any enriched uranium received. The proposal has since received the support of the Netherlands and Germany.

15.17 The transparency of the IAEA decision-making in acting as a "guarantor" increases the credibility of the assurance. As with the Six-Country proposal, however, the eligibility requirements are so stringent that it would be unlikely that states satisfying those requirements would not be able to purchase enriched uranium on the international market. It is also not inconceivable that supplier states would breach their international legal obligations, reducing the credibility of the bond.

FUEL BANK PROPOSALS

15.18 The concept of a fuel bank is an extension of the assurance of supply concept in which a quantity of enriched uranium is held by a country or the IAEA and disbursed to a state whose regular supply arrangements have been disrupted. The fuel bank may be either virtual (consisting of assured access by the bank administrator to a given quantity of enriched uranium, guaranteed by a state) or involve the physical possession of uranium in the reserve. The fuel bank mechanism also operates as a default mechanism where a state cannot access enriched uranium on the commercial market for political reasons.

15.19 Fuel banks may offer a more credible assurance of supply than bare assurances. However, that credibility depends on who possesses the fuel, who decides when a disbursement should be granted and upon what criteria. The costs and practicalities associated with storing a fuel reserve pose a further challenge. The reliability of fuel fabrication services is a more acute problem for fuel banks, as it is not feasible to stock fuel assemblies for all different types of reactors, which leaves the development of national fuel fabrication facilities as the most effective way to ensure access. However, fuel fabrication plants do not present the same proliferation threats as the other sensitive technologies being discussed.

15.20 *U.S. Proposal on a Reserve of Nuclear Fuel* (2005). The United States announced that it would down-blend seventeen tons of highly enriched uranium deemed in excess of national security needs to use as a reserve of nuclear fuel "to support assurances of reliable nuclear fuel supply for states that forego enrichment and reprocessing". Though the low enriched uranium (LEU) would serve to complement any IAEA reserve and support IAEA supply assurances, the material would remain under U.S. control and subject to obligations attached to U.S.-origin material. These eligibility requirements and obligations prevent the proposal from delivering security of supply or any economic advantage to customer states in excess of the existing market. Its contribution to the multilateralization of the nuclear fuel cycle will be marginal.

15.21 *Nuclear Threat Initiative Fuel Bank* (2006). In 2006, the Nuclear Threat Initiative (NTI) provided the IAEA with $50 million for the establishment of an LEU stockpile under IAEA control to ensure fuel supply to customer states on a non-discriminatory, non-political basis. Two conditions attached to the funds: that the IAEA receive another $100 million or equivalent value of LEU from Member-States for the establishment of the reserve, and that the IAEA take the necessary actions to approve the establishment of the reserve. The first requirement was met in March 2009, but the IAEA Director General's proposal to formulate a detailed plan of how the fuel bank would

function was defeated by the IAEA Board of Governors in June by developing nations who saw the fuel bank as impinging upon their Article IV rights. NTI has stated that it hopes the fuel bank will offer enhanced security of supply to customer states in compliance with their non-proliferation obligations and who have chosen to rely on the market rather than develop their own enrichment facilities.

15.22 *Russian LEU Reserve Proposal* (2009). As part of its proposal to establish international nuclear fuel centres under the supervision of the IAEA, Russia has also announced a proposal for 120 tonnes of low enriched uranium to be held at the Angarsk International Uranium Enrichment Centre to ensure stable fuel supplies to power plants in case of disruption not related to technical or commercial considerations, including "insurmountable political difficulties". This reserve material would be accessible to any IAEA member state that honours its non-proliferation commitments, and supply from the fuel bank would be decided by the IAEA. The recommendation that the Director General bring forward draft agreements embodying this proposal again, however, won no acceptance at the June 2009 Board of Governors meeting.

15.23 The IAEA Board of Governors' defeat of the NTI proposal – and its Russian variant – highlights the aversion of crucial states to any proposal requiring states not to develop indigenous enrichment facilities. Despite this, the fact that the eligibility criteria and structure will be determined by the Board of Governors and administered by the IAEA makes the NTI proposal highly credible in terms of security of supply and the most likely to receive international support, should an agreement be reached, because the proposal has the input of both supplier and customer states. Two practical issues that will need to be resolved are how the LEU reserve held by the IAEA will be stored and how its price will be determined.

MULTILATERAL FACILITY PROPOSALS

15.24 Multilateral fuel cycle facility proposals involve either the construction of new multilateral enrichment, reprocessing or spent fuel storage facilities, or the conversion of existing facilities to multilateral control. They are the most effective mechanism for simultaneously offering security of supply, economic incentives, including economies of scale in the delivery of fuel cycle services and safeguards, and greater equality among supplier and customer states. A possible such arrangement has been discussed for some time by Gulf Cooperation Council countries – though so far without result – whereby they would approach nuclear energy development as a common entity, with facilities held in common. Urenco and Eurodif represent successful models for multilateral enrichment arrangements currently

operating in the market. (It has to be noted, however, that while one of the attractions of multilateral facilities has been seen as peer scrutiny of staff of different nationalities operating as a deterrent to diversion of materials, technology or know-how, A.Q. Khan's example of technology theft while at Urenco, and perhaps Iran's involvement in Eurodif, demonstrate that there are risks in such arrangements.)

15.25 The establishment of multilateral facilities creates unique challenges that will take time to resolve. The degree of control accorded to different stakeholders, including the IAEA, technology supplier state, host state and customer state participants must be carefully calibrated to maximize incentives and efficiency without increasing proliferation risks. The costs of working out new legal and commercial arrangements to establish such facilities must be factored into any calculation of their economic benefits. Arrangements with the host state need to be made in order to ensure that enriched uranium or spent fuel can be transported to and from the facility unimpeded.

15.26 *Reprocessing Services.* Proposals for multilateral facilities have tended to focus on multilateral enrichment facilities and, to a lesser extent, reprocessing facilities. Yet 75-100 per cent of demand for enrichment services in 2030 would be satisfied by existing capacity and projected demand for reprocessing services will also be easily satisfied by existing capacity. Unfortunately the proposals are vague or silent on the areas where demand for additional fuel cycle services is most acute and the technical case for multilateral cooperation is perhaps strongest – interim and final spent fuel storage.

15.27 With the exception of Japan, all existing reprocessing plants are located in nuclear-armed states. Provision of reprocessing services is not something ever likely to be denied, since it could never be in the interests of the present range of suppliers to leave spent fuel unprotected with its plutonium content intact, especially in a nuclear aspirant state. That is not to say that states not themselves possessing reprocessing facilities, and prepared to forego the option, should not have assurances that other reprocessing services will always be available as needed. On the other hand, the product of reprocessing, the separated plutonium, is not something that should be routinely returned – only if there are no proliferation or security concerns, and then only as MOX fuel with delivery carefully phased in accordance with the principles of just-in-time to avoid the accumulation of stocks at the reactor site. If the new technologies outlined in Section 14 prove viable, it would not be necessary to use MOX fuel.

15.28 The reprocessing of spent fuel can significantly reduce the quantity of the nuclear waste left over for final disposal. Even so, there is no reason to

suppose that present world capacity cannot meet all reprocessing needs for decades to come. The international business of reprocessing is already highly competitive with France, Russia and the UK willing to accept foreign spent fuel for treatment. But India is one state with interests in the reprocessing game who may yet challenge the relatively stable status quo. We discuss below some other international reprocessing options in the context of two other proposals, the Russian *Global Nuclear Power Infrastructure* and *GNEP.*

15.29 *Interim Storage/Final Disposal.* Proliferation risks attach to the present practice of storing spent fuel, including the contained plutonium, and frequently for long periods, at the reactor site pending reprocessing or decisions on final disposal. For some situations, physical protection can also be an issue especially in light of concern about terrorist risks. Because of its radioactivity, the issue here is less one of theft than attack to try to spread contamination; theft is an issue, however for research reactor fuel. Spent fuel storage can be quite expensive for countries with small nuclear programs or research reactors only. IAEA studies have concluded that significant economies of scale would result were the storage task to be handled multilaterally. More to the point, concentrating storage in several regional sites and imposing IAEA safeguards over each would measurably assist in the IAEA monitoring role.

15.30 The main problem with any multinational storage would be the likely lack of domestic receptivity in any potential host country. That the spent fuel in question would have a multilateral pedigree would not necessarily render the whole arrangement palatable to domestic opinion. Cost estimates would also need to take into account long term liability issues, making long lasting, open-ended financial arrangements almost unavoidable. So far, of the multinational storage proposals, only the Russian proposal discussed next has contemplated the acceptance of other countries' waste, and even then the legislation only permits for waste from Russian origin fuel.

15.31 *Global Nuclear Power Infrastructure* (2006). This Russian proposal involves a network of international nuclear fuel cycle service centres around the world, under IAEA control and providing those services on a non-discriminatory basis. Russia has proposed four types of fuel cycle service centres within its borders – an International Uranium Enrichment Service Centre (IUEC) at Angarsk, which it has already established, a reprocessing and spent fuel storage facility, a personnel training and certification facility and a nuclear research and development facility. While the details of the proposal remain vague, and Russia has only implemented the front end of its fuel cycle multilateralization (see IUEC section below) its legislation permits fuel leasing and, were it to offer such services, it could greatly improve the incentives for states to rely upon the market for fuel cycle services and would give Russia a considerable competitive advantage over other suppliers.

15.32 *International Uranium Enrichment Centre* (2007). Russia established the IUEC as a model facility under its Global Nuclear Power Infrastructure at the existing Angarsk Electrolysis Chemical Complex. Rather than constructing a new facility, IUEC effectively multilateralises an existing facility by negotiating contracts for enrichment services with the Angarsk Electrolysis Chemical Complex that are guaranteed by the Russian government. This leaves management, operations and technology in Russian control, effectively "black-boxing" the enrichment technology so that foreign participants cannot access it. IUEC operates as a joint stock company and provides guaranteed access to enrichment for participant states, who may join IUEC through an agreement with the Russian government, provided that they meet (undefined) "established non-proliferation criteria". Kazakhstan is currently the only participant state; however, Armenia and Ukraine have already signed agreements to join the project in the near future and negotiations are continuing with Finland, South Korea and Belgium.

15.33 Though the details as to how the IUEC actually functions are unclear, it provides a model as to how existing facilities could be multilateralized. As criteria for participation are vague and Russia retains a significant degree of control over the venture, it is unclear whether such a balancing of stakeholder interests would be acceptable to all states.

15.34 *Global Nuclear Energy Partnership* (2006). The international component of this U.S. initiative involves the establishment of a group of supplier states who would provide reactors and fuel cycle services (including spent fuel take back, reprocessing and recycling) to customer states. Initially it was proposed that customer states would forego enrichment and reprocessing technologies, but this drew an adverse reaction: a number of states, including Argentina, Australia, Canada, South Africa, South Korea and Ukraine, indicated that they were considering their options before the "window of opportunity" to become a supplier state closed, and subsequently this requirement was dropped. GNEP's objective, however, is to establish circumstances whereby countries with nuclear power programs would have no need to pursue sensitive fuel cycle capabilities, predicated on development of new reprocessing and reactor technology to develop an economically viable closed fuel cycle operated by supplier states. This work is being carried out by a number of governments under the coordination of the Generation IV International Forum. U.S. plans to establish a domestic reprocessing plant under the GNEP banner were cancelled in April 2009.

15.35 As one of the only proposals focusing on the back-end of the fuel cycle, GNEP may provide sufficient incentives for states to rely upon the market for fuel cycle services, though its realization is heavily dependent upon the successful development and commercialisation of new technologies. GNEP would, however, entrench the division between supplier and customer

states, underscoring the importance of developing multilateral fuel cycle approaches to address the access and equity concerns of customer states. Continued political support of the U.S. government is important to the future of the program internationally. In October 2009 GNEP's Executive Committee agreed to a review of its future direction, including the possibility of a change of name to the "International Nuclear Energy Framework".

15.36 *Multilateral Enrichment Sanctuary Project* (2007). Under this German proposal, a new commercial multilateral enrichment plant would be established by a group of states, in agreement with the IAEA, and administered by a company set up by those states. The plant would be situated in a host state that would cede sovereignty over the territory. The IAEA would control all movements of nuclear materials in and out of the territory and would act as the regulatory authority for those facilities. Enrichment services would be guaranteed to all states satisfying criteria set by the IAEA, and would not be required to forego the development of indigenous enrichment facilities.

15.37 The MESP proposal would provide its participants and other customer states with a high degree of security of supply and strong economic incentives, and abolishes the supplier/customer distinction that makes GNEP and IUEC unpalatable for customer states. The project raises unique practical, political and legal challenges, not least finding a willing host state, and would need to build on the progress made by the simpler multilateralization proposals.

15.38 *Multilateralization of the Nuclear Fuel Cycle* (2007). This Austrian proposal provides a road map towards full multilateralization of the fuel cycle and integrates many of the proposals outlined above. It consists of two tracks. The first involves increasing the transparency and confidence in the international fuel cycle by requiring states to report their nuclear activities to the IAEA, which would then publish a periodic review of the fuel cycle services market based on that information. The second track involves the establishment of a nuclear fuel bank, similar to the NTI proposal, to be administered by the IAEA, and the IAEA assuming the role of a virtual broker for all transactions involving fissionable or source materials. Existing fuel cycle facilities would be multilateralized in a similar manner to the IUEC and Angarsk Electrolysis Chemicals Complex, and new facilities would be multilateralised from the outset. Once all facilities were fully multilateralized, a legally binding international agreement would prohibit the national pursuit of sensitive nuclear technologies, moving from an incentive-based to a restrictive multilateral fuel cycle arrangements.

THE WAY FORWARD

15.39 Multilateralization of the nuclear fuel cycle has acquired significant political momentum in recent years, as shown by the numerous proposals

put forward to achieve layered and incremental re-structuring of the international fuel cycle. Despite this, there are three main obstacles to the implementation of a multilateralized fuel cycle management system that would successfully stem the proliferation of sensitive nuclear technologies.

15.40 The first is the perpetuation of discrimination among supplier and customer states. All proposals, with the exception of the NTI, WNA and Austrian proposals, have been developed by supplier states. Greater consultation with, and participation by, customer states might help ensure that proposals receive more support from those states who will ultimately determine the success or failure of the proposal in supporting non-proliferation. Second, all proposals either explicitly or implicitly exclude states not complying with IAEA safeguards or outside the NPT. A situation such as that currently unfolding in Iran would thus not be addressed by any of the above proposals. Third, those proposals that are likely to be implemented in the short to medium term, such as the assurances of supply and fuel banks, might not provide sufficient economic and energy security incentives for states with current plans to expand their civilian nuclear power programs to not develop indigenous enrichment and reprocessing capabilities.

15.41 Spent fuel take-back as part of multilateral arrangements would greatly increase its attractiveness to customer states, but is only included in long-term proposals such as the Russian proposal and GNEP. However domestic aspects of GNEP have been cancelled and the Obama administration position on its international arm has yet to be announced. This administration is also less enthusiastic about reprocessing than its predecessor, though funding of research and development in relation to proliferation-resistant technologies is likely to continue.

15.42 Fuel fabrication is a complicating factor in all front-end fuel cycle initiatives such as fuel banks – different reactors require customized fuel assemblies, and stockpiling fuel for every reactor would not be feasible. States could however develop national fuel fabrication facilities without posing an additional proliferation risk.

15.43 The longer term multilateral facility proposals are more likely to encourage states not to develop these capabilities, but may not be implemented soon enough to provide states currently expanding their nuclear programs with a sufficiently attractive alternative to developing sensitive nuclear technologies nationally.

15.44 Assurance mechanisms such as the WNA proposal and Six-Country proposal are likely to come online in the next few years but are unlikely to stem the spread of enrichment technology. The establishment of the NTI – and Russian – proposed fuel banks will depend upon how long it takes

the IAEA Board of Governors to agree, if at all, upon the details: the first discussions in June 2009 were not promising in this respect. The establishment of an entirely new multilateral infrastructure lacks a compelling economic rationale, especially as current and planned global enrichment capacity among established technology holders is likely to satisfy present demand until 2030. No supplier state is likely to be eager to multilateralize existing facilities in a manner that shares control as well as providing access to fuel cycle services. And even if they were, this may not dissuade those countries determined to build their own national facility as a matter of principle, except at such time that all sensitive nuclear technologies are under safeguards in a world entirely free of nuclear weapons.

15.45 It must be noted, however, that most countries with nuclear programs are not proliferators. For the large majority, they are concerned simply with reaping the benefits of peaceful nuclear energy. Energy security, including access to nuclear power on a timely, predictable and economically attractive basis is their principal objective. For the most part, furthermore, they recognise the risks of widely dispersed weapons-useable material, and understand the need for restraint. Still, many of these same countries find it difficult to accept the notion that some states are more equal than others in the peaceful nuclear sector, and consequently are likely to reject the establishment of principles that further codify discrimination. In this regard, any new binding international norm stipulating that sensitive fuel cycle activities must be conducted exclusively in the context of a multilateral arrangement and no longer as a national undertaking, would amount to a reinterpretation of Article IV of the NPT and the rights specified therein for each party to pursue their own national programs.

15.46 Such a reinterpretation might not be entirely impossible, but would likely only be agreed in the context of a broader negotiation in which all existing facilities, wherever located, in nuclear-weapon states or elsewhere, would need to be subsumed into the new arrangement. Any new restrictions on independent national operations would need to apply to all, including non-NPT, nuclear-armed states as well as to non-nuclear-weapon states, thus bringing them to the same level of obligation as the latter. Clearly, negotiating this would be a tall order, not least given the predictable resistance of existing industry and technology holders. And that is to leave aside other possible preconditions that most likely would include demands for additional steps regarding disarmament and summary conclusion of an FMCT. All of this would be a time consuming process at best.

15.47 In the absence, therefore, of any near term new binding or universal norm, the best that might be hoped for in the medium term is a voluntary arrangement in which, in return for assurances of supply, recipient states would renounce the national construction and operation of sensitive fuel

cycle facilities for the duration of the agreement. In practice, countries would enter or not into such an arrangement according to their individual perception of advantage. The hope would have to be that a satisfactory experience in a multilateral venture in securing reliable and adequate supplies of fuel and services would lead most states to conclude that this way of meeting their nuclear requirements was preferable to a more independent, but problematic, alternative.

15.48 The Commission strongly believes that multilateralizing the nuclear fuel cycle would play an invaluable role in building global confidence in the peaceful uses of nuclear energy, and any efforts to that end should be encouraged. Such arrangements would provide an important foundation for a world free of nuclear weapons, where all sensitive fuel cycle activities will need to be under multilateral verification and control.

Recommendations on Multilateralizing the Nuclear Fuel Cycle

39. Multilateralization of the nuclear fuel cycle – in particular through fuel banks and multilateral management of enrichment, reprocessing and spent fuel storage facilities – should be strongly supported. Such arrangements would play an invaluable role in building global confidence in the peaceful uses of nuclear energy, and provide an important foundation for a world free of nuclear weapons, for which a necessary requirement will be multilateral verification and control of all sensitive fuel cycle activities. [15.48]

40. Pending the acceptance of more far-reaching proposals, support should be given to voluntary arrangements whereby, in return for assurances of supply, recipient states would renounce the national construction and operation of sensitive fuel cycle facilities for the duration of the agreement. [15.47]

PART IV:

FROM POLICY TO ACTION: A COMPREHENSIVE AGENDA

16. A PACKAGE FOR THE 2010 NPT REVIEW CONFERENCE

THE IMPORTANCE OF THE REVIEW CONFERENCE

16.1 Since it entered into force in 1970, the Nuclear Non-Proliferation Treaty (NPT) has been simultaneously the cornerstone of non-proliferation efforts, the foundation for the promotion of nuclear disarmament and the guarantor of the right to develop nuclear energy for peaceful purposes. Its breadth of membership gives it great normative force – every state is a member but for India, Pakistan and Israel (and North Korea, to the extent that its claim to have withdrawn from the treaty is accepted) – and, as we have noted elsewhere, it has been remarkably successful in holding the line against what was widely expected in the 1960s to be, by now, a world with a score or more nuclear-armed states. But, as we have also noted earlier in this report, the treaty regime has been under great strain in recent years – not least with the challenges posed by the A.Q. Khan illicit network, North Korea's breakout, Iran's testing of some of its conceptual and enforcement limits, and the indifference shown by most of the nuclear-weapon state NPT members most of the time to their disarmament obligations under it.

16.2 The NPT made provision for five-yearly meetings of its member states to "review the progress of the Treaty". Particularly since the 1995 Review Conference, which had the responsibility of deciding whether the treaty was to continue in force – and which resolved that it should, indefinitely – these have become major occasions, in the words of the 1995 decision, to "look forward as well as back …identify the areas in which, and the means through which, further progress should be sought in the future [and] address specifically what might be done to strengthen the implementation of the Treaty and to achieve its universality".

16.3 The 2000 Review Conference, taking place against the troubling background of the Indian and Pakistani nuclear weapons tests, and the loss of momentum following the U.S. Senate's failure to ratify the Comprehensive Nuclear-Test-Ban Treaty (CTBT), was successful particularly in reaching agreement on a series of measures that would advance disarmament (the "Thirteen Practical Steps", discussed below). But the 2005 conference was an unrelieved disaster, with considerable evident backsliding on disarmament by key weapon states, and no agreement reached about anything at all. All eyes are now on the May 2010 Review Conference, in the hope that it will not only recapture lost ground but advance significantly both the disarmament and non-proliferation agendas. In the new atmosphere which

has accompanied, in particular, the change of U.S. administration, there is some optimism that this will happen.

16.4 The review conference process itself is disconcertingly complex for the uninitiated, with a preparatory committee process extending over three years and the conference itself involving three major committees – on disarmament, non-proliferation and peaceful uses respectively – wrestling with literally hundreds of working papers and competing draft texts. It is important in this context that attention be prioritized, with the main goal being to reach agreement on a relatively small number of important substantive issues. While many issues ranging beyond this core will be debated and the subject of proposed resolutions, for 2010 we believe that priority attention should be focused on reaching agreement in the three areas discussed successively below: a "new consensus" statement on disarmament; specific new measures to strengthen the NPT non-proliferation regime and the IAEA; and ways of taking forward the 1995 Resolution on the Middle East and enhancing nuclear-weapon-free zones. In addition the opportunity should be taken to reinforce whatever momentum is generated on the issue of nuclear security by the April 2010 Summit, and to clearly restate the general international commitment to support the development of nuclear energy for peaceful purposes.

16.5 In the lead-up to the 2010 Review Conference it is important, in order to build a sense of, and heighten expectations as to, what may be achievable, that action be pursued on as many as possible of the related "Short Term Action Agenda to 2012" items identified in Section 17 below – including early U.S.-Russian agreement on a START follow-on treaty making big cuts in deployed strategic weapons; efforts to bring the North Korean and Iran situations closer to resolution; a serious start to negotiations in Geneva on fissile material production cut-off; and significant forward movement on the counter-terrorism and related nuclear security issues to be debated at the President Obama-initiated summit scheduled for April 2010.

UPDATING THE "THIRTEEN PRACTICAL STEPS" ON DISARMAMENT

16.6 The "Thirteen Practical Steps", adopted as part of the final document of the 2000 NPT review conference on the initiative of the New Agenda Coalition (of seven states favouring early nuclear disarmament), was an important statement of commitment of a kind which deserves to be put on the record again in 2010. The failure of the 2005 conference owed much to the unwillingness of the U.S. (supported by France publicly and Russia privately), to support its reaffirmation in any form – a hardly surprising attitude given the Bush administration's previous decisions in 2001 not to seek to ratify the CTBT, in 2002 to abrogate the ABM Treaty, in the same year to halt (with Russian acquiescence) the Trilateral Initiative work on

verification of weapon-origin material, and in 2004 not to support any fissile material cut-off treaty that was verifiable.

16.7 In considering what it might be possible to agree upon for 2010 in the new and more positive current atmosphere, it is to be noted that few if any NPT member states appears to be arguing for the reaffirmation of the 2000 text without change. A good deal of the original language negotiated still has resonance and relevance, but some of it is outdated, and the document as a whole is not as sharply-focused and accessibly ordered as it might be. In the following paragraphs the Commission, after reviewing the present text, proposes that a revised twenty-point "New International Consensus on Action for Nuclear Disarmament" be adopted (see Box 16-1). We have taken into account in formulating this proposal (and in our other recommendations elsewhere in this report) not only the draft recommendations already before the review conference, but a number of substantial recent contributions to the international debate, including the "Five Point Proposal" of UN Secretary-General Ban Ki-moon in October 2008 and the "Eleven Benchmarks" proposed by former Japanese Foreign Minister Hirofumi Nakasone in April 2009.

16.8 We propose that the terms of this statement be applicable where relevant to the three nuclear-armed states – India, Pakistan and Israel – which remain outside the NPT, and be capable of being embraced also by them. The Commission is of course conscious of the strength of feeling among many NPT member states about the non-membership of these states, and the obvious desirability of universality in the treaty's membership were that at all capable of realization. But the well-known problem is that none of these states would apply to join the treaty, if at all, other than as a weapon state, and that none would be accepted other than as a non-weapon state. Given that reality, the most immediately important objective here as elsewhere, in the interests of achieving a nuclear weapon free world, is not to be stalemated at the threshold in this way, but to ensure so far as possible that the "elephants outside the room" accept effectively the same commitments, with respect to both disarmament and non-proliferation, as NPT member states.

16.9 **Language worth preserving from 2000.** Referring to the relevant paragraph numbers in the 2000 final document, it will be seen that the "importance and urgency" of bringing the CTBT into force (#1) has only increased since then, as has the need for preserving the moratorium on testing in the meantime (#2). The principle of the irreversibility of nuclear disarmament and arms control and reduction measures (#5) remains a crucial basic principle, albeit not easy to enforce. The "unequivocal undertaking… to accomplish the total elimination of their nuclear arsenals" (#6) remains the starting point for the whole disarmament enterprise. The six specific disarmament steps identified for the nuclear-weapon states (#9) all remain applicable, and should be central elements in any new statement, although

some of the language could be a little sharper, and made potentially applicable to nuclear-armed states outside the NPT as well. There is still a need to bring unrequired fissile material under international verification (#10). The reference to "general and complete disarmament" as the ultimate objective (#11) looks, as always, a little Quixotic in the world as we know it, but it is clearly articulated in Article VI of the NPT, and the international aspiration remains. Reporting obligations (#12) are still appropriate, although they could be widened. And the further development of verification capabilities (#13) remains a necessity.

16.10 **Modified and new language needed.** In the 2000 document, the reference to the Conference on Disarmament fissile material negotiations needs now to reflect recent developments (#3), as does the following reference to the CD's role in nuclear disarmament. The reference to U.S.-Russian treaty negotiations (#7) is no longer applicable, with the U.S. abrogation of the ABM treaty in 2002 effectively nullifying START II. And with the Trilateral Initiative on verification (#8) running its course, different language is needed on taking this issue further. Beyond that new, as distinct from corrective, language is we think appropriate on a number of issues. In particular, it is important to start systematically focusing attention and commitment not only on long-term or ultimate disarmament objectives, and very immediate short-term ones, but also on what we describe as the medium-term objective of achieving, by 2025, a "minimization point": as discussed elsewhere, particularly in Section 18, this is characterized by very low numbers of nuclear weapons, together with significant doctrinal changes (drastically limiting the role of nuclear weapons) and accompanying force posture changes (deployments, launch arrangements and the like making that doctrinal marginalization credible in practice). We also believe, as discussed further in Section 17, that unqualified negative security assurances – that nuclear weapons will not be used against non-nuclear-weapon state NPT members, or at least those in compliance with their NPT obligations – are important ways of demonstrating diminishing commitment to nuclear weapons, and ought to be incorporated in any new statement.

16.11 **A new twenty-point action statement.** Bringing these various elements together, we propose for the consideration of the May 2010 NPT Review Conference the draft statement set out in the accompanying Box 16-1. This would need to be taken into the negotiating process with a group of state sponsors, as was the 2000 proposal by the New Agenda Coalition, and will clearly need to have the support, among others, of the five nuclear-weapon state NPT members. The language proposed does not always read as strongly as our own recommendations elsewhere, but not every bridge has to be crossed at once. The main point of seeking its adoption is not to create at this stage any binding legal obligations on those states, or anyone else, but rather – as always with these kinds of documents – to create a normative consensus on what is the broad path to follow and the right thing for each state to do, raising the political costs for those who choose to act otherwise.

BOX 16-1

"A NEW INTERNATIONAL CONSENSUS ON ACTION FOR NUCLEAR DISARMAMENT"

The States party to the Nuclear Non-Proliferation Review Conference in May 2010 to agree:

On the Objective: A World Free of Nuclear Weapons

1. To reaffirm the unequivocal undertaking by the nuclear-weapon States to accomplish the total elimination of their nuclear arsenals leading to nuclear disarmament to which all States parties are committed under Article VI.

2. On the need for nuclear-armed States not party to the Nuclear Non-Proliferation Treaty to make a similar undertaking to accomplish ultimately the total elimination of their nuclear arsenals, and to acknowledge the universal and binding nature of the norms against testing, acquisition, and use or threat of use of nuclear weapons otherwise than for defence against nuclear attack.

On Key Building Blocks: Banning Testing and Limiting Fissile Material

3. On the importance and urgency of signatures and ratifications, without delay and without conditions and in accordance with constitutional processes, to achieve the early entry into force of the Comprehensive Nuclear-Test-Ban Treaty.

4. On a continuing moratorium on nuclear-weapon-test explosions or any other nuclear explosions pending entry into force of that Treaty.

5. On the need to maintain and increase support for the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization in further developing the treaty verification regime.

6. On the need to negotiate to an early conclusion in the Conference on Disarmament a non-discriminatory, multilateral and internationally and effectively verifiable treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices.

7. On the need for all nuclear-weapon States, and other nuclear-armed states, to declare or maintain a *moratorium on the production of fissile material for weapon* purposes *pending the conclusion of this treaty.*

8. On the need for nuclear-weapon States and other nuclear-armed States to make arrangements to place fissile material designated by each of them as no longer required for military purposes under IAEA or other relevant international verification and arrangements for the disposition of such material for peaceful purposes.

On Specific Steps toward Nuclear Disarmament

9. On the need for nuclear-weapon States, and other nuclear-armed states, to make an early commitment to not increasing their nuclear arsenals, and take whatever steps are necessary, unilaterally, bilaterally or multilaterally, to achieve nuclear disarmament, in a way that promotes international stability and is based on the principle of undiminished security for all.

10. On the need to set as an interim objective the achievement in the medium term, as soon as possible and no later than 2025, of a world in which:

    (a) the number of all nuclear weapons, of whatever size, role or deployed status, is reduced to a small fraction of those in existence in 2010;

    (b) the doctrine of every State with nuclear weapons is firmly committed to no first use of them, on the basis that their sole remaining purpose is to deter the use of nuclear weapons by others; and

    (c) the deployment and launch-alert status of those weapons is wholly consistent with that doctrine.

11. On the particular need for leadership from, and cooperation between, those nuclear-weapon States which possess the greatest numbers of nuclear weapons in agreeing early on deep reductions, and making sustained efforts to continue such reductions for all classes of weapons.

12. On the need for all the nuclear-weapon States, and other nuclear-armed States, to make further efforts to reduce their nuclear arsenals, and act early to prepare the ground – through studies, strategic dialogues with each other, and preparatory work in the Conference on Disarmament – for a multilateral disarmament process.

13. On the need for the nuclear-weapon States, and other nuclear-armed States, to accept and announce as soon as possible a diminishing role for nuclear weapons in their security policies to minimize the risk that these weapons will ever be used and to facilitate the process of their total elimination.

14. On the need for the nuclear-weapon States, and other nuclear-armed States, to as soon as possible give unequivocal negative security assurances, endorsed by the UN Security Council, that they will not use nuclear weapons against non-nuclear-weapon States not determined by the Security Council to be in non-compliance with the Nuclear Non-Proliferation Treaty.

15. On the need for the nuclear-weapon States, and other nuclear-armed states, to take concrete measures in relation to the operational status of nuclear weapons systems to the extent possible at each stage of the disarmament process, in particular to lengthen launch decision times and to generally reduce the risk of accident or miscalculation.

On Transparency

16. On the need for increased transparency by the nuclear-weapon States, and other nuclear-armed States, with regard to nuclear weapons capabilities, in the implementation of arms control agreements and as a voluntary confidence-building measure to support further progress on nuclear disarmament.

On Accountability

17. To all States with significant nuclear programs making regular reports, to the relevant United Nations organs and within the framework of the strengthened review process for the Nuclear Non-Proliferation Treaty, on the implementation of their disarmament and non-proliferation obligations and programs including, in the case of nuclear-weapon States and other nuclear-armed States, on their nuclear arsenals, fissile material not required for military purposes, and delivery vehicles.

On Verification

18. To further study and development of the verification capabilities that will be required to provide assurance of compliance with nuclear disarmament agreements for the achievement and maintenance of a nuclear-weapon free world.

On Irreversibility

19. To the principle of irreversibility applying to nuclear disarmament, non-proliferation and other related arms control and reduction measures.

On General and Complete Disarmament

20. To reaffirm that the ultimate objective of the efforts of States in the disarmament process is general and complete disarmament under effective international control.

SPECIFIC MEASURES TO STRENGTHEN THE NPT AND IAEA

16.12 The necessary measures to strengthen the NPT legal regime, and IAEA on which it depends for institutional support, were fully addressed in Section 9, but those of them that could most usefully be endorsed by the 2010 Review Conference may be summarized as follows.

16.13 As to *safeguards and verification,* the most critical need is for all states to accept the application of the Additional Protocol. To encourage universal take-up, all states should make such acceptance a condition of their nuclear exports.

16.14 As to *compliance and enforcement,* the most critical need is agreement to strengthen collective measures to deal with withdrawal from the NPT, with the NPT Review Conference declaring that a state withdrawing from the NPT is not free to use for non-peaceful purposes nuclear materials, equipment and technology acquired while party to the NPT; recommending that the Security Council make it clear that any withdrawal will be regarded prima facie as a threat to international peace and security; and recommending to states that they make it a condition of nuclear exports that safeguards agreements continue to apply after any such withdrawal.

16.15 As to *strengthening the IAEA*, the most critical need, if the agency is to fully and effectively perform its assigned functions, is for its regular budget to be significantly increased – without any "zero real growth constraint" and so as to reduce reliance on extra-budgetary support for key functions – as recommended in 2008 by the independent Zedillo Commission on the Role of the IAEA to 2020 and Beyond.

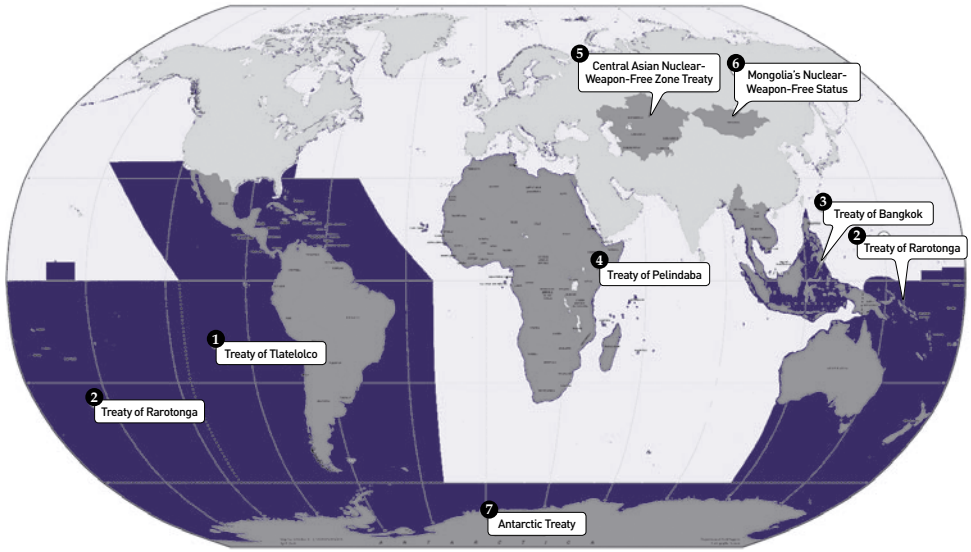
THE MIDDLE EAST AND NUCLEAR WEAPON FREE ZONES

16.16 Successive review conferences have given strong support to the establishment and further development of nuclear-weapon-free zones (NWFZ), six of which are now in force around the world – in Latin America and the Caribbean, the South Pacific, South East Asia, Central Asia, Africa and, effectively though not so described, the Antarctic. Though varying in their strength and specificity, these zones generally prohibit the testing, stationing, development and use of nuclear weapons within a designated territory, and include protocols by which nuclear-weapon states can renounce the use and threat of use of nuclear weapons against states included in the zone. The Commission strongly encourages all NPT nuclear-weapon state members to sign and ratify the protocols for all the Zones and, similarly, all the other nuclear-armed states (so long as they remain outside the NPT) to issue stand-alone negative security assurances for each of them.

BOX 16-2

NUCLEAR WEAPON FREE ZONES

Demarcation of nuclear-weapon-free zones, nuclear-weapon-free status and nuclear-weapon-free geographical regions



Land territory covered by nuclear-weapon-free treaties
Sea territory covered by nuclear-weapon-free treaties

Nuclear-weapon-free zones

1. The 1967 Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean

2. The 1985 South Pacific Nuclear-Free Zone Treaty

3. The 1995 Treaty on the South-East Asia Nuclear-Weapon-Free Zone

4. The 1996 African Nuclear-Weapon-Free Zone Treaty

5. The 2006 Treaty on a Nuclear-Weapon-Free Zone in Central Asia

The treaties establishing the nuclear-weapon-free zones, inter alia, ban nuclear weapons within the respective territories of the zones, including the acquisition, posession, placement, testing and use of such weapons.

Nuclear-weapon-free status

6. In 1992, Mongolia declared its nuclear-weapon-free status, which is internationally recognised and prohibits, inter alia, the aquisition, posession, placement, testing and use of nuclear weapons on its territory.

Nuclear-weapon-free geographical regions

7. The 1959 Antarctic Treaty, inter alia, prohibits any measures of military nature on the continent of Antarctica, including any testing of nuclear weapons.

Source: UN Office for Disarmament Affairs

16.17 The Commission believes that the NWFZs have made, and continue to make, a very important contribution to nuclear non-proliferation and disarmament, notably the oldest and in many ways most substantive and successful of them, the Latin American and Caribbean NWFZ established under the 1967 Treaty of Tlatelolco. Not the least of their role has been in helping to build and consolidate the normative constraint against nuclear weapons. States that have joined these zones reinforce their commitments under the NPT, and this second layer of commitments, made explicitly to neighbours, raises confidence that non-proliferation obligations will be upheld, and increases the probability and severity of backlash against a state that does not comply. We support any effort to introduce them in parts of the world not presently covered.

16.18 Most current attention in this respect focuses, as it has for many years, on the issue of a NWFZ, or broader Weapons of Mass Destruction Free Zone (WMDFZ), for the Middle East. Agreement on a resolution at the 1995 NPT Review Conference, calling for practical steps to be taken towards the establishment of such a zone, was undoubtedly an essential element in achieving the decision then to indefinitely extend the treaty's duration. It will be equally important at the 2010 conference to make significant further progress on this front, difficult though that will be if movement on a wider Middle East peace process continues to remain largely stalled.

16.19 The Commission supports, in this context, a major new effort being made to implement the 1995 resolution, and in particular the convening by the Secretary General of the UN – of a conference of all states concerned to address creative and fresh ways and means to do so, including the identification of confidence building measures that all key states in the region can embrace, with early consultations – drawing explicitly on the experience of other zones – to facilitate that. A Special Representative should be appointed to shepherd these efforts. No-one doubts that it will be a protracted process for a NWFZ agreement to be negotiated and enter into force, but the prerequisites for it, and the basic elements that any such agreement would need to contain, can and should be discussed now.

16.20 Most of the obstacles that have impeded convening such a meeting, and the follow-on process that would hopefully follow it, are debating points or negotiating tactics stemming from reluctance on the part of Israel to confirm or concede its deterrent, and on the part of Arab states to normalize relations while the Palestinian issue remains unresolved. But given the longer-term unsustainability of the nuclear imbalance, the clear interest of all states is in removing nuclear proliferation as a source of regional resentment and instability. The experiences of Latin America, the South Pacific and most recently Africa with nuclear-weapon-free zones have thoroughly validated the concept. Disarmament and peace must be pursued in parallel.

16.21 Participating in a conference would not require an immediate, and some would argue premature, end to Israel's policy of nuclear ambiguity. (The "opacity" issue, as it affects Israel, is discussed again in more detail in Section 17, paras 17.33–38.) In coded language, successive Israeli governments have indicated readiness to abolish their weapons (and fissile-material stocks) and be part of a NWFZ if a sustainable peace in the region is achieved. Israel's conventional military pre-eminence is such that the foreboding about existential threat that originally warranted the build-up of a deterrent is no longer appropriate. Moreover, none of the other states of the region is any longer outright rejectionist: all have at various times (not least in the context of the Arab Peace Initiative first proposed by then Crown Prince Abdullah of Saudi Arabia in 2002 and re-endorsed at the Arab League Summit in 2007) indicated the possibility of normalization, of recognizing and cooperating with Israel, if certain conditions are met. Even Iran has said that it would respect the decision of a majority of the Palestinian people should they opt to accept a two-state solution. Since all relevant regional countries are already members of the UN there should be no formal inhibition about them participating in a meeting process under these auspices. The Commission believes that they should.

Recommendation on Priorities for the 2010 NPT Review Conference

41. The following should be the major priority issues for the 2010 NPT Review Conference:

    (a) *Action for Disarmament.* Agreement on a twenty-point statement, "A New International Consensus for Action on Nuclear Disarmament" (see Box 16-1), updating and extending the "Thirteen Practical Steps" agreed in 2000.

    (b) *Strengthening Safeguards and Enforcement.* Agreement:

    - that all states should accept the application of the Additional Protocol and that, to encourage its universal take-up, acceptance should be made a condition of all states' nuclear exports;
    - to declare that a state withdrawing from the NPT is not free to use for non-peaceful purposes nuclear materials, equipment and technology acquired while party to the NPT;
    - to recommend that the Security Council make it clear that any withdrawal will be regarded prima facie as a threat to international peace and security; and
    - to recommend to states that they make it a condition of nuclear exports that safeguards agreements continue to apply after any such withdrawal.

(c) *Strengthening the IAEA*. Agreement that the IAEA's budget be significantly increased – without any "zero real growth" constraint, and so as to reduce reliance on extra-budgetary support for key functions – as recommended in 2008 by the Zedillo Commission.

(d) *Middle East Weapons of Mass Destruction Free Zone*. Agreement that the Secretary-General of the UN should convene an early conference of all relevant states to address creative and fresh ways to implement the 1995 resolution, including the identification of confidence building measures that all key states in the region can embrace, and to commence early consultations to facilitate that.

(e) *Nuclear security*. Agreement that states should take further measures to strengthen the security of nuclear materials and facilities, including early adoption of the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material and the most recent international standards, accelerated implementation of the cooperative threat reduction and associated programs worldwide, and greater commitment to international capacity building and information sharing.

(f) *Peaceful uses.* Agreement that the inalienable right to the use of nuclear energy for peaceful purposes remains one of the fundamental objectives of the NPT and to dedicate increased resources, including through the IAEA's Technical Cooperation Programme, to assist developing states in taking full advantage of peaceful nuclear energy for human development.

17. SHORT TERM ACTION AGENDA: TO 2012 – ACHIEVING INITIAL BENCHMARKS

BOX 17-1

THE SHORT TERM ACTION AGENDA – TO 2012

On Disarmament

- Early agreement on a START follow-on treaty, with the U.S. and Russia agreeing to deep reductions in deployed strategic weapons, addressing the issue of strategic missile defence and commencing negotiations on further deep cuts in all classes of weapons.
- Early movement on nuclear doctrine, with all nuclear-armed states declaring at least that the sole purpose of retaining the nuclear weapons they have is to deter others from using such weapons against them or their allies (while giving firm assurances to such allies that they will not be exposed to unacceptable risk from other sources, including in particular chemical and biological weapons).
- All nuclear-armed states to give strong negative security assurances to complying non-nuclear weapon states parties to the NPT, supported by binding Security Council resolution, that they will not use nuclear weapons against them.
- Early action on nuclear force postures, with particular attention to the negotiated removal to the extent possible of weapons from "launch-on-warning" status.
- Early commitment by all nuclear-armed states to not increasing their nuclear arsenals.
- Prepare the ground for a multilateral disarmament process by all nuclear-armed states conducting relevant studies; engaging in strategic dialogues with the U.S., Russia and each other; and commencing a joint dialogue within the framework of the Conference on Disarmament work program.

On Non-Proliferation

- A positive outcome for the May 2010 NPT Review Conference, with member states reaching agreement on measures to strengthen the NPT regime, including improved safeguards, verification, compliance and enforcement; measures to strengthen the effectiveness of the IAEA; "A New International Consensus for Action on Nuclear Disarmament" statement on disarmament issues; and measures to advance the implementation of the Middle East and other existing and proposed Nuclear Weapon Free Zones.
- Satisfactory negotiated resolution of the North Korea and Iran nuclear program problems.
- Movement toward strengthening non-proliferation regimes outside the NPT, and applying equivalent disciplines to NPT non-members.

On Both Disarmament and Non-Proliferation

- Bring into force the Comprehensive Nuclear-Test-Ban Treaty.
- Conclude negotiations on a Fissile Material Cut-off Treaty.

On Nuclear Security

- Bring into force the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material, accelerate implementation of the cooperative threat reduction and associated programs designed to secure dangerous nuclear weapons, materials and technology worldwide, and achieve greater commitment to international capacity building and information sharing.

On Peaceful Uses of Nuclear Energy

- Movement toward greater multilateralization of the nuclear fuel cycle, and government-industry cooperation on proliferation-resistant technologies and other measures designed to reduce any risks associated with the expansion of civil nuclear energy.
- Promotion of international cooperation on nuclear energy infrastructure to raise awareness worldwide of the importance of the three Ss – safeguards, security and safety – and assist countries concerned in developing relevant measures.

DEFINING SHORT TERM OBJECTIVES

17.1 **Defining and Marking the Short Term.** The most immediate short term objective is a successful NPT Review Conference which will in turn, as discussed in the last section, require intense commitment in the months leading up to it by both nuclear-weapon and non nuclear-weapon state members to define the issues and build consensus. But for the purposes of this report we prefer to regard the short term as extending beyond May 2010 to 2012, partly because the end of the present Obama and Medvedev terms (and the year of the scheduled expiry of the Moscow Treaty) is a natural time to stocktake, but more importantly because there are a number of moves on both the disarmament and non-proliferation fronts, summarized below, about which it is important to inject a sense of urgency but which at the same time will need more than just a few months to accomplish.

17.2 One way of recognizing the end of the short term, benchmarking its achievements, and defining the way forward in the years ahead might be for the United Nations General Assembly to hold a Special Session on Disarmament late in 2012. The three previous such special sessions (in 1978, 1982 and 1988) were stultified by the rehearsal of familiar and mutually contradictory national positions, and there is always an issue whether such grand international occasions are likely to be productive, unproductive or counter-productive. But the UN General Assembly, with its uniquely comprehensive membership and political legitimacy is, at its best, an extremely important international norm-setting institution, and a 2012 SSOD might be well timed to capture and build upon a new sense of optimism about what is achievable in nuclear disarmament. And the formal mechanism to commence such organization already exists in a consensus General Assembly resolution of 2008.

17.3 Past experience suggests that some two years lead time would be necessary to prepare effectively for such a session, which would allow the decision as to whether to have it in the latter part of 2012 to be deferred until mid-2010. The Commission favours this course which would, in turn, allow for reflection on the outcome of the 2010 Review Conference, and a judgment to be made as to whether enough momentum is building to justify the resources and effort involved.

17.4 **Disarmament Objectives.** There are four distinct disarmament-related objectives, addressed successively below, which the Commission believes should be pursued in the short term to 2012: early agreement on a START follow-on treaty, with the U.S. and Russia agreeing to reductions in deployed strategic weapons, seriously addressing the issue of strategic missile defence and commencing negotiations on further deep cuts in all classes of weapons; preparation of the ground for a multilateral disarmament

process by all nuclear-armed states engaging in strategic dialogues with the U.S., Russia and each other, conducting relevant studies, and committing themselves to not increasing their nuclear arsenals; early movement on nuclear doctrine, with nuclear-armed states declaring that the sole purpose of retaining the nuclear weapons they have is to deter others from using such weapons against them or their allies, and giving unequivocal negative security assurances to non-nuclear weapon states parties to the NPT *)*; and early action on nuclear force postures, with particular attention to removing weapons from launch-on-warning status.

17.5 **Non-Proliferation Objectives.** The highest priority short term non-proliferation objective is clearly a positive outcome for the May 2010 NPT Review Conference, with member states reaching agreement on measures to strengthen the NPT regime, including improved safeguards, verification, compliance and enforcement; measures to strengthen the effectiveness of the IAEA; "A New International Consensus for Action on Nuclear Disarmament" statement on disarmament issues; and measures to advance the implementation of the Middle East and other existing and proposed Nuclear Weapon Free Zones (see Section 16). The most immediately pressing non-proliferation problems concern North Korea and Iran, discussed later in this section, both of which the Commission believes may be capable of being resolved satisfactorily – although not without great difficulty along the way – by negotiation.

17.6 Also needing attention in the short term will be the accelerated implementation, worldwide, of cooperative threat reduction and associated programs, designed to secure from terrorist or other misuse dangerously "loose" nuclear weapons, materials and technology (see Section 13), and at least some movement toward greater multilateralization of the nuclear fuel cycle, and government-industry cooperation on proliferation-resistant technologies and other measures designed to reduce any risks associated with the expansion of civil nuclear energy (see Sections 14 and 15). More difficult to define, but just as important, will be finding ways of strengthening non-proliferation and related disciplines outside the NPT, not least so as to embrace those non-NPT member states (India, Israel and Pakistan) who seem unlikely candidates for accession to it any time soon, but whose nuclear programs need, in the wider interest, to be effectively safeguarded (see Section 10).

17.7 **Building blocks for both non-proliferation and disarmament.** We have emphasized throughout this report, and will continue to, the crucial importance of early entry into force of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) (see Section 11*)*, which is awaiting not only passage through the U.S. Senate, but ratification by eight other countries (China, Egypt, India, Indonesia, Iran, Israel, North Korea and Pakistan) and early completion of

the barely commenced Geneva negotiations on a Fissile Material Cut-off Treaty (FMCT) (Section 12). Another important priority, which is overdue for attention, but has barely received it from anywhere, is finding a way to equitably share the cost burdens associated with disarmament and non-proliferation, addressed in paragraph 18.26.

REDUCING WEAPON NUMBERS: U.S. AND RUSSIAN LEADERSHIP

17.8 Leadership by the two major nuclear powers, possessing between them over 95 per cent of the world's nuclear warheads, will be indispensable from the outset. Much has been done, but much more remains to be done. A dramatic reduction in strategic offensive forces began with the Strategic Arms Reduction Treaty (START) signed in 1991, which barred each side from deploying more than 6,000 such nuclear warheads, distributed between a maximum of 1,600 ICBMs (intercontinental ballistic missiles), SLBMs (submarine launched ballistic missiles) and heavy bombers, and resulted in the removal of around 80 per cent of all the strategic nuclear weapons then in existence.

17.9 START, due to expire on 5 December 2009, was supplemented in 2002 by the Strategic Offensive Reductions Treaty (SORT), better known as the Moscow Treaty, under which each side agreed to further limit its strategic arsenal to 1700 – 2200 deployed weapons, while able to "determine for itself the composition and structure of its strategic offensive arms". Significant in the scale of the further reductions envisaged – and actually accomplished under it – and innovative in focusing just on warheads rather than delivery systems, SORT has nonetheless been criticized for its lack of any verification provisions, the absence of any requirement that weapons taken out of deployment be destroyed, and for its targets only having to be met by 31 December 2012, the day it expires.

17.10 For all the advances achieved by these agreements, and some additional unilateral decision-making, the two states' total arsenal of useable warheads still remains huge: some 9,400 for the U.S. and 13,000 for Russia. On the best available current estimates (some but not all figures are on the public record) these numbers can be sub-divided as follows:

For the U.S., 9400 nuclear warheads, of which:

- some 2200 are operationally-deployed strategic warheads
- some 500 are operationally-deployed "sub-strategic" warheads
- around 2500 warheads are in reserve (of which some 500 are "sub-strategic")
- around 4200 are awaiting dismantlement

For Russia, 13000 nuclear warheads, of which:

- close to 2800 are operationally-deployed strategic warheads
- roughly 2000 are operationally-deployed "sub-strategic" warheads
- an estimated 8150 warheads are in reserve or awaiting dismantlement (of which some 3400 are "sub-strategic")

17.11 In an important breakthrough, following President Obama's visionary Prague speech in April 2009 and agreement between Presidents Medvedev and Obama at their July 2009 Moscow Summit, negotiations are now under way for a follow-on treaty to renew and expand START, designed to combine its verification rigour with some of the flexibility of the Moscow Treaty, with lower numbers of warheads and their associated delivery vehicles. The Joint Understanding of that Summit set ranges of 1500–1675 warheads each, and 500–1100 delivery vehicles, with the understanding that more specific numbers within these limits would be agreed in the course of negotiations.

17.12 Even if quick agreement is reached on the lower of these numbers, and 2010 commences with commitments by both the U.S. and Russia to reduce their deployed strategic weapons to 1500 each, a huge task will remain to bring overall numbers of warheads – including sub-strategic weapons, and those in reserve and awaiting dismantlement – right down to the levels that we will argue, in the next section, need to be achieved by 2025 if the world is going to be serious about ultimate elimination. While it is unlikely that another major bilateral agreement will be achievable in the short term framework that we identify – not least because many difficult issues like ballistic missile defence and conventional arms imbalances are bound to cause more negotiating complications as the disarmament process goes further – it is crucial that discussions about such deep further cuts, in the context of an ongoing broader strategic dialogue, continue seamlessly after the conclusion of the START follow-on treaty.

17.13 Achieving further such deep reductions will be easier if the implementation of this follow-on treaty can be accelerated. The scheduled expiration of START I in December 2009 allowed little time for negotiations of this treaty. As a result, the proposed *reduction* in the total number of nuclear warheads envisaged under it (a maximum of 700-1100 warheads, and 150-600 delivery vehicles from existing levels of deployed strategic forces) are in the view of the Commission far too modest for the planned treaty implementation time-frame of seven years and the total life-span of the treaty of ten years. These cuts contrast very unfavourably with the reductions under START I of some 4000 to 6000 for each party during the treaty's seven year implementation period. Accordingly, we urge both parties to bring forward the envisaged reductions under the START follow-on treaty to no later than 2015. Furthermore, we urge that once this treaty

is ratified, the U.S. and Russia resume intensive negotiations with a view to reaching a further START agreement no later than 2015 – that agreement should bring total number of warheads down to no more than 1000 for each, and hopefully much less, by the year 2020.

MULTILATERAL DISARMAMENT: PREPARING THE GROUND

17.14 While the U.S. and Russia must lead the way down on numerical reductions, the other nuclear-armed states will by definition have to follow, if not only the ultimate elimination of all nuclear weapons is to be achieved, but significant reductions along the way. Commencing and following through the necessary multilateral process will involve both path-breaking and back-breaking diplomacy. New formats for inter-state dialogues and negotiations will have to be created, while clarifying competing interests and objectives among all relevant states and setting the parameters for negotiations will take unprecedented effort. These are not reasons to avoid or delay the challenge, but for starting to come to terms with it now. The process will be long, drawn-out and is likely to occupy the whole of our medium-term time frame, but there are both substantive and procedural elements of it which can and should be initiated, or at least should be attempted, in the short term before 2012 as well.

17.15 **"No increase" declarations.** In terms of substance, as distinct from process, the highest priority need is for all nuclear-armed states to explicitly commit not to actually increase the number of their nuclear weapons. Efforts should certainly be made to meet to achieve this in the short-term, if at all possible before the 2010 NPT Review Conference, where such declarations would make a big impact. But again the size of this task should not be underestimated. Several nuclear-armed states – India, Pakistan and probably China – appear to be currently increasing rather than reducing the number of their nuclear warheads, along with their fissile material production. Israel's position is, as so often, unclear. It is only France and the UK, along with the U.S. and Russia, who have been clearly reducing their nuclear arsenals and have ostensibly ended fissile material production for military purposes. (For North Korea the urgent task remains of persuading it not only not to add to its stock of explosive devices, but to reverse course completely). An explicit no-increase commitment from China in particular would facilitate greater progress on disarmament between the U.S. and Russia, and this would in turn be helpful in persuading all or most of the other nuclear-armed states to reduce, or at least not further increase, their arsenals.

17.16 It may be that, encouraged by the momentum of U.S.-Russian disarmament, there will be unilateral warhead cuts (as has already occurred

in the UK and France) and a deferral or cancellation of pending force modernization choices (like the UK's Trident-missile carrying submarine replacement program). But it cannot be expected that the other nuclear-armed states will reduce their nuclear weapon holdings simply as a consequence of the two major powers agreeing to further very deep cuts. In the past, U.S. and Soviet/Russian offensive nuclear warhead numbers, whether rising or falling, have not served as the main force determinants of the other nuclear powers, who have taken their individual decisions in response to their own perceived circumstances. The considerations that may and may not influence the decisions of other states to reduce and ultimately eliminate their weapons are discussed in more detail in Section 18, setting out an action plan for the medium-term.

17.17 **Strategic dialogues.** The first procedural need is for serious strategic dialogues, opening up all relevant issues, to be initiated not only by the U.S. with Russia and China – the most immediately important enterprise – but by all the relevant parties with each other. These can proceed on a bilateral basis in the first instance, while the options for commencing a multilateral process are systematically explored. What is crucially necessary, here as elsewhere, is that an atmosphere be created in which the nuclear-armed states come to feel that cooperation rather than conflict is the defining feature of their relations.

17.18 In the case of U.S.-Russia, renewed habits of U.S.-Russian cooperation in arms control make plausible the wider strategic dialogue that is now necessary on everything from perceived conventional force imbalances and the role of NATO, to the role of "battlefield" and "tactical" weapons, missiles and launch decision times. Ballistic missile defence – further discussed in Section 18 of this report – is a particularly central issue, complicating calculations about whether conflicts including nuclear attacks could be won or survived and generating intense suspicions: while the attractiveness of acquiring immunity from attack is obvious, the technological unlikelihood, fantastic expense, and destabilising consequences of the effort cry out for rational, sustained dialogue on how to manage these systems. The U.S. and Russia should enter into substantive discussion on strategic missile defence as a first step in recreating a legal limitation regime.

17.19 The time is also ripe for enhanced U.S. strategic dialogue with China – upgraded to the same level as that which exists between the U.S. and Russia – especially if successful U.S.–Russian arms-reduction comes to reduce the huge gap in the size of their respective arsenals. It is important that the U.S. and others fully understand the extent and depth of China's concerns on such issues as conventional imbalances, strategic ballistic missile defence and the potential weaponization of space. Equally, China's ever-growing prominence in the international system, economic and political, and its

clearly expanding military capability, especially at sea, makes vital its greater embrace of habits of strategic cooperation: transparency and confidence-building; restraints on nuclear capability; ratification of the CTBT, and fuller participation in multilateral forums, including the export-control regimes.

17.20 **A multilateral disarmament forum?** If a multilateral disarmament process is to advance it is important that early attention be given to the most productive forum in which that might occur. One option that deserves serious consideration is the UN machinery that already exists, embracing all the nuclear-armed states, in the Conference on Disarmament, which is already seized of the issue to the extent that agreement was reached in 2009 (as part of the agreement on a larger work program, involving commencement of negotiations on the Fissile Material Cut-off Treaty) to establish a working group on "Cessation of the nuclear arms race and nuclear disarmament" to "exchange views and information on practical steps for progressive and systematic efforts to reduce nuclear weapons with the ultimate goal of their elimination". While the last decade's history of procedural obduracy and general inaction justifies a degree of scepticism about the CD as a serious negotiating forum, it needs to be remembered that it has been responsible for such major achievements as the Chemical Weapons Convention and the CTBT, and is perfectly capable of major achievements in the future – including the negotiation of an all-embracing Nuclear Weapons Convention, as discussed further in Section 20 – if only the political will can be summoned.

17.21 Within the framework of the CD, and the agenda item mentioned, a consultative group of the nuclear-armed states could be established on a formal or informal basis, with the opportunity to discuss the full range of issues that we have identified as necessary ingredients in both our short and medium term action agendas – from nuclear doctrine (including "sole purpose" and "no first use" declarations, and negative security assurances), to force posture (including launch alert status), to actual weapons numbers (including the possibility of an early statement of commitment at least not to increase nuclear arsenals), and all the associated and parallel issues that arise along the way. It may take some time for such a process to gain traction, but the groundwork for it cannot be laid soon enough.

17.22 **National studies.** Part of the groundwork that will need to be done for any serious multilateral process, and all the strategic dialogues associated with it, is the conduct at all stages of systematic and substantial national studies of the multiple issues that will arise – including those of asymmetry and stability at low numbers addressed in Section 18 of this report – than have so far been tasked. One of the major reasons there has been no real discussion of these issues between the nuclear-armed states is that there appears to have been little or no such serious analysis done within any of them. At a minimum, each nuclear-armed state should commission its

relevant government agencies, and think tanks as appropriate, to begin such studies, on the working assumption that the results will be subsequently debated at an intergovernmental level. It is only by opening the windows in this way that any kind of momentum for change can be developed.

17.23 Much of the energy of the global campaign against nuclear weapons has come from civil society – activists, scholars, and think-tanks. Governments of nuclear-armed states can demonstrate their readiness to learn from efforts frequently more committed than their own by paying closer attention to the extraordinary amount of drafting and modelling of approaches that has already been devoted to nuclear hypothesizing. Too often the basic challenges of conflict resolution, confidence building, and delegitimization have been left unmet by governments because the intellectual effort of applying systems theory, game theory, and risk management has been overtaken by a combination of inertia and preoccupation with reacting to the urgent at the expense of the important.

17.24 A particular field of research already investigated – by governments, including the British and Norwegian, and by international organizations, including the IAEA in its Trilateral Initiative with the U.S. and Russia in the 1990s – is the verification of disarmament, as distinct from non-proliferation verification that is the primary task of IAEA safeguards. The British Government has announced that its new Nuclear Centre of Excellence may be used for verification research in support of an FMCT. But investing in such research, and conducting international exercises to prove its concepts, would be a persuasive demonstration of disarmament seriousness on the part of all the nuclear-armed states.

17.25 **Nuclear archaeology.** As multilateral nuclear disarmament progresses, at some point it will be essential to provide confidence that states do not retain undeclared nuclear weapons or fissile material. This will require verification measures aimed at assuring that states' declarations of fissile holdings are complete, i.e. that nothing has been withheld. The verification process will need to include establishing baselines of historic fissile material production and subsequent transactions, against which declarations of current holdings can be evaluated. Establishing these baselines – an exercise that might be termed "nuclear archaeology" – will involve major challenges. It will be necessary for the verifiers to review records, undertake measurements and analyses of nuclear materials and related materials and wastes, and possibly interview personnel.

17.26 The point, for present purposes, is that in order to facilitate this future verification process, the necessary practical steps have to start being taken *now*: to ensure that all relevant records are identified, secured and preserved; to clarify records that appear incomplete or inconclusive with personnel familiar with the operations concerned; and where relevant – e.g. in the treatment of wastes, and dismantling of facilities – to ensure that relevant measurements and samples are taken. The key here is for the states concerned to recognize they have a mutual interest in ensuring that future verification is able to provide credible results.

Recommendations on Reducing Weapon Numbers: Bilateral and Multilateral Processes

42. The "minimization point" objective should be to achieve no later than 2025 a global total of no more than 2,000 nuclear warheads, with the U.S. and Russia reducing to a total of 500 nuclear weapons each, and with at least no increases (and desirably significant reductions) in the arsenals of the other nuclear-armed states. The objective must be to cut not only strategic but all classes of weapons, and not only deployed weapons but those in storage and those awaiting destruction (but still capable of reconstitution and deployment) as well. [7.8; 18.1–3]

43. To bring the bilateral target within achievable range, the U.S. and Russia should accelerate implementation of the START follow-on treaty now being negotiated, bringing forward the envisaged reductions under this to no later than 2015. [17.13]

44. Once this treaty is ratified, the U.S. and Russia should resume intensive negotiations with a view to reaching a further START agreement no later than 2015, which would bring the total number of warheads down to no more than 1000 for each, and hopefully much less, by the year 2020. [17.12–13]

45. To achieve the minimization point objective of a global maximum of no more than 2,000 warheads, with the nuclear-armed states other than the U.S. and Russia having no more than 1,000 between them, the highest priority need is for all nuclear-armed states to explicitly commit *not to increase* the number of their nuclear weapons, and such declarations should be sought from them as soon as possible. [17.15–16]

46. To prepare the ground for multilateral disarmament negotiations, strategic dialogues should be initiated by all the nuclear-armed states with each other, and systematic and substantial national studies conducted of all the issues – including missile defence, conventional imbalances and disarmament verification – that will arise at all stages of the process. [17.17–19, 22–24]

47. Consideration should be given to the Conference on Disarmament in Geneva as an appropriate forum for initial consultations, on a formal or informal basis, between all the nuclear-armed states, given the need, if the multilateral disarmament process is to advance, for there to be early agreement on an appropriate negotiating process. [7.9; 17.20–21]

48. To facilitate future verification processes, in the credibility of which all nuclear-armed states will have a mutual interest, "nuclear archaeology" steps should be taken now by them to ensure that all relevant records are identified, secured and preserved; and relevant measurements and samples are taken. [17.25–26]

NUCLEAR DOCTRINE: BEGINNING TO LIMIT THE ROLE OF NUCLEAR WEAPONS

17.27 Just as important as President Obama's commitment to numerical weapons reduction in his Prague speech in April 2009 was his statement that "To put an end to Cold War thinking we will reduce the role of nuclear weapons in our national security strategy and urge others to do the same". Achieving common ground among the nuclear-armed states on nuclear doctrine (i.e. how those weapons could ever be used), will be very difficult, given the wide variations in their present positions, and the process is likely to extend well into our medium-term time frame. But a significant early move, even by the U.S. alone, toward declared doctrine that visibly reduces the salience, or prominence, of nuclear weapons in national defence and security systems – together with physical arrangements for their location and handling that are entirely consistent with such a declaration and adds credibility to it – would add significant momentum to the disarmament cause, and by extension, be a very significant boost for non-proliferation efforts, in the context of the 2010 NPT Review Conference and beyond.

17.28 **"Sole purpose" and "no first use".** On doctrine, the Commission's preferred position, pending the ultimate elimination of nuclear weapons, is that every nuclear-armed state makes a clear and unequivocal "no first use" declaration, committing itself to using nuclear weapons neither preventively

or pre-emptively against any possible nuclear adversary, keeping them available only for use, or threat of use, by way of retaliation following a nuclear strike against itself or its allies. We acknowledge, however, that such has been the cynicism about the Cold War "no first use" commitment of the Soviet Union, which has been almost universally dismissed as purely a propaganda exercise, and such has been the subsequent caution with which such continuing declarations from China and India have received, that it may be better to settle in the first instance for a different formulation of essentially the same idea. This would be a declaration to the effect that "the sole purpose of the possession of nuclear weapons is to deter the use of such weapons against one's own state and that of one's allies."

17.29 The legitimate security concerns of states affected by such declarations would need to be taken very much into account. We are conscious that this issue is a sensitive one particularly for some U.S. allies but, as discussed in Section 6, there is no reason to believe that Washington's embrace of "sole purpose" doctrine, would in any way weaken, or be perceived to weaken, U.S. extended deterrence. It is important, nonetheless, that those allies be given very firm assurances that they will not be exposed to unacceptable risk from other sources, including especially chemical and biological weapons. In this context, it is crucial that continuing strong efforts be made to promote universal adherence to the Chemical Weapons Convention and the Biological and Toxin Weapons Convention, and to develop more effective ways of ensuring compliance with the latter.

17.30 The present position of most of the nuclear-armed states is some distance away from either "sole purpose" or "no first use". Present U.S. strategy is based on the Pentagon's OPLAN 8010-08 (Operations Plan, Global Deterrence and Strike, 2008) which focuses on Russia and China, and apparently on some "rogue states", and provides for great flexibility of nuclear and conventional combinations of strategic strike options, envisioning – as did the last Nuclear Posture Review, conducted by President George W. Bush's administration in early 2001 – the use of nuclear weapons in a whole variety of threat contingencies, both nuclear and non-nuclear. This example is being followed by Russia. Having affirmed in 2000–2001 its abandonment in 1993 of the USSR no first use position, Moscow is now emphasizing the crucial role of nuclear weapons in providing for its security. Its military doctrine calls for maintaining parity with the U.S. and preserving nuclear deterrence with the capability "to inflict the designated (planned) level of damage on any opponent", and its Strike Plan provides for a possibility of "measured combat use" of strategic forces for "demonstration of resolve" or for "de-escalating aggression", which translates into specific warfighting missions. Most U.S. and Russian flexible strike options imply first use of nuclear weapons.

17.31 Taken as a whole, the current official nuclear postures of the eight nuclear-armed states (leaving aside North Korea for present purposes, not least because it has not formalized its position in any way) may be summarized as follows. All envision the use of nuclear weapons in response to a nuclear attack upon their territory. All those with allies and forces abroad envision the use of nuclear weapons in response to a nuclear attack upon them. All, except China, keep open the option of the first use of nuclear weapons in response to an attack by chemical or biological weapons. All, except China and India, envision the first use of nuclear weapons in response to an overwhelming conventional force attack, putting national security at critical risk, with conventional forces against themselves or their allies. And all, except China and India, may initiate the use of nuclear weapons to pre-empt or prevent an attack by missiles or other delivery systems, which might carry weapons of mass destruction.

17.32 If the commitment to disarmament of the five nuclear weapons states under the NPT, and the nuclear-armed states generally, is to begin to be taken seriously, it is crucial that – as a first step – those states which have not adopted a no first use posture move at least to a "sole purpose" declaration, and that every nuclear-armed state be serious in practice about making that declaration credible to the rest of the world. The critical leadership role on the formal declaration side rests with the U.S.: with President Obama having so clearly committed himself in Prague, as noted above, to an effort to "reduce the role of nuclear weapons in our national security strategy", all eyes are now focused on the new Nuclear Posture Review scheduled for completion early in 2010. If the President could embrace at least a "sole purpose" position, this would be a significant contribution on this front, placing very strong pressure on the other nuclear-armed states to change their own positions in a more forthcoming way, and giving a major demonstration of good faith to those reluctant, on double standards grounds, to support strengthening the non-proliferation regime at the 2010 NPT Review Conference.

17.33 **Negative Security Assurances (NSAs).** The embrace of common "sole purpose", or even more so "no first use", language by the nuclear-armed states would add to the weight and credibility of the negative security assurances – pledges not to use nuclear weapons – that have been given so far rather half-heartedly by the five nuclear weapon states under the NPT to the non-nuclear weapon states parties to that treaty. But even without movement on this wider doctrinal front the strengthening of these assurances, and their embrace by the other nuclear-armed states outside the NPT, could occur separately and independently, and the Commission believes this would be desirable.

17.34 When the NPT was signed in 1968 the UN Security Council adopted Resolution 255 recommending that the five weapon states pledge not to

use their nuclear weapons against non-nuclear NPT member states, and every year since 1978 the UN General Assembly has adopted resolutions of a general nature on such negative nuclear security assurances. In 1995, in connection with the NPT Extension Conference, the five each made such statements which were collectively recognized in Security Council Resolution 994. Those pledges, however, were far from comprehensive, in particular in not applying to a non-nuclear weapon state member of the NPT allied with a nuclear-weapon state, participating in joint military operations with a nuclear-weapon state against the pledging power, or committing armed aggression against the pledging power or its allies while being allied with another nuclear-weapon state. So far from diluting the political or military utility of nuclear weapons, and reassuring those NPT non-nuclear member states which under its Article II had accepted the obligation not to acquire them, these equivocal pledges did rather the opposite, reconfirming the important role of nuclear weapons in the national security, foreign policy and defence strategy of the nuclear- weapon states.

17.35 The issue continues to exercise many in the international community, with quite widespread support for not only removing the qualifications to these pledges but making negative security assurances legally binding: the 2000 NPT Review Conference stated that legally binding assurances were needed, at the 2005 Review Conference non-nuclear weapon states urged the nuclear-weapon states to provide such pledges, and the issue is squarely on the agenda again for the 2010 Review Conference.

17.36 One way of achieving this objective would be a binding Security Council resolution under Chapter VII of the Charter simply prohibiting the use of nuclear weapons anytime, anywhere against non-nuclear-weapon states parties to the NPT (or at least those of them not maintaining nuclear weapons on their territory under any alliance arrangement): the idea being that this would significantly enhance the security of the non-nuclear-weapon states without undermining the capability of all the nuclear-armed states (not just the five nuclear-weapon states under the NPT) who would be bound by it. As with "no first use" generally, such an approach would not satisfy those who are uncomfortable campaigning for any binding legal prohibition amounting to less than the outright elimination of nuclear weapons, but it is consistent with the incremental, phased approach supported by this Commission.

17.37 The question arises whether any such simply formulated assurance would have to be qualified by a requirement that, to benefit from it, the non-nuclear-weapon state in question would have to be in compliance with its NPT treaty obligations, an issue made very pertinent by recent developments in North Korea (where a complicating threshold issue, discussed elsewhere in this report, is whether it is still a member of the NPT or has succeeded in

its stated intention to withdraw) and Iran. In 1995, only two of the Permanent Five, the U.S. and UK, specifically referred to compliance in their NSA statements, and did so in differing terms. The U.S. statement (S/1995/262) prefaced its assurance with the statement that "consistent with generally recognized principles of international law, parties to the [NPT] must be in compliance with [their] undertakings in order to be eligible for any benefits of adherence to the Treaty", whereas the UK perhaps set the bar a little higher by saying that it "does not regard its assurance as applicable if any beneficiary is in material breach of its own non-proliferation obligations under the [NPT]."

17.38 Although the Commission is attracted by the certainty and simplicity of the formulation in paragraph 17.24 above, which would amount to a significant further step forward in the delegitimation of nuclear weapons (and still of course leave open many military and other options for dealing with a state in breach of its membership obligations), we accept that this approach may not win general support among the Permanent Five in the present environment, and believe on balance that the new NSA statements that we recommend should contain a compliance condition. But there remains a question as to how this should be expressed and applied. The complicating factor here is that, as noted in Section 9, the NPT itself has no mechanism for determining compliance: that falls by default to the IAEA Board of Governors, which makes compliance determinations in relation to safeguards agreements, which are taken in effect to amount to compliance determinations on NPT Article III and possibly Article II. When the IAEA makes such a determination, it is required to report it to the Security Council, which can then take any action at all it deems appropriate in all the circumstances: it may or may not make its own compliance determination. In determining whether a negative security assurance applies to a particular state, or is inapplicable because that state is in non-compliance with the NPT, whose decision is to prevail?

17.39 One approach would be to say that the applicability of a negative security assurance should depend wholly on there not being a non-compliance determination by the IAEA Board of Governors. The alternative approach would be to say that this is not enough, and should depend on a specific finding of non-compliance by the Security Council itself. The difficulty with leaving it to the Security Council is that could result, in effect, in IAEA findings being contested and reversed, or failing through application of the veto, with there also being a great deal of uncertainty until a final decision was made. But the difficulty of leaving the determination wholly to the IAEA, in a context where the stakes are so high – viz. whether the state in question is to be immune or not from nuclear attack – is that, given that breaches of safeguards agreement obligations are bound to vary in their seriousness (a factor that the UK in 1995 may have been wanting to take

into account in referring to "material breach"), a relatively small violation may have disproportionate consequences. Yet another factor that has to be taken into account is that, whoever is to make the relevant determination, the stakes are so high in this NSA context that there might be a reluctance in the future to make any formal non-compliance findings at all, which would undermine the effectiveness of the NPT. On balance, again, while fully understanding the force of competing views, the Commission takes the view that the decision on whether a state's non-compliance with its NPT obligations is so material as to justify the non-application of NSAs so long as it persists, should be left to the Security Council. This is consistent with the position we took in Section 9 that the IAEA should focus on applying technical criteria, leaving the political consequences for the Security Council to determine.

Recommendations on Nuclear Doctrine: No First Use, Extended Deterrence, and Negative Security Assurances

49. Pending the ultimate elimination of nuclear weapons, every nuclear-armed state should make an unequivocal "no first use" declaration, committing itself to not using nuclear weapons either preventively or pre-emptively against any possible nuclear adversary, keeping them available only for use, or threat of use, by way of retaliation following a nuclear strike against itself or its allies. [17.28]

50. If not prepared at this stage to make such a declaration, every nuclear-armed state should at least accept the principle that the sole purpose of possessing nuclear weapons – until such time as they can be eliminated completely – is to deter others from using such weapons against that state or its allies. [7.10; 17.28–32]

51. The allies in question – those presently benefiting from extended deterrence – should be given firm assurances that they will not be exposed to unacceptable risk from other sources, including especially biological and chemical weapons. In this context, continuing strong efforts should be made to promote universal adherence to the Biological and Toxin Weapons Convention and the Chemical Weapons Convention, and to develop more effective ways of ensuring compliance with the former. [17.29]

52. It is particularly important that at least a "sole purpose" statement be made in the U.S. Nuclear Posture Review due for publication early in 2010, placing pressure as this would on other nuclear-armed states to be more forthcoming, and undermining "double standards" arguments at the 2010 NPT Review Conference. [17.32]

53. New and unequivocal negative security assurances (NSAs) should be given by all the nuclear-armed states, supported by binding Security Council resolution, that they will not use nuclear weapons against non-nuclear weapon states. The only qualification should be that the assurance would not extend to a state determined by the Security Council to be in non-compliance with the NPT to so material an extent as to justify the non-application of any NSA. [17.33–39]

54. All NPT nuclear-weapon state members should sign and ratify the protocols for all the Nuclear Weapon Free Zones, and the other nuclear-armed states (so long as they remain outside the NPT) should issue stand-alone negative security assurances for each of them. [16.16]

FORCE POSTURES: MOVEMENT ON DE-ALERTING AND DEPLOYMENT

17.40 Whatever declaratory policies are adopted by the nuclear-armed states, they must be accompanied by appropriate changes to force postures (i.e. in this context, arrangements for the deployment of those weapons, and their launch alert status). Nuclear forces deployed in a way – and seen by others to be so deployed – that makes clear their essential function is intended to be retaliatory rather than potentially aggressive. Most of the necessary changes will take considerable time to implement – extending well beyond our short-term time frame to 2012, but the issue of launch alert status has to be tackled with a greater sense of urgency, given the risks inherent in the present arrangements.

17.41 **Launch alert status.** The issue of most immediate concern, which certainly does not have to wait for reductions in weapon numbers, is the huge number of weapons that remain on dangerously high alert, planned to be launched more or less immediately on receiving information (or what is perceived to be information) about an opponent's attack. As described in earlier sections of this report, of the more than 10,000 warheads estimated to be now deployed by all the nuclear-armed states, an estimated 2,150 U.S. and Russian warheads retain this very high alert status, also known as launch-on-warning (LOW) or launch-under-attack (LUA), giving presidential decision-makers just 4-8 minutes decision time in the event of an alarm, false or otherwise. On the face of it, this is the ultimate absurdity of nuclear deterrence twenty years after the end of Cold War, when political, economic and security relations at least among the five NPT nuclear-weapon states makes deliberate nuclear attack virtually unthinkable. It is crucial that ways be found to lengthen the decision-making fuse.

17.42 So long as the logic of mutual deterrence prevails in the minds and behaviour of U.S. and Russian decision-makers, however, it has to be

acknowledged that, for all the evident need to do so urgently, stepping back quickly from this precipice is going to prove rather more difficult than might appear at first sight. Russia, with some 90 per cent of its warheads deployed on silo-based ICBMs, submarines at bases rather than at sea, and bombers at airfields, sees itself as very vulnerable to a counterforce strike (i.e. one directed at its military assets, as distinct from a countervalue strike, targeting mainly civilian populations), with such an attack having the capacity to dramatically weaken its retaliatory, and thus deterrent, capability. Mutual de-alerting of the principle launch-on-warning force – ICBMs – is seen by Moscow as making U.S. missiles virtually invulnerable, while leaving Russian ICBMs highly exposed to U.S. Trident-2 SLBMs, sea-launched cruise missiles and, in future, to U.S. long range precision guided conventional weapons, with the prospect of more effective national ballistic missile defence in the future further compounding the problem.

17.43 All this means that taking weapons off launch-on-warning alert, if it is to be real and not just symbolic in its impact, may involve a process almost as complicated as numerical weapons reduction, needing to be operational and technical in character, comprehensive, equal to both sides and implemented in a phased way. Such a process will need, in parallel, to embrace ICBMs (including removal of warheads from missiles), SLBMs on submarines at bases (removal of warheads or missiles from launch tubes), sharp reduction in the patrol rates of nuclear-armed submarines at sea, and bombers (removal of internal launch racks, and nuclear weapons stored away from airfields).

17.44 **Transparency and opacity.** To be meaningful, force postures need to be transparent: well known and understood by friend and foe alike. Achieving much greater transparency than exists at the moment – notably in Russian sub-strategic deployments, and in Chinese willingness to disclose information about almost anything at all related to its nuclear arsenal – will be a major task for the years immediately ahead. Without it, meaningful progress in almost any kind of multilateral disarmament will be impossible.

17.45 The most opaque by far of all the nuclear-armed states is of course Israel, which – despite the universal understanding of policymakers elsewhere that it acquired nuclear-armed status by 1970, and now possesses, along with formidable ballistic missile and airborne delivery capability, at least 60 and as many as 200 nuclear warheads – for almost fifty years has maintained a policy of nuclear ambiguity. It continues to pledge that it will "not be the first to introduce nuclear weapons into the region"– and has certainly not used or threatened to use them so far despite the temptation to do so in the war of 1973 – but "non-introduction" is defined, in effect, as "non-testing" and "non-declaration".

17.46 This policy is seen in Israel as having served it well, operating in practice as a deterrent to potential regional aggressors, while allowing it

maximum freedom of action. It has been a willing participant in the CTBT, and applies the Nuclear Suppliers Group guidelines controlling nuclear exports. But it stays outside the NPT, will be very reluctant to accept any new fissile material control regime, and has tempered its support in principle for a Middle East Nuclear Weapons Free Zone, or weapons of mass destruction free zone, by making this wholly dependent on achieving a comprehensive and sustainable regional peace. The ambiguity policy has also been very acceptable to Arab leaders, who have seen it as enabling them to avoid entering into very costly nuclear competition, which they privately claim they would be forced to do if they acknowledged anything more than Israel had "unsafeguarded nuclear facilities".

17.47 Israel's nuclear opacity could certainly accommodate a more deliberate display of its force posture, at the level of its delivery systems and platforms, without abandoning its current policy on weapons. But the larger question is whether Israel's policy, and its general acceptance by others, will indefinitely serve, if it does already, the interests of non-proliferation and disarmament. It is not self-evident to this Commission that it will. The issue has started to be debated again domestically, with points being made that the strategy has not exactly worked as a deterrent against conventional attacks; that it has not deterred Iran from a program which has brought it to the edge of weapons capability, and that if Iran is to be deterred from finally crossing that line, it may be time for Israel's weapons to be brought out of the basement; and that Israel cannot continue to indefinitely support only in principle a Nuclear Weapons Free Zone, conditioning overt steps toward disarmament on a comprehensive peace process while at the same time doing less than the rest of the world, including the U.S., would like it to do to advance it.

17.48 If there are to occur the kind of strategic dialogues this Commission supports, and these are to generate real cooperative evolution in the overall security environment, it is difficult to see how much can be achieved without all the issues – and competing interests – being openly on the table. If global nuclear disarmament is seen to be at last seriously on the agenda, and the subject of serious commitment by all the major current nuclear-armed states, including Israel, it is hard to believe that any Arab states will come under any irresistible pressure to acquire nuclear weapons simply because what has long been common assumed knowledge, among leaders and publics in the Arab world as elsewhere, is now formally confirmed.

17.49 All that said, if both Israel and its neighbours remain dug into their pro-opacity positions, it may still be possible for Israel to participate in multilateral nuclear disarmament and non-proliferation negotiations, of the kind discussed below and in subsequent sections, without acknowledging that it possesses nuclear weapons. Nuclear disarmament can be defined as a process of taking unsafeguarded fissile materials and putting them under international safeguards. When unsafeguarded, these materials could be

in the form of weapons, uranium metal hemispheres, plutonium pits and the like. When put under safeguards, fissile materials would need to be in non-weaponized form, as occurred in South Africa in the early 1990s. When all fissile materials in the world are under international safeguards in non-weaponized form, the world could be considered nuclear-weapons-free. (This definition can apply regionally, too, in terms of nuclear-weapon-free zones).

17.50 So Israel could be involved in negotiations on nuclear disarmament without ever acknowledging that it possessed nuclear arms. Once it had put all of its fissile material under safeguards, it would be disarmed. At that point, for purposes of verification and confidence building, it could provide information on any past nuclear-weapon related stockpiles and activities, as South Africa did. Declarations of Israel's past nuclear activities and status in this context should not cause political or security problems because Israel would by then have satisfied its neighbours' nuclear disarmament demands.

Recommendations on Nuclear Force Posture: Launch Alert Status and Transparency

55. The basic objective is to achieve changes to deployment as soon as possible which ensure that, while remaining demonstrably survivable to a disarming first strike, nuclear forces are not instantly useable. Stability should be maximized by deployments and launch alert status being transparent. [7.12–15; 17.40–50]

56. It is crucial that ways be found to lengthen the decision-making fuse for the launch of any nuclear weapons, and in particular – while recognizing the difficulty and complexity of the negotiating process involved between the U.S. and Russia – that weapons be taken off launch-on-warning alert as soon as possible. [17.43]

57. In order to achieve strategic dialogues capable of making real progress on disarmament, maximum possible transparency in both nuclear doctrine and force postures should be offered by all nuclear-armed states. [17.44]

58. A relaxation of Israel's policy of complete opacity would be helpful in this respect, but continued unwillingness to do so should not inhibit its engagement in multilateral disarmament negotiations (given that nuclear disarmament can be defined as a process of taking unsafeguarded fissile materials and putting them under international safeguards). [17.45–50]

NORTH KOREA AND IRAN

17.51 There are significant differences between these two countries' situations: Iran remains within the NPT while North Korea has purported to withdraw from it; Iran has conducted no nuclear test explosions while North Korea has conducted two; Iran appears not to possess any nuclear explosive devices while North Korea has several; and Iran insists that it will never be a nuclear-armed state while North Korea asserts that it already is. But what they have in common is that, between them, they pose by far the greatest current challenges to the global non-proliferation regime. The behaviour, capability and perceived intentions of both states deeply troubles their neighbours; both have acted in defiance of Security Council resolutions; and neither situation looks likely to be resolved by the further application of coercive sanctions. Nor in the absence of any actual aggression by either state does resort to military force appear to be any solution: such action would pose disproportionately – and perhaps catastrophically – high risks for those who would notionally benefit most from the destruction (if this could, indeed, be accomplished) of Pyongyang's and Tehran's present capability. The satisfactory resolution, by negotiation, of the North Korea and Iran nuclear problems remains a very high priority for the international community.

17.52 **North Korea.** Achieving a satisfactory negotiated solution of the North Korean problem will be immensely difficult, but in the Commission's judgment is by no means impossible. We have been there before: the Agreed Framework, negotiated in 1993–94 after the initial revelations of Pyongyang's clandestine activities, achieved for eight years its primary purpose of freezing the North's plutonium production program, and – although it is clear that Pyongyang did not meet its obligations under the agreement, not least in its secret dealings with the A.Q. Khan network to acquire centrifuge technology during this period – that it broke down was not a matter of entirely one-sided fault. North Korea has dug itself into deeper holes since, with growing evidence of a supplementary uranium enrichment program; its two underground tests of explosive devices in 2006 and 2009; a series of provocative missile tests; and its insistence that its departure from the NPT is final and that it is, will remain, and should be recognized as, a fully-fledged nuclear-armed state.

17.53 But Pyongyang remains under immense pressure from China, the U.S., South Korea, Japan and Russia to return to the Six-Party Talks process initiated in 2003, and knows very well that there remains on the table a deal that would, in return for its complete, verifiable and irreversible commitment to denuclearization of the Korean peninsula, deliver it serious security assurances and major economic support. It knows that the consequences of its nuclear-weapons program have been economic deprivation, the termination of civil nuclear cooperation and development, and no additional national or regime

security. And it knows that no one intends to invade North Korea militarily to achieve a regime change.

17.54 Some analysts continue to insist that North Korea has no interest in ever giving up its nuclear weapon capability: not only because of the perception, objectively well-based or not, that this would protect it from any possible attack or direct attempt at regime change, but because it still nurses hegemonic ambitions over the whole peninsula, sees nuclear weapons as raising its strategic position in the region and wider world, possibly still sees an international market for its bomb technology, fissile material and hardware, and fears that any opening up of its economy as part of a denuclearization deal would inexorably generate internal pressure for regime change. Others are convinced otherwise, seeing the whole program as ultimately just negotiating coin – to be traded for aid, trade, investment and security guarantees, and finding other explanations for some of Pyongyang's most intransigent behaviour (e.g. succession anxiety – and the need for Kim Jong Il to demonstrate to the military that they had nothing to fear from his son – as the main reason for the backward steps in early 2009).

17.55 The reality, given the very opaque character of the North Korean system, is that no-one can be sure of *what* its leadership's intentions are, and that the only way forward is to treat the present government, or one very much like it, as the one with which the world has to deal, and continue to act as though a negotiated solution is possible. That does not mean conceding that North Korea is already a nuclear-armed state, or that such capability as it has already has bought it immunity from attack should it engage in any form of aggression. Nor does it mean giving ground on sanctions, or "selling the same horse twice", simply to get it back to the negotiating table. But it does mean all the relevant players being willing to make clear the benefits that would flow from cooperation, being flexible about process (within the general framework of the Six Party Talks), and above all being patient.

17.56 Buying time is something that the North Koreans have used to their advantage in the past, but for the foreseeable future it will not relevantly change the overall security balance even if there is some further development of the missile and weapons hardware capability which, understandably, continues to concern its neighbours. Pyongyang can have nothing more for years ahead than a tiny arsenal of not very survivable weapons, and any aggression of any kind would be suicidal. As frustrating as the process has been, and will no doubt continue to be for a good while yet, persistent, determined, intelligent and patient negotiation – fully deploying both incentives and disincentives (including the continuing application of all current Security Council measures until North Korea's behaviour changes) – is the only available way forward, and is in everyone's interests.

17.57 **Iran.** On the face of it the Iran situation is more readily susceptible than North Korea to an early negotiated solution, if for no other reason than things have not gone so far. Tehran is undoubtedly close to – and may already possess – breakout capability, but it has not yet crossed the red-line that really matters by actually acquiring nuclear weapons, and continues to proclaim that it has no intention whatever of doing so. There will be those who remain deeply sceptical that the situation is retrievable, and they have a good deal of evidence to call in aid. Iran is clearly not in full compliance with its comprehensive safeguards agreement or a series of related IAEA Board of Governors and UN Security Council decisions and resolutions. It has a long history of complying (or almost complying) with the letter of its safeguards obligations but not their spirit, responding to inquiries and offers at (or just beyond) the last possible moment, and replying to accusations with lengthy obfuscation. The revelation of the Qom enrichment facility in September 2009 is just the latest in a line of such cases, and given that Tehran has been obviously keen to disperse and harden its facilities as a precaution against military attack, and deeply reluctant to declare any of them until forced to do so, more can probably be expected.

17.58 Moreover, it has become increasingly obvious that Iran is in no mood to yield, now or at any time in the foreseeable future, on what has been until now the irreducible demand of the international community – expressed through the six governments (China, France, Germany, Russia the UK and U.S., known as the P5+1 or the E3+3) that have been engaging with it on this issue, and through the UN Security Council – that it give up on its uranium enrichment capability. Add to that Iran's continued extreme hostility to Israel, particularly as expressed in the language of President Ahmedinejad; the suspicion with which its regional ambitions are regarded by most of its Arab neighbours; and an increasingly authoritarian, albeit disunited, leadership in the aftermath of the disputed 2009 presidential election, the situation may not seem likely any time soon to lend itself to a solution acceptable to the wider international community.

17.59 The Commission is persuaded, however, that negotiation remains the only way forward, and that a satisfactory outcome can eventually be achieved, with the support of the Security Council and the members of the IAEA, which is consistent both with the security concerns of the region and the wider world, and Iran's own needs and aspirations. Among the issues at stake for Iran is its national pride (long battered by a series of perceived humiliations going back to the overthrow of President Mossadegh and beyond), its sense of grievance about international double standards (most acutely felt in the context of the West's support for Iraq, and indifference to Baghdad's use of chemical weapons, in the bloody war of 1980-88), its desire to demonstrate its sophisticated technological capability, and its determination to be accepted as a major regional power.

17.60 The elements of a workable deal would seem to include acceptance by the international community of the reality of Iran's enrichment program, notwithstanding the latent break-out capability that will continue to represent, but only in exchange for acceptance by Iran of a very intrusive safeguards inspection and verification regime, of at least Additional Protocol, and desirably "Additional Protocol Plus" level, combined with agreement to significantly slow down that program, and to accept some international role in its management, all of a kind which would given the wider world real confidence that Tehran will never proceed to weaponization. These core elements would need to be accompanied by a wider package of incentives, including normalization of diplomatic relations and the lifting of sanctions, and clearly articulated disincentives, not excluding a full range of coercive measures should the agreement be breached. They would also need to be accompanied by efforts to fully engage and integrate Iran as a cooperative partner in addressing the region's many security and other problems. The process would be greatly facilitated, in turn, if Iran were to declare its lack of hostile intent against Israel and make clear its renunciation of any support for terrorist activities.

17.61 There were signs in October 2009, as the Commission was concluding its deliberations on this report, of a willingness on both sides to find constructive ways forward, but many more twists and turns can no doubt be expected before the issue is finally resolved, and in a way which preserves the reality, and the integrity, of the global non-proliferation system.

Recommendations on North Korea and Iran

59. Continuing efforts should be made, within the framework of the Six-Party Talks, to achieve a satisfactory negotiated solution of the problem of North Korea's overt pursuit of a nuclear weapons program, involving verifiable denuclearization and resumed commitment to the NPT in return for security guarantees and economic assistance. [17.52–56]

60. Continuing efforts should be made by the P5+1, Security Council and IAEA member states to achieve a satisfactory negotiated resolution of the issue of Iran's nuclear capability and intentions, whereby any retention of any element of its enrichment program would be accompanied by a very intrusive inspection and verification regime, giving the international community confidence that Iran neither has nor is seeking nuclear weapons. [17.57–60]

18. MEDIUM TERM ACTION AGENDA: TO 2025 – GETTING TO THE MINIMIZATION POINT

BOX 18-1

THE MEDIUM TERM ACTION AGENDA – TO 2025

- Progressive achievement of interim disarmament objectives, culminating by 2025 in a "minimization point" characterized by:
  - low numbers: a world with no more than 2,000 nuclear warheads (less than 10 per cent of today's arsenals);
  - agreed doctrine: every nuclear-armed state committed to no first use;
  - credible force postures: verifiable deployments and alert status reflecting that doctrine.
- Progressive resolution of parallel security issues likely to impact on nuclear disarmament negotiations:
  - missile delivery systems and strategic missile defence;
  - space-based weapons systems;
  - biological weapons;
  - conventional arms imbalances.
- Development and building of support for a comprehensive Nuclear Weapons Convention to legally underpin the ultimate transition to a nuclear weapon free world.
- Complete implementation (to extent already not achieved by 2012) of short-term objectives crucial for both disarmament and non-proliferation:
  - Comprehensive Nuclear-Test-Ban Treaty in force;
  - Fissile Material Cut-off Treaty negotiated and in force, and a further agreement negotiated to put all fissile material not in weapons under international safeguards;
  - Measures to strengthen the NPT regime and the IAEA agreed and in force;
  - Nuclear security measures in force, and cooperative threat reduction and associated programs fully implemented;
  - Progressive implementation of measures to reduce the proliferation risks associated with the expansion of civil nuclear energy.

DEFINING MEDIUM TERM OBJECTIVES

18.1 The central objective of the minimization phase to 2025, as described earlier in this report, is to take really major strides on the disarmament front – in delegitimizing nuclear weapons, dramatically reducing their numbers and perceived role in international security, and drastically limiting the risk of their accidental, miscalculated or deliberate use. The aim is to create thereby a platform, the "minimization point", from which it will be seriously possible to take the final step to elimination, albeit only after a number of difficult further geopolitical and technical conditions are satisfied. The other objective is to complete, as soon as possible within this period, any unfinished business on the world's non-proliferation agenda, recognizing that a number of the short-term objectives that we targeted for achievement by 2012 might not, realistically, have been accomplished by that time.

18.2 There are three specific disarmament targets we identify for the minimization point. The first is that there would be, worldwide, no more than 2,000 nuclear weapons (compared with 23,000 today, a reduction of over 90 per cent). This would be achieved by U.S. and Russian reductions to a total of 500 nuclear weapons each, and at least no increases (and desirably significant reductions) in the arsenals of the other nuclear-armed states. Secondly, all nuclear-armed states would embrace a "no first use" doctrine. And, thirdly, every nuclear-armed state's force deployments and readiness arrangements would be verifiable, consistent with that no first use commitment, and give credibility to it.

18.3 The numerical component of this target is ambitious for the U.S. and Russia – involving over a 95 per cent reduction in their current arsenals – and may not be achievable by 2025. But when measured against the time taken in the past to reach and implement arms control agreements, and rates of weapon dismantlement previously (if not currently) achieved, it is by no means impossible.

18.4 The more encouraging consideration is that while the measures needed to advance this medium term action agenda will certainly require substantial political will and sophisticated, proactive diplomacy, they do not require the transformation of the existing international relations system to the extent that seems likely to be necessary to achieve the ultimate objective of a nuclear weapon free world. They can be undertaken in the framework of existing international institutions and practice, generally run with the grain of the existing system, and be characterized as an exercise in principled pragmatism rather than anything more confrontational. The nuclear-armed states other than Russia and the U.S. would have to foreswear adding to their nuclear arsenals – by not producing additional fissile material for weapons, and not converting existing stockpiles of fissile material into new weapons. Negotiated multilateral reductions would be highly desirable,

but very difficult to achieve and not strictly necessary to hold the line at the overall total we propose. The process, and achievement, of getting to the minimization point would put at risk no fundamental state interests or perceived interests, including the security interests of states relying on extended nuclear deterrence from their nuclear-armed allies.

18.5 Important preconditions for achieving the medium term targets we identify are strengthening of the legal and institutional underpinnings of the NPT treaty regime, with no further erosion in the form of significant signatories removing themselves from its disciplines; ratification and bringing into force of the CTBT, important legally, symbolically, practically and politically if the prospect of achieving major reductions in weapons levels is to be taken seriously; negotiation of a verifiable FMCT (banning the production of fissile material for nuclear weapons), and a subsequent agreement not to turn existing stocks of these materials into weapons. For these targets to be met, the likely renaissance in the peaceful use of nuclear energy also would have to unfold in a safe, secure and safeguarded manner, reinforcing rather than undermining the non-proliferation regime and efforts towards nuclear disarmament.

18.6 There is a mutually reinforcing relationship between the achievement of the disarmament components of the minimization point and both non-proliferation and industry objectives. Improvements in the non-proliferation regime, and confidence in the secure management of peaceful nuclear industry, are part of what is required to make nuclear-armed states willing to significantly reduce the numbers of their weapons: conspicuous acts of proliferation in East Asia or the Middle East would pose severe challenges to our medium term program of disarmament action. Conversely, achieving minimization objectives would significantly assist non-proliferation, undermining claims of double standards by demonstrating the readiness of nuclear-armed states powers to play their part in reducing the nuclear danger, and establishing firmer controls on nuclear materials, systems and command and control.

18.7 Equally, targeting and achieving the minimization point should enhance international cooperation in developing peaceful nuclear industry by reducing the spectre of nuclear weapon dangers. The more unambiguously peaceful the atomic energy field becomes, the more readily its benefits can be shared. Vendors of nuclear reactor technology understand that an accident, security breach, or proliferation incident anywhere would undermine the industry everywhere. Industry, in selecting where and when to cooperate in assisting additional countries to acquire nuclear reactors, will favour markets where non-proliferation bulwarks are strongest and risks slightest.

18.8 **A timetable for stepping down to the minimization point?** It will become clear from the discussion which follows that continuing to make major progress in deep U.S.-Russia cuts, and ensuring an end to nuclear arms racing in other countries (by banning production of new fissile materials for weapons and new weapons from existing materials) will be a multi-phased and extremely complicated process, requiring not only great technical and political skills to carry through, but an international security environment, both globally and in the more volatile regions, that continues to evolve in a more cooperative and less confrontational direction. There is no escaping the linkage between progress in nuclear disarmament and progress in resolving security problems and dilemmas more generally.

18.9 The Commission would like to have been able to identify a time-line, with benchmarks along the way, for the achievement of all the objectives we have proposed for the medium-term period through to 2025, but we have found ourselves simply unable credibly to do so. There are just too many variables and uncertainties in play. But we hope we have done enough to at least broadly map the action path required, and to make the case that none of the obstacles that are bound to be encountered along the way are manifestly insurmountable.

REDUCING WEAPON NUMBERS

18.10 **Definitional issues.** A threshold issue in any discussion of reducing nuclear weapon numbers is determining what it is that is actually being counted, and has to be verified. Is it just warheads themselves, or the missiles and planes that deliver them? Is it just strategic weapons, or sub-strategic (medium-range, theatre and tactical or battlefield) nuclear weapons as well? Is it just deployed weapons that should be taken into account, or those in storage and capable of being deployed? Should those awaiting dismantlement, but not yet so destroyed and thus also capable of being deployed, be part of the count? And how should each of these terms – "deployed", "strategic" and the rest – be defined? These questions not only make life exceedingly difficult for non-specialists trying to wrestle with the policy issues involved, but divide, and often confuse, specialists themselves.

18.11 The crucial need as this debate proceeds is to win general acceptance for a single unit of account, under which "a nuclear weapon is a nuclear weapon". To date U.S. –Russia arms control agreements have focused on deployed strategic weapons, and placed as much, if not more, emphasis on counting and verifying numbers of delivery systems as on the warheads themselves. For other nuclear-armed states, who have not yet entered into any such agreements – and who for the most part have been less transparent

about the make-up of their arsenals – the counting issue has barely arisen. No doubt delivery systems will continue to play a prominent part in negotiations, and may need over time to be the subject of parallel agreements, not least because of Russian and Chinese concerns about the U.S.'s capacity to deploy conventionally armed long-range precision-guided missiles, promoted as a weapon against terrorists and outlaw states, but also seen as a new potential threat to deterrence and strategic stability. Moreover, the reduction of delivery systems through verifiable dismantlement is important to making disarmament irreversible, by excluding reconstitution of nuclear force levels through returning warheads from storages to missiles and bombers. But what ultimately matters for present purposes is the distinctive, and alarming, destructive capability of the nuclear weapons mounted, or capable of being mounted, on those delivery systems. The objective must remain to ultimately rid the world of every last one of them, whatever their size and wherever they happen to be located. And if the "minimization point" objective is to be a world with no more than 2,000 nuclear weapons, that must mean all such weapons, not some sub-class of them.

18.12 It is particularly important in this context to end any counting distinction between "strategic" and "sub-strategic" weapons. As we have already noted in Section 2, whatever the formal definitions in treaties like START (which focus on the nature and range of various delivery systems rather than the yields of the warheads themselves), for practical military purposes the distinctions are extremely elusive: states living side-by-side do not think of "strategic" weapons just in terms of those mounted on intercontinental-range missiles. The use of "tactical" or "battlefield" weapons, designed for theatre operational combat tasks, will if used in densely populated areas be more or less indistinguishable in the havoc they cause from much bigger weapons, or those capable of being delivered over longer distances, and in any event carries the risk of escalation to such weapons. In humanitarian terms the distinction between them is effectively meaningless.

18.13 It is similarly important, for basic counting purposes, to put no weight on the difference between deployed weapons, those in storage or reserve, and those awaiting dismantlement. "Deployed" or "operational" or "operationally deployed" weapons are essentially those that are either mounted on combat-ready delivery vehicles – as warheads attached to missiles launched from land, sea or air; loaded on planes as gravity bombs; or able to be fired as shells from field artillery – or stored at armed forces' bases and able to be coupled within hours to a delivery vehicle in the event of an alarm. "Reserve" weapons may be described as those in separate storage or transit, in process of manufacture or being kept as spares, which would normally take much longer – days or weeks – to be coupled with a delivery vehicle. A separate category of non-deployed weapons are those "awaiting dismantlement" pursuant to an arms control agreement or

national decision, but which in practice still could also, with some delay, be coupled to a delivery vehicle. As will be discussed below, these distinctions remain very important in the context of force posture and alert status, but when it comes to basic counting, again "a nuke is a nuke".

18.14 **United States and Russia: Further Deep Reductions.** If the "minimization point" target is to be met, it is crucial that the U.S. and Russia continue to lead the way with deep cuts throughout that period. If the world as a whole is to have no more than 2,000 warheads in total by 2025, the U.S. and Russia will have to greatly intensify their negotiations on reductions, the parallel security issues (discussed below) likely to impact on those negotiations, and confidence building measures like joint military operations. They have not yet negotiated agreements to account for and dismantle warheads. And while this is not a big problem with respect to strategic missile warheads (provided that the missiles themselves are dismantled), it may be a serious complication with warheads that can be carried by dual purpose fighter-bombers or short-range missiles. Our view is that priority should be put on the properly verified dismantling of weapons designed for delivery by aircraft, missiles and other vehicles likely to be retained in conventional forces.

18.15 If the 2009 negotiations for a START follow-on treaty, described in the last section, are successful in reducing each side's deployed strategic warheads to 1500, that will – taking into account sub-strategic weapons, those not deployed but in reserve storage, and those awaiting dismantlement – still leave to be disposed of by 2025 some 13,000 warheads on the Russian side and 9,400 on the U.S. side. Managing the destruction, or dismantlement, side of that equation in the time available is by no means beyond the capacity of both sides when compared to the dismantlement rates achieved, on average, in the 1990s, of around 1200 per year for the U.S., and 1500-2000 for Russia, although present Russian dismantling capacity is lower now due to the closure of two out of four nuclear munitions plants and it will take both time and money to reconstitute it. It is just a matter, always, of the political will being summoned and resources allocated. Our minimization point envisions a total of 500 Russian and U.S. weapons each, and if the dismantlement process should happen to lag, then all other weapons beyond those limits would have to be at least reduced to the status of unuseable surplus awaiting dismantlement (with unuseability established by such means as the verifiable destruction of firing mechanisms).

18.16 What is likely to prove more difficult than any physical or technical issue of this kind is meeting other security and political concerns that will arise bilaterally in the period ahead: the treatment of tactical and other sub-strategic weapons, and a set of parallel security issues: ballistic missile defence, and conventional weapons prominent among them. If reductions

are to be achieved in nuclear-armed states other than the U.S. and Russia, as should certainly be sought and hopefully will prove possible, questions will arise about how and when these other states can be brought into the play, the issues of asymmetry and proportionality that will become prominent when they are, and the general problem of ensuring stability at low numbers. All of these issues are addressed below.

18.17 **"Tactical" and other sub-strategic weapons.** These include, in the bilateral U.S.-Russia context, battlefield nuclear weapons, B-61 bombs deployed on the territory of allies for extended deterrence purposes (in Belgium, Germany, Italy, the Netherlands and Turkey), and nuclear-tipped anti-aircraft and anti-ballistic missiles (e.g., the Gazelle ABM system around Moscow). As noted above, the numbers of such operationally deployed weapons are estimated at more than 2,000 in Russia and some 500 in the case of the U.S. These weapons, together with those of their kind held in reserve, could as a technical matter easily be eliminated much earlier than 2025, but this presupposes significant doctrinal changes in Russia, and within NATO, where the removal of weapons from Turkey in particular could, if the strategic situation in its region deteriorates, lead to some pressure to reconsider its choice to renounce national nuclear endeavours. Disarmament in the area of tactical nuclear weapons would be greatly facilitated by movement on NATO–Russia conventional arms issues and, more generally, confidence building and security cooperation in Europe and elsewhere.

18.18 **Ensuring No New Production of Fissile Materials and Weapons.** As a political reality, the U.S. and Russia will argue that it makes little sense for them to go through the difficulty and expense of accounting for and eliminating thousands of nuclear warheads if neither they nor other states agree not to make new stocks of military fissile materials or weapons. If dismantlement is occurring in one facility, but additional weapons were being made in others, what would be the gain? Similarly, the minimization phase depends on all other nuclear-armed states agreeing not to add to their arsenals of fissile material and weapon stockpiles. Two measures are required: a verifiable treaty banning new production of fissile materials for nuclear weapons (an FMCT, as discussed in Section 12) and, negotiated subsequently, an agreement to put under international safeguards all fissile materials not in weapons. The latter would be a way to effectively achieve an agreement not to add to nuclear arsenals.

18.19 **Multilateral disarmament.** To reach the "minimization point" target by 2025 will require not only that the U.S. and Russia reduce their arsenals to no more than 500 each, but – at the very least – that none of the other nuclear-armed states increase their arsenals. It would be very desirable, and important, to go beyond that and have all the other nuclear-armed states contributing to a multilateral disarmament process during the minimization

phase which would actually reduce their arsenals and not just maintain them at their present levels. We have recommended, in Section 17, that steps be taken immediately to prepare the ground for such a process, with all nuclear-armed states conducting relevant studies, engaging in strategic dialogues with the U.S., Russia and each other, and commencing a joint dialogue within the framework of the Conference on Disarmament work program.

18.20 That said, we acknowledge that choreographing the stepping down process between all the competing interests will clearly be nightmarishly complex, with considerations not only of absolute numbers but their relative proportions looming very large for all the players. It would appear politically and strategically not feasible that all of the nuclear-armed states would agree to reduce to the same low number, say, 100. Some nuclear-armed states seek to deter more than one other nuclear-armed state, and also have obligations to extend their deterrence for non-nuclear-weapon allies. These states may insist on retaining more nuclear weapons than others, and to the extent that their case has some rational foundation (rather than being based simply on assertion or hegemonic recalcitrance), this should not be an insurmountable negotiating obstacle. Relevant states have been satisfied to this point with very asymmetrical forces, e.g. China against both the U.S. and Russia, and India as against China.

18.21 The suggestion has been made that if the U.S. – and Russia – were to reduce their total arsenals to around 500 each, China in particular might be tempted to "race to parity". But it is not likely that Washington or Moscow would go down to this level without being confident that China would not seek to increase its nuclear arsenal. If the necessary combinations of states are satisfied that they could maintain effective deterrence with uneven numbers, a question may still arise whether continued disparities will be acceptable to relevant political constituencies. It may be helpful in this respect to place the emphasis in negotiations on ratios rather than absolute numbers, recognizing that these will increase for those with smaller inventories as the major powers' inventories come down by larger numbers.

18.22 **Ensuring stability with low numbers.** Apart from the question of parity with others, other questions arise as numbers of weapons are dramatically reduced, and each individual warhead tends to acquire greater significance for a variety of actors. Among these will be allies wondering about the worth of defence guarantees, scientific personnel concerned to ensure the reliability of their remaining forces, and military personnel anxious about survivability of those forces in the event of attack and their credibility in the face of strategic missile defences. How low can any state's arsenal go while still preserving its deterrent credibility? And, more generally, is it the case that low numbers are inherently destabilizing?

18.23 The number of nuclear weapons needed to maintain deterrent credibility has tended to be vastly exaggerated by U.S. and Russian military planners. One powerful answer was given in a study on a "limited" nuclear exchange published by the U.S. Office of Technology Assessment (OTA) in 1979. This analysed in detail the impact of a conflict limited to the use by each of the U.S. and the Soviet Union of just ten missiles, carrying a total of 80 warheads, a tiny fraction of each state's inventory, targeting only oil refineries. It concluded that the impact on both countries would be enormous. In the U.S., over five million people would be killed and 64 per cent of refining capacity would be destroyed, shattering the whole economy and permanently and irrevocably changing the whole society; in the Soviet Union, up to 1.5 million people would be killed, and 73 per cent of refining capacity destroyed. All this makes clear that rather fewer than 100 warheads is sufficient to inflict a wholly unacceptable level of damage on a continental-sized economy, and suggests that – even for the most enthusiastic proponent of nuclear deterrence – maintaining an arsenal at higher than that level is unnecessary.

18.24 Of course other worst-case factors have to be brought into the equation: the possibility, remote as it might be, of more than one nuclear adversary having to be confronted simultaneously; and the need to build in some redundancy to cover first-strike losses, technical failures and the possibility of the growing effectiveness of ballistic missile defences. But it is difficult to accept that these together require the retention of many hundreds of warheads, let alone thousands. It is instructive in this respect to note the relative degree of comfort with which all the other nuclear-armed states have until now lived with very much lower numbers, none of them – China, France, the UK, India, Pakistan or Israel – evidently worried that their arsenals (at the least numbered well under 100 and at the most around 300) would not constitute an adequate deterrent.

18.25 The argument is heard that low numbers are inherently destabilizing, essentially on the ground that they might leave a state vulnerable to a first strike, especially from one with a larger arsenal, thus putting it under pressure to use its arsenal earlier in a conflict, or emerging conflict, situation. But the historical experiences of states managing with low numbers, often asymmetrically with potential adversaries, suggest this is much exaggerated. Moreover, while one cannot avoid in this debate dealing with wholly worst case scenarios, there is reason for optimism that arms control and confidence building measures, and the general improvement in the atmospherics of international security cooperation, of the kind that would necessarily accompany any shift down to significantly lower levels would themselves be significant stabilizing factors.

18.26 **Sharing the cost burden.** Assuming that momentum continues to build for universal non-proliferation and for disarmament by the nuclear-armed states, the cost implications (of dismantlement, verification, disposition and the like) will become a significant consideration over the longer term, particularly for developing states. The sums involved are very large: the cost of the Cooperative Threat Reduction program to date, for example, has been over $6 billion; the cost to France of dismantling its Marcoule and Pierrelatte facilities will be over $8 billion; while dismantlement costs for the U.S. under the START I and INF treaties alone have been around $30 billion (leaving aside potentially much larger costs for environmental clean-up). Part of the costs involved can undoubtedly be met by the savings involved in maintaining an arsenal of reduced size – for the U.S., a reduction to 1000 total weapons would save over $20 billion a year according to the Center for Strategic and Budgetary Assessments – but, overall, there are almost certain to be net increases in outlays all round.

18.27 It may be helpful to commission a detailed study on the calculation of disarmament and non-proliferation costs and ways of funding them. Available models for the financing of international organizations and initiatives run all the way from polluter-pays to sovereign equality. There is also a spectrum of compulsion, from voluntary to assessed contributions, and potentially extending as far as an internationally levied tax. Arguments can be made for each formula: for example, that an impost (per capita but at an infinitesimal rate), externally determined and ostensibly outside government control, may be easier in some societies for government to attribute to impersonal forces, whereas contestable voluntary contributions may all too readily be whittled away by competing national priorities. But it will be crucial to have the chosen formula in place before the implementation of non-proliferation and disarmament commitments becomes resource-intensive.

PARALLEL SECURITY ISSUES: MISSILES, SPACE, BIOLOGICAL AND CONVENTIONAL WEAPONS

18.28 **Ballistic missiles and missile defence.** There seems little prospect in the medium term for the global elimination of entire categories of ballistic missiles. Russia, the U.S., France and the UK have foregone the possession of medium-range missiles, but for China, India, Pakistan, Israel and North Korea these are likely to remain a key component of their strategic forces. What is crucial to address again is the issue of anti-ballistic missile (ABM) defence systems, in a way which would allow the development of *theatre* ballistic missile defence systems not to hinder negotiations over *strategic* offensive reductions. The comparatively muted debate which followed the U.S. withdrawal in 2002 from the 1972 Anti-Ballistic Missile (ABM) Treaty (which had limited the U.S. and USSR to one defensive missile site each) is

now coming to life again, with concern that the absence of restrictions could be generally destabilizing – or more immediately pertinent in the present context, block further reductions of offensive systems.

18.29 It is certainly the case, historically, that attempts to build up significant ABM defences against enemy missiles has played a major role in determining the number of nuclear warheads produced by countries facing such a challenge. During the Cold War, not only did the USSR and the U.S. engage in a massive build-up of strategic nuclear warheads on their ICBMs as they began deploying ABM systems; but the smaller nuclear powers, France and the UK, considering that they had to follow suit, multiplied up to six-fold the number of warheads on their submarine-based missiles. In the present environment, it seems unlikely that Russia will be willing to further significantly reduce its nuclear weapons if the U.S. does not agree to put some numerical and qualitative limits on its potential strategic ballistic missile defence capabilities, seen again as jeopardizing its own deterrent capability. And it is already clear that China is unlikely to be willing to undertake reductions if Washington does not stop developing and deploying systems that could negate a significant percentage of its nuclear arsenal.

18.30 Short of a fundamental transformation of strategic relations to the point that states no longer feel the need to be able to deliver nuclear arms against other states that possess ballistic missile defences – which we cannot be confident is achievable in our medium term framework – the only way forward in the near term appears to be to accept severe limits on strategic ballistic missile defences to facilitate multilateral reductions of nuclear arms, while promoting cooperation in research, development and the potential joint operations of defence systems in areas of mutual concern. In the longer term, on the other hand, if a world without nuclear weapons can be achieved, missile defences could play an important stabilizing role as an insurance policy against potential cheaters. In this respect, the U.S. and Russia would agree on the technical parameters which define strategic missile defence (as distinct from theatre missile defence and extended air defence), along the lines of the 1993-97 "delineation talks" between Moscow and Washington. Other states with missile defence capabilities could undertake similar commitments.

18.31 **Weapons in space.** In the same spirit, ongoing attempts to prevent an arms race in outer space (PAROS) at the Geneva Conference on Disarmament, and work at the Vienna-based UN Committee on the Peaceful Uses of Outer Space will, if successful, contribute to removing concerns about the vulnerability of smaller nuclear arsenals, notably to military activity directed against space-based command, control and information assets, or to space-based ABM systems. The Commission strongly supports this element of the CD's work program and hopes that substantive progress on it can be made in the near term.

18.32 **Biological weapons.** Biological weapons are not a major threat, and should not be a seriously complicating factor in nuclear disarmament negotiations at present, but may well become more of an issue in the future. Efforts to strengthen the 1972 Biological Weapons Convention failed in 2001, largely over efforts to develop an effective verification regime, and most attention since has been focused on building an effective public health response capability. The difficulties involved in crafting an effective verification regime for this kind of weapon – as distinct from chemical and nuclear weapons – are very great, given the very small scale on which laboratory experimentation can be conducted, but the issue needs to be revisited.

18.33 Possible ways forward on verification, partly suggested by the evidence of the positive impact of UN inspections in Iraq, include challenge inspections of facilities suspected of a treaty violation; monitoring exports of equipment and technology needed for the large scale production of biological weapons; field investigations of unusual disease outbreaks possibly associated with the covert development of biological weapons or an accidental leak from a clandestine development or production facility; and non-challenge clarification visits to declared facilities, which could be either routine or voluntary in nature, random or non-random. Certainly universalization of the Biological Weapons Convention, as with the Chemical Weapons Convention, should continue to be actively pursued, not least to help meet the concerns of those states who remain particularly anxious about being possibly targeted by such weapons and who remain inclined to believe that nuclear weapons may have some deterrent utility against them.

18.34 **Conventional weapons.** We have noted earlier in this report the concerns that have begun to be expressed in Russia, China and by other states that a world without nuclear weapons, or with their numbers dramatically reduced, would significantly accentuate already great U.S. conventional military advantages. The irony is that while this is a factor playing in favour of serious commitment to nuclear disarmament in the U.S., it is generating real caution elsewhere; a further irony often remarked upon is that the European fear of USSR conventional superiority which drove so much of the West's nuclear armament during the Cold War has now become Russian anxiety about Western conventional capability.

18.35 The time seems ripe, accordingly, to revisit some of the issues addressed in the Treaty on Conventional Armed Forces in Europe (CFE) which was negotiated during the last years of the Cold War and adopted in 1999, establishing comprehensive limits on key categories of conventional military equipment in Europe (from the Atlantic to the Urals) and mandating the destruction of excess weaponry. It is clearly the case that without wider-ranging efforts to resolve underlying security dilemmas and introduce some greater balance in non-nuclear military capabilities (with qualitative

considerations being as important as quantitative ones in this respect), the U.S. and Russia and China will be unable to agree on substantially minimizing – let alone abolishing – nuclear weapons. Similar considerations will weigh in the regional contexts of South Asia and the Middle East.

18.36 A particular concern of Russia and China is the expansion of U.S. strategic systems (ballistic and cruise missiles) with precision guided conventional munitions, which are suspected of amounting to a disarming strike capability. This concern should be addressed at START negotiations limiting such weapons as well as through specific new agreements and confidence building measures. The development of more cooperative approaches to conflict prevention and resolution may well prove more productive in this context than focusing entirely on arms limitation measures.

Recommendations on Parallel Security Issues: Missiles, Space, Biological and Conventional Weapons

61. The issue of anti-ballistic missile (ABM) systems should be revisited, with a view to allowing the further development of theatre ballistic missile defence systems, including potential joint operations in areas of mutual concern, but setting severe limits on strategic ballistic missile defences. It should be recognized that while, in a world without nuclear weapons, strategic missile defences could play an important stabilizing role as an insurance policy against potential cheaters, they now constitute a serious impediment to both bilateral and multilateral nuclear disarmament negotiations. [18.28–30; see also 2.30–34, 17.18]

62. International efforts to curb missile proliferation should continue, but continued failure to multilateralize the INF should not be used as an excuse for either present party to withdraw from it. [2.35–37]

63. Ongoing attempts to prevent an arms race in outer space (PAROS) at the Geneva Conference on Disarmament, and work at the Vienna-based UN Committee on the Peaceful Uses of Outer Space, should be strongly supported. [18.31]

64. Continuing strong efforts should be made to promote universal adherence to the Biological and Toxin Weapons Convention and the Chemical Weapons Convention, and to develop more effective ways of defending against potential biological attacks, including – for all its difficulties – building a workable Convention verification regime. [17.29; 18.32–33]

65. The issue of conventional arms imbalances, both quantitative and qualitative, between the nuclear-armed states, and in particular the relative scale of U.S. capability, needs to be seriously addressed if it is not to become a significant impediment to future bilateral and multilateral nuclear disarmament negotiations, including by revisiting matters covered in the Treaty on Conventional Armed Forces in Europe (CFE). The development of more cooperative approaches to conflict prevention and resolution may well prove more productive in this context than focusing entirely on arms limitation measures. [18.34–36]

NUCLEAR DOCTRINE AND FORCE POSTURES: CONSOLIDATING CHANGE

18.37 As stated in Section 17, it would be extremely helpful to have significant early movement, if only from the U.S., on nuclear doctrine, with "sole purpose" or "no first use" declaratory statements visibly reducing the role of nuclear weapons in national defence and security systems. To the extent that those declarations have not been made before 2012 – and it is extremely unlikely, given the scale of present differences, that any kind of common position could occur so quickly – achieving them, and in particular getting agreement on strong "no first use" positions will be a major task for the medium term.

18.38 Similarly with changes to force posture – the physical arrangements for the location and handling of nuclear weapons – that must precede or accompany such declarations, and be wholly consistent with them, if the doctrinal changes are to have credibility. The crucial need, as stated in the last section, is for nuclear forces to be deployed in a way – and seen by others to be so deployed – that makes clear their essential function is intended to be retaliatory rather than potentially aggressive. That means essentially having weapons systems which can demonstrably survive a disarming first-strike (thus diminishing any incentive to "use or lose" them), though not so many of them that they are perceived themselves as constituting a significant first-strike threat; having the majority of weapons stored in reserve and uncoupled from their delivery systems (with a significant lead time needed to assemble and actively deploy them); and generally maximizing the decision time required to launch those weapons that are deployed. Again it will be a task for the medium-term to 2025, but hopefully accomplished much sooner, to achieve changes – including, most urgently, to launch decision time – which have not been put in place by 2012.

OTHER ELEMENTS IN THE NON-PROLIFERATION AND DISARMAMENT AGENDA

18.39 There are a number of other changes we identified as short term objectives that may not, realistically, be achievable in that initial period to 2012, in particular those listed and cross-referenced below. Momentum for both disarmament and non-proliferation needs to be generated and sustained on multiple fronts, and that means completing any such unfinished business as early as possible in the medium-term framework. A further important project for the medium term, noted below and discussed in detail in Section 20, is to develop and build support for the comprehensive legal regime that will need to accompany the final move to elimination.

18.40 It is also important to set real constraints on the ability of nuclear-armed states to easily reverse course on any of these fronts: the achievements of the minimization phase should so far as possible function as ratchets in the nuclear disarmament process, making further forward movement possible while preventing backsliding. Of the issues check-listed below – all of which are discussed in detail elsewhere in this report, in the cross-references given – the most significant contributors to securing the irreversibility of gains made are likely to be the first two, the CTBT and FMCT.

18.41 Comprehensive Nuclear-Test-Ban Treaty. (See Section 11, "Banning Nuclear Testing".) It is crucial that this come into force sooner rather than later to consolidate the informal moratorium that has been in place and observed by all states other than North Korea since 1998. It would also be highly desirable that its impact be further consolidated in the medium term by a "CTBT-Plus" agreement by all relevant parties to dismantle existing nuclear test sites, as has been done with the decommissioning of the French facilities in Mururoa and Fangataufa. Although this dismantling can be done unilaterally, there would be virtue in making this a common commitment, with agreed verification procedures. Under such a regime, CTBT signatories would commit themselves not to undertake new test site construction work: visible from outer space, this would lend itself to challenge inspection.

18.42 **Fissile Material Cut-off Treaty.** (See Section 12, "Limiting the Availability of Fissile Material".) The negotiation and coming into force of a treaty banning the production of high enriched uranium and plutonium for weapons purposes, with strong verification provisions, has long been regarded as one of the highest priorities on both the disarmament and non-proliferation agendas. Current divergences of interest between nuclear-armed states which have a surfeit or sufficiency of fissile material (U.S., Russia, France, UK) and those which apparently want to build-up their stocks (China, India, Pakistan) make it unlikely that there will be rapid progress in the Geneva Conference on Disarmament-based negotiating process begun

in 2009, but intense focus must be maintained on getting a strong outcome as soon as possible.

18.43 The issue of managing existing stocks of fissile material, including all that now in nuclear weapons, will be even more difficult to resolve, and an enforceable regime may have to await the final elimination stage, but ways of progressively advancing this objective (including a Fissile Material Control Initiative) have been proposed and ought to be part of parallel discussions from the outset. If existing stocks are not, as is likely, covered by the FMCT, it should be immediately followed by negotiation of a Fissile Material Treaty to be ready for the commencement of the final elimination stage.

18.44 **Non-Proliferation Treaty and International Atomic Energy Agency.** (See Section 9, "Strengthening the Non-Proliferation Treaty", and Section 10, "Strengthening Non-Proliferation Disciplines Outside the NPT".) Complete implementation (to extent not already achieved in the short term) of measures to strengthen the NPT regime and IAEA, and also to reinforce the many significant non-proliferation mechanism outside the NPT, must be high priorities for early in the medium term.

18.45 **Nuclear security.** (See Section 13, "Sustaining an Effective Counter-Terrorism Strategy".) There must be complete implementation as soon as possible (again to the extent this has not already been achieved in the short term) of the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material and the objectives of the cooperative threat reduction and related programs, designed to secure dangerous nuclear weapons, materials and technology worldwide.

18.46 **Nuclear energy management.** (See Section 14, "Responsible Nuclear Energy Management", and Section 15 "Multilateralizing the Nuclear Fuel Cycle") Progressive achievement of multilateralized nuclear fuel cycle arrangements, proliferation-resistant technologies, and other measures designed to reduce the proliferation risks associated with the expansion of civil nuclear energy should be a high priority for policymakers throughout the medium term.

18.47 **Nuclear Weapons Convention.** (See Section 20, "Mobilizing and Sustaining Political Will'.) An important project for the medium term will be to develop, refine and build international understanding and acceptance of the need for a Nuclear Weapons Convention – a comprehensive international legal regime to accompany the final move to elimination. Much work has already been done by civil society groups in producing a model convention prohibiting the development, testing, stockpiling, transfer, use and threat of use of nuclear weapons, and that draft has been circulated to member states in October 2008 by UN Secretary General Ban Ki-moon as a possible basis for multilateral negotiation. There is no reason why detailed

further work on such a convention should not commence now, and with government support, but its implications are so wide-reaching that there is, realistically, little chance of it becoming the subject of formal negotiation until the disarmament process is much further advanced, which is why the Commission identifies developing and building support for a Nuclear Weapons Convention as a medium rather than short term objective.

19. LONGER TERM ACTION AGENDA: BEYOND 2025 – GETTING TO ZERO

BOX 19-1

THE LONGER TERM ACTION AGENDA – BEYOND 2025

- Create political conditions, regionally and globally, sufficiently cooperative and stable for the prospect of major war or aggression to be so remote that nuclear weapons are seen as having no remaining deterrent utility.
- Create the military conditions in which conventional arms imbalances, missile defence systems or any other national or intergovernmental-organization capability is not seen as so inherently destabilizing as to justify the retention of a nuclear deterrent capability.
- Create verification conditions that will ensure confidence that any violation of the prohibition of nuclear weapons would be readily detected.
- Create the international legal regime and enforcement conditions that will ensure that any state breaching its prohibition obligations not to retain, acquire or develop nuclear weapons will be effectively penalized.
- Create fuel cycle management conditions that will ensure complete confidence that no state has the capacity to misuse uranium enrichment or plutonium reprocessing for weapons development purposes.
- Create personnel oversight conditions to ensure confidence that individuals' know-how in the design and building of nuclear weapons will not be misapplied in violation of prohibition obligations.

DEFINING "ZERO": THE NATURE OF THE TASK

19.1 The unequivocal objective of the longer term agenda – pursued with real passion and a sense of urgency, not just passive lip-service – must be to get from the minimization point to a world of zero nuclear weapons. But even defining that objective is not quite as simple as at first sight may appear. Seriously eliminating nuclear weapons means more than just dismantling all those in existence at the time. It has to include all fissile materials removed from them being accounted for and internationally monitored, delivery systems being dismantled in parallel to the destruction of warheads, and military fissile material production facilities being dismantled as well. In practice it would need to mean, at the very least, that if a leader of a former nuclear-armed state ordered subordinates to again build nuclear weapons, he would have to be told that this would take more than one year, and that the risks of detection by others would be very high.

19.2 We have explained earlier, in Sections 7 and 18, that the Commission would like to have been able to identify a particular target date for achieving the complete elimination of nuclear weapons. But we have found it impossible credibly to do so, given the nature and complexity of the conditions that will have to be satisfied in the final elimination-phase move from low numbers to zero, which we will describe in more detail in this section.

19.3 Another way, if one is needed, of describing the magnitude and difficulty of the abolition task is to note that every one of the familiar barriers to the take-up of what economists describe as "global public goods" are applicable here: preservation of sovereignty (countries' reluctance to accept international binding rules and monitoring of their own compliance with agreements); differing preferences (the fact that countries have different strategic, economic and political stakes in specific solutions to global problems); the "free rider" problem (the incentive for every party to wait until others provide the solution and then enjoy it); the "weakest link" problem (an effective solution can only be applied when every country fully complies with a common approach); and the "summation" constraint (whereby the successful solution of a global problem is literally the sum of the individual efforts of all the separate participants).

19.4 That said, none of these problems are insurmountable, and all become more manageable in a geopolitical environment becoming more genuinely cooperative. Creating and sustaining such a politically and militarily stable world must be the underlying goal.

GENERAL CONDITIONS FOR MOVING FROM MINIMIZATION TO ELIMINATION

19.5 The essential task is to create confidence in each nuclear-armed state that it can give up its last nuclear weapon, in concert with others, without its security, reputational or other national interests being threatened. Choreographing the endgame will be daunting, and it is impossible to foresee this far out exactly what factors will be in play. But it is not too soon to begin, now, very detailed studies, as we have recommended, on all the different variables and scenarios, and it is certainly possible to describe now in general terms, as we do in the following paragraphs, what kinds of basic systemic conditions are bound to have to be satisfied. Later in this section we will address the more specific factors that seem likely, to the extent we can now judge, to have most impact on the decisions of particular nuclear-armed states.

19.6 **Geopolitical conditions.** The most basic need is to create cooperative geopolitical conditions, regionally and globally, making the prospect of major war or aggression so remote that nuclear weapons are seen as having no remaining deterrent utility. Political-security relations among the nuclear-armed states and their neighbours will have to be cooperative and balanced enough that none feels that only nuclear weapons could deter threats to their national survival. And in purely military terms, conventional arms balances, missile defence systems or any other national or intergovernmental-organization military capability will have to be seen as not so inherently destabilizing, or inherently threatening, as to justify the retention of a nuclear deterrent capability.

19.7 In practice this will have to mean that all outstanding territorial disputes and other potential sources of major conflict involving nuclear-armed states and their allies are resolved, or at least that the status quo has become comfortable enough for all sides in these situations for any motivation to use major force to be non-existent. That such a world could be achieved within decades is not as fanciful as it might to some appear. Since the end of the Cold War there has been a well-documented and remarkable decline in the number of major violent conflicts and the number of battle fatalities – some 80 per cent in each case – with significantly more existing conflicts resolved than new ones started. Much of the turnaround is attributable simply to greater commitment to conflict prevention and resolution by the international community at all levels, with more professional and effective arrangements – through the UN, regional organizations and others, including sophisticated new civil society organizations – for mediation, transitional peacekeeping and post-conflict peacebuilding addressing underlying causes. For everything that continues to go wrong, much is now going right, and

there is no reason to believe, in a world growing ever-more interdependent, that this trend is inherently unsustainable.

19.8 **Verification conditions.** Without verification arrangements that will ensure confidence that every state is complying, and that any violation of the prohibition of nuclear weapons would be readily detected, getting to zero will be impossible. Effective verification is not a sufficient condition for disarmament: even a perfect detection system, were that attainable, would need to be backed by an effective enforcement system to deal with cases of violation, of which more below. But it is a necessary condition. Technologies and procedures continue to improve and must do so if the necessary confidence levels are to be reached. And to achieve a nuclear-weapon free world, all nuclear-armed states are going to have to agree to subject themselves to unprecedented verification procedures, with strong international institutions and oversight.

19.9 It needs to be understood, however, that building a system that sufficiently justifies confidence in disarmament, is not the same as building one that will be capable of detecting absolutely everything. The amounts of fissile material needed to make one or a few nuclear weapons are so small compared to the quantities that have been produced that it will be simply impossible to verify that every last kilogram of plutonium or high enriched uranium has been accounted for. Historical records of production are too inexact (even if our earlier recommendation on "nuclear archaeology" is followed) and inherent uncertainties in accounting are too great to allow perfection. In Russia and the United States, these inherent uncertainties amount to enough fissile material for hundreds of nuclear weapons; the uncertainties in other nuclear-armed states are very much lower, but greater than zero. All that acknowledged, ways do exist to build confidence that such uncertainties would not in fact mean that a state was illicitly retaining a cache of nuclear weapons. Expert interviews of key figures in nuclear weapon establishments could provide invaluable insights which could be compared to production records to identify possible deception. Intrusive inspections could further deter cheating. And verification experience in the U.S., Russia, South Africa and Iraq can certainly inform the development of better rules and procedures.

19.10 **Enforcement conditions.** There will have to be enforcement arrangements in place under an international legal regime strong enough to ensure that any state breaching its prohibition obligations not to retain, acquire or develop nuclear weapons will be effectively penalized: in effect, that any breakout will be controllable, and controlled. The first requirement of effective enforcement is to identify and formalize punishments that could deter states from breaching their obligations and deny them the benefits of any violation. But those punishments have to be actually implemented,

meaning decision-making bodies and procedures that enjoy international legitimacy and that will work in a manner timely and robust enough to deter or eliminate threats. Too many discussions of nuclear disarmament in recent decades have underestimated this challenge, simply assuming that in the event of a violation enforcement actions would be employed.

19.11 In the absence of alternatives that are difficult to envision today, the UN Security Council and a stronger IAEA would be vital elements of any enforcement-authorizing mechanism. Experience to date, most recently with Iran and North Korea, indicates that these bodies would have to become much more effective before states would relinquish their last nuclear weapons. Improvements in the Security Council's operation will depend, in this context as others, on achieving a closer alignment of perceived interests as between the U.S., Russia and China, and a more representative membership, including from major developing countries. More specifically, it will also mean getting around the current barrier that the Permanent Five's veto poses to enforcement, which has been argued to leave the abolition process at a dead-end. The difficulty, of course, is to persuade the five not to veto any veto removal, as the UN Charter enables them to do. We can only hope that the improvements in security relations that would be necessary to achieve, and facilitated by, movement to our proposed minimization point would help prepare the way for improvements of this kind in collective enforcement.

19.12 **Fuel cycle management conditions.** The need here is to create fuel cycle management conditions that will ensure complete confidence that no state has the capacity to misuse uranium enrichment or plutonium separation for weapons development purposes. Nuclear industry will have to be managed differently if nuclear weapons are to be completely eliminated. The inherently dual-use potential of uranium enrichment and reprocessing – for both nuclear power and nuclear weapons – is the foundation of the present system of international safeguards and inspections. But this is imperfect, and illicit enrichment (or plutonium separation) could occur without timely detection. These deficiencies have been tolerated by the major powers at least partly because they perceive their nuclear weapons as deterring anyone who might take advantage of the safeguard system's limitations. To give up their nuclear deterrents, these states are going to insist that uranium enrichment and plutonium reprocessing be done under conditions that would make cheating on a nuclear weapon prohibition nearly impossible. An important aspect of this will be the introduction of proliferation resistant technology, such as new forms of processing that avoid separated plutonium.

19.13 All states ought to share the objective of ensuring that enrichment and reprocessing capabilities cannot be misused for weapons purposes. Yet, key non-nuclear-weapon states today resist proposals to limit national

enrichment and reprocessing activities beyond current rules. They resist what they see as a new double standard in the nuclear order: following the distinction between those who have nuclear weapons and those that do not, there would be a new one between those allowed to conduct enrichment and reprocessing and those not. Resistance to further dichotomization is perfectly understandable in today's world, but it avoids the question of how nuclear industry must evolve if the world is to implement the goal of nuclear disarmament. Nuclear abolition would establish one standard for all states: zero nuclear weapons. A similar single standard would likely have to exist for uranium enrichment and plutonium reprocessing. If entitling each state to conduct enrichment and reprocessing under safeguards does not produce enough security to allow nuclear disarmament, then all states will have to agree to some form of multilateral control. One of the prices for achieving a world free of nuclear weapons will be all states having to rely on the same means of servicing their needs for uranium enrichment and plutonium reprocessing and recycling.

19.14 It is to be hoped that timely movement to reach the minimization point would build confidence among nuclear-armed and unarmed states alike to take further steps that would make abolition possible. Management of the nuclear fuel cycle would have to be a priority. In the meantime, to the extent that reforms in nuclear fuel-cycle management cannot be implemented, greater emphasis will have to be placed on non-proliferation enforcement.

19.15 **Personnel oversight conditions.** If and when states are negotiating to eliminate their last nuclear weapons, one of the most difficult questions will be how to ensure that individuals who know how to design and build nuclear weapons will refrain from doing so. The need will be to create personnel oversight conditions ensuring confidence that this know-how will not be misapplied in violation of prohibition obligations. Terrorist cells or something analogous to them will probably continue to exist, and some states probably will continue to act far enough out of the mainstream to arouse suspicion. The mainstream states will want to know that former nuclear-states are willing to keep track of known nuclear experts in order to bolster confidence that nuclear weapons will not be illicitly produced. Given the international alarm aroused by A.Q. Khan for spreading his know-how and wares, it is easy to imagine the anxiety that could be aroused by a similar character in a world when no one is supposed to have nuclear weapons. Balancing the rights and freedoms of individuals and the interests of global security will be a non-trivial challenge.

OVERCOMING SPECIFIC CONCERNS OF PARTICULAR STATES

19.16 Beyond these basic systemic conditions, each nuclear-armed state could be expected to identify more particular conditions it would need met before it relinquished its last nuclear weapons. That is yet another of the realities that this Commission, like all other supporters of an early move to a nuclear-weapon free world, has to face. While it is impossible now to identify with any precision the concerns that are likely to be preoccupying the various powers fifteen to twenty years hence, it is important to have at least some sense of the weight of the considerations for each of them that, at least viewed from today's vantage point, seem likely to be most pertinent.

19.17 They seem daunting now, but as nuclear arsenals are reduced and become less salient during the minimization phase, pressure is bound to mount further on governments to justify their retention of these weapons. If our minimization point is reached and the outlook is one of sustained stability, nuclear-armed states will be able to justify resisting further moves toward zero only if they can credibly identify genuine threats to their national survival which can be reasonably argued would grow stronger if all nuclear weapons were eliminated. It is not too soon to start studying and debating these scenarios now.

19.18 **United States.** The U.S. seems certain to remain large and militarily powerful enough not to need to be concerned, for the foreseeable future, about any non-nuclear threat – at least of a kind currently known – to its existence or that of its allies. Like every other nuclear-armed state it would no doubt want to be confident that there was not some new kind of non-nuclear threat in the pipeline with a destructive capability functionally equivalent to today's nuclear weapons – and biological weapons, while there is no reason today to be so alarmist, are thought by some to have that potential. The greatest impediment to the U.S. moving to nuclear abolition, however, may well prove to be not geopolitical, military, or technical but domestic-political: when even the Genocide Convention, about the merits of which there was no serious controversy at all, took forty years to win the necessary 67 Senate votes required for treaty ratification, history does not inspire optimism that this hurdle will ever be readily overcome.

19.19 **Russia.** Russia will want to be confident, in the future as now, that its military capability is not seen as dramatically weaker than that of the U.S. if nuclear weapons are taken out of the equation: it will remain concerned about perceived U.S./NATO advantages in conventional weapon systems and forces, ballistic missile defence technologies and space support and potential strike capabilities. It is also likely to be particularly wary of its future with China. As the latter's population, wealth and power – and size

of armed forces – continue to grow, and Russia's population is not sufficient to support dense settlements or defences in the Far East bordering China, if Sino-Russian relations do not continue to strengthen, Russian leaders may, whatever the objective logic of doing so, cling to nuclear weapons as a deterrent. More generally, the psychological dimension of nuclear power status is likely to weigh particularly heavily with Moscow. Nuclear weapons made the Soviet Union a superpower, and with diminished claims on other grounds now to that status, Russian leaders may well be asking for a long time yet "Will the other great powers treat us a great power if we do not have nuclear weapons?"

19.20 **China.** China is now deeply integrated into the international community, its relationship with other nuclear-armed states is improving, and cross-Strait relations are focused on peaceful development. But if that wider integration process should become disrupted in any major way, and particularly should Taiwan seek and claim independence, supported by one or more nuclear-armed state, Beijing could be expected to be very reluctant indeed to give up its nuclear deterrent. The Taiwan contingency apart, is hard to believe that China's identity or survival in a nuclear disarmed world could possibly be threatened in any way that nuclear weapons could credibly prevent, although – like Russia – it is showing growing signs of concern about the relative scale of U.S. non-nuclear military capability, and may well want to be assured of a reasonable degree of balance between the major powers in this respect.

19.21 **France.** History weighs heavily in France's attachment to its nuclear weapons, and is as likely in two decades' time, as now, to make it one of the very last of the nuclear-armed states to be prepared to give them up. The memory of defeat, invasion, lost national pride and millions of lives lost in 1870, 1914 and 1940, along with the perceived role played by its nuclear arsenal in guaranteeing such humiliating devastation will never occur again, lives on – even though the geopolitical ground has now been transformed by the creation of the European Union.

19.22 **United Kingdom.** Of all the nuclear-armed states the UK seems the least wedded, either militarily or psychologically, to its nuclear deterrent, and there is no reason to disbelieve, or fear the non-continuation, of its present position that if everyone else were prepared to give up their nuclear weapons it would not seek to justify their retention. It remains to be seen whether, in the context of significant reductions by other nuclear-armed states, that could translate into an early decision to phase out completely, and not replace at all, its ageing Trident-carrying submarines. One unstated consideration, as with France, is likely to be the UK's concern that – in a world increasingly likely to press for a single EU seat on the Security Council, as part of its necessary restructuring to reflect the world of the 21st century –

giving up its nuclear weapons will be to diminish whatever remaining claim it has to sit at the world's top tables.

19.23 **India.** National pride, as well as national security, appears to have played a major role in India's acquisition of nuclear weapons, and may again in the elimination endgame as well. Given its very strong conventional capability, security conditions, on the face of it, should not inhibit India from matching its very strong and consistent support in principle for abolition by going to zero if others do likewise. A complicating factor, however, may be Indian doubts about the determination of the Pakistani Army and intelligence services to vanquish terrorists that may continue to prey across its border, and the perception that Pakistani factors may be retaining some unconventional weapons to use in any conventional war thus generated.

19.24 **Pakistan.** Defeat by India in three conventional wars was undoubtedly the catalyst for Pakistan developing its own nuclear weapon capability, and it shows every sign of being determined to hold on to its arsenal so long as its military or civilian leaders feel that a risk of conventional war with India remains – as will clearly be the case if the two countries have not resolved their conflicting claims and interests in Kashmir and elsewhere. A further complicating factor – at least at the present stage of the country's evolution from military to civilian rule – is the effective control of Pakistan's nuclear weapons by the military, the military's visible reluctance to hand over that control to the civilian government, and its disposition to play up the threat from India as the fundamental justification for retaining such weapons.

19.25 This all may mean that to get to zero in this region, India has to be removed as a perceived threat to Pakistan, which in turn means the risks of war stemming from subversion, low-intensity operations in Kashmir and terrorism must be more or less eliminated. This may, in turn, require the Pakistani military to play a less dominant role in the political system, and certainly to acknowledge civilian control over the state's nuclear weapons. Since civilian rulers might also be reluctant to relinquish Pakistan's nuclear arms, the subordination of the military to civilian rule would not in itself be sufficient for Pakistan's nuclear disarmament, but it may be necessary.

19.26 **Israel.** Security, rather than any consideration of prestige, is the overwhelming rationale for Israel acquiring its – undeclared – nuclear weapons capability, and it can be taken at face value in saying that it will be prepared to join in a Middle East Weapons of Mass Destruction Free Zone if its neighbours demonstrate by word, treaty and deed their willingness to live permanently in peace with it. The difficulty, given the troubled history of the peace process, is not only to see how that status is to be achieved, but what will satisfy Israel that it is sustainable: one can only hope that a more mutually cooperative and trusting environment will evolve over time.

Certainly Israel will require exceptionally strong procedures for verifying that none of its neighbours is retaining weapons of mass destruction or the capacity to make them. It may not be willing to rely alone on the IAEA or other international inspectorates to do this, but insist on inspecting and monitoring for itself. This is impossible to imagine many Arab states and Iran accepting today: another indication of how much change in political-security relations is going to be needed before zero can become a reality in this region.

20. MOBILIZING AND SUSTAINING POLITICAL WILL

THE ELEMENTS OF POLITICAL WILL: LEADERSHIP, KNOWLEDGE, STRATEGY AND PROCESS

20.1 In the scale of international political ambition, moving to a world in which there are no nuclear weapons at all from one in which eight major nuclear-armed states possess between them 23,000 nuclear warheads – with a number of them reluctant to even reduce their arsenals, let alone give them up entirely – will be matched in difficulty in the decades ahead only by the task of reducing to zero, in an ever more energy-hungry planet, the global increase in carbon emissions. These are both formidably daunting challenges, but the sheer scale of the problems being confronted in each case demand that they be tackled.

20.2 We will not get to a nuclear weapon free world, or even very far down the long road towards it, or achieve all the other goals spelt out in this report in relation to non-proliferation, nuclear security, and the continuing development of peaceful uses of nuclear energy, simply by making lists of manifestly desirable outcomes. This is certainly the case for generalized calls to embrace the ideal (e.g. "universalize NPT membership"), but it is also true even for the sharply-focused, prioritized and pragmatic short, medium and longer term action agendas that we have tried to spell out, and which are at the heart of this report. It will be a matter of mobilizing, and sustaining over many years, the necessary political will on the part of all relevant decision-makers, and in this final section we suggest how this might best be done.

20.3 The absence of political will is never a good excuse for something not happening. In almost any policy context, domestic or international, the will to do something difficult, sensitive or expensive will rarely be a given. It usually has to be painfully and laboriously constructed, case by case, context by context, with multiple actors needing to be involved, reflecting the four main elements that usually have to come together in that construction process. First there is *leadership*, without which – however many of the other boxes are ticked – inertia will almost invariably prevail. Second there is *knowledge* – without information about the problem, and an accompanying concern to address it, nothing can begin to happen, and this means effective education and advocacy at all levels. A third element is *strategy* – having a confident sense that there is a way forward that will actually make a difference. And the fourth element is *process* – having the institutional and organizational means at hand to advance the relevant strategy in practice.

Recommendations on Action Agendas: Short, Medium and Longer Term

66. The Short Term Action Agenda, for the period between now and 2012 – and including the 2010 NPT Review Conference – should focus on the issues we identify in Box 17-1.

67. Consideration should be given to the possibility of the United Nations General Assembly holding a Special Session on Disarmament late in 2012, as a way of benchmarking the achievements of the short term and defining the way forward. Any decision should be deferred until mid-2010, to allow for reflection on the outcome of the 2010 Review Conference, and whether enough momentum is building to justify the resources and effort involved. [17.2–3]

68. The Medium Term Action Agenda, for the period between 2012 and 2025, should focus on the issues we identify in Box 18-1.

69. The Longer Term Action Agenda, for the period beyond 2025, should focus on establishing the conditions we identify in Box 19-1.

70. Given that questions of cost-burden sharing are likely to arise as disarmament momentum builds over the longer term, it may be helpful for interested states to commission a detailed study on the calculation of disarmament and non-proliferation costs and possible ways of funding them. [18.26–27]

20.4 **Leadership.** Without real commitment from the top – the player or players that really matter – hostility, indecisiveness or sheer inertia are likely to prevail, and progress will be stumbling and halting at best. On the nuclear issue, thinking is beginning to change at senior political levels, but not yet fast enough. The initial Kissinger-Shultz-Nunn-Perry Wall Street Journal article in 2007, followed up by similar statements over the next two years from equivalently distinguished groups in the UK, Germany, France, Italy, Norway, Australia and elsewhere, had a major impact. So did, even more, the election of President Barack Obama, with his very clearly articulated vision – now rewarded by the 2009 Nobel Peace Prize – of a cooperative rather than confrontational approach to solving the world's security problems generally, and his very specific commitment to place nuclear disarmament high on his policy agenda. The support of Russian President Medvedev for early movement on U.S.-Russia nuclear arms reduction was crucial in consolidating this early momentum. And UK Prime Minister Brown, and the Australian and Japanese prime ministers who initiated and have supported this Commission, are among other leaders who have made clear their seriousness about tackling the issue anew.

20.5 But there is still a very long way to go before the need for a fundamental change in direction is really internalized in global political leadership thinking. The prevailing psychological mindset among policymakers in the nuclear-armed states (and a few others who shelter behind them or would like to emulate them), shared by a significant proportion of their publics, seems to be that nuclear weapons – while maybe dangerous, and on balance a regrettable invention – are nonetheless significant contributors to national security.

20.6 In most domestic and even international policy contexts, one does not need to look beyond a small handful of players to identify the leadership that really matters. But the nuclear context is rather different. The problem of achieving a nuclear weapon free world – and ensuring that things don't get worse before they get better – is so complex, and involves so many different players at different levels, that no one actor's leadership is likely, by itself, to be decisive. What is really required is leadership at three different levels – from the top down, from like-minded peers, and from the bottom up – as discussed later in this section. The optimal impetus will come from a combination of willingness to move on the part of the major nuclear-armed states; like-minded groups of other state actors pushing out the envelope and creating peer pressure for disarmament; and effective civil society action keeping governments responsive and politically accountable. Each is necessary, and none by itself sufficient.

20.7 **Knowledge.** It certainly cannot be assumed that there is sufficient knowledge and concern about the nuclear problem – its magnitude, severity and urgency, in all its dimensions as we have spelt them out in this report – at the level of policymakers, those in the media and elsewhere who most influence them, and in the general publics who give political decision-makers their mandates.

20.8 In one sense there is no shortage of relevant professional knowledge on nuclear issues. In militaries, defence ministries, weapons research laboratories and think tanks and research institutes generally there is still a reasonable pool of specialist technical knowledge on nuclear weapons systems and arms control strategies. But it is not clear that enough of these specialists and scholars are finding it possible to make the transition from Cold War thinking to that required in today's world, where nuclear weapons are far less the solution than the problem. Nor is it clear that the pool is being refreshed at a sufficient rate by new entrants with both the skills and mindset to cope with the huge challenges involved in winding back the whole existing system. And within most of the foreign ministries and intergovernmental institutions and organizations where new strategic thinking is not only going to have to be generated but translated into very

complex negotiated treaties, arrangements and understandings, the relevant experience and expertise is becoming very thin indeed.

20.9 At the level of civil society the outlook is a little more promising, as discussed further below, with a number of significant non-governmental organizations beginning to find their mobilizing voice on nuclear issues after a long period of marginalization. But the mainstream media remains largely uninterested, except in the context of the immediate challenges of the kind posed by North Korea and Iraq. And among publics at large, although the younger generation is far more information-technology and social-networking savvy than its elders, it is not clear that nuclear issues are gaining much traction by comparison with other public policy concerns like climate change, environmental degradation generally, resource security, global disease, and financial and employment security.

20.10 Clearly there is a need, which hopefully will be partly met by reports like this, for advocates of change to do a better job of explaining to the media and publics directly why the elimination of nuclear weapons is a good idea. But public engagement is a long-haul enterprise, requiring rather more than a few well-placed op-eds, and public lectures and seminars in major capitals. Sustained media campaigning is required, and not only through the traditional print and broadcasting formats, but through the blogosphere generally and all the rapidly evolving social networking tools – of which Facebook, Twitter, and YouTube are just the best-known current Western examples – which are becoming the primary information channels for an extraordinarily high proportion of the global population. NGOs will necessarily be the major vehicle for conducting these campaigns, and they will need generous support from governments and philanthropic foundations to enable them to do so effectively.

20.11 Beyond and behind this kind of knowledge-and-concern building effort there needs to be a renewed emphasis on formal education and training, in schools and universities. High school curricula should find a place for explaining the history of the nuclear arms race, the huge risks that the world faces if it continues in any form, and the sheer enormity of the horrors that are involved in any actual use of nuclear weapons. Field trips by students around the world to Hiroshima may be the most graphic way of all of driving this message home, and they should continue to be supported (as should the UN Disarmament Fellowship Program, sponsored by Japan, which so far has brought some 700 diplomats to visit Hiroshima and Nagasaki since 1983). The living reminders of what these weapons mean in practice – the "*hibakusha*" victims of Hiroshima and Nagasaki – gave painful and moving testimony to this Commission, but with the average age of survivors now in the mid-70s there will be all too few opportunities for others to directly share our experience. But their story can and should be told to future generations,

using all the classroom resources of modern technology: those who forget, or never learn about, the agonies of the past are all too often condemned to repeating them.

20.12 An associated need is for more specialized courses on nuclear-related issues – from the scientific and technical to the strategic policy and legal – in universities and diplomatic-training and related institutions. On any view of the time it will take to work through all the non-proliferation, disarmament and peaceful use strategies and agendas detailed in this report, a large number of experts across multiple disciplines are going to be fully occupied for decades to come. As anxious as this Commission is to put the nuclear weapons age behind us, we cannot emphasise too strongly the scale and duration of the resource commitment – and not least that in human resources – that will be needed to achieve this.

20.13 **Strategy.** If policymakers are actually to be moved to action, their knowledge of a problem and general willingness to address it has to be accompanied by a clear sense that there is a productive way forward. The dilemma for those concerned to achieve a world free of nuclear weapons is that too often in the past the strategies proposed have been either too ambitious to be credible – like having all nuclear-armed states negotiate now to give up all their weapons by a given date – or too modest either to inspire hope that this goal could ever be achieved. Unless there is a very clear vision of what the ultimate objective is, small steps in arms control, however individually worthwhile, are likely to lack direction, purpose and pace, and be almost as much a distraction from the main game as a contribution to it.

20.14 In this Commission's judgment, there is no practical alternative to proceeding step by step rather than through one great, comprehensive single leap. But as we have sought to make clear in the action plans that we have formulated, we believe that it is important from the outset to articulate a very clear and sharp ultimate goal, and map the path – or, more accurately, multiple paths – to it in as much detail as it possibly can be, setting a number of target dates and benchmarks along the way. Specific elements like the CTBT, FMCT, and deep bilaterally negotiated cuts in weapons arsenals, are all indispensable, but they have to be accompanied by something more than a vague idea that this will all lead somehow, at some point, to nuclear disarmament. Deadlines have in the past sometimes worked well to speed things up – as with the agreement to conclude CTBT negotiations, made in 1995 as part of the deal to extend the NPT indefinitely. But even talk of setting them has also proved divisive, as with the response in 1988 to Rajiv Gandhi's "time-bound action plan".

20.15 We hope that we have steered a course through these perils by making a clear distinction between the minimization and elimination phases of the

process. For the latter, while being very clear about the ultimate goal and the conditions that will need to be in place to achieve it, we have acknowledged that it is impossible now to credibly identify a particular date by which it might be achieved. But for the former, we have argued for the feasibility of quite clear and measurable short term (to 2012) and medium term (to 2025) objectives – culminating in a very specific "minimization point" characterized by no more than 2,000 weapons in existence worldwide, with "no first use" doctrine universally agreed, and force deployment arrangements in place that would make this credible. The task now is to get these action plans accepted in principle. Then it will be a matter of ensuring that there are in place the remaining necessary elements of political will, the institutional processes and actors needed to turn blueprint into action.

20.16 **Process.** There is no shortage of available institutional machinery through which to advance both non-proliferation and disarmament objectives, and a good deal of this report has been occupied with describing it, and recommending its further and better use: existing treaties like the NPT and CTBT, with their associated implementation agencies, the IAEA and the CTBTO; Nuclear Weapon Free Zones and other regional arrangements; treaty-making bodies like the Geneva Conference on Disarmament, which can be used to negotiate new binding agreements like the FMCT; norm-setting forums like the NPT Review Conference and the UN General Assembly; formal enforcement mechanisms like the UN Security Council itself and the monitoring systems put in place pursuant to its resolutions like UNSCR 1540; and less formal enforcement arrangements like the Nuclear Suppliers Group and Proliferation Security Initiative.

20.17 Beyond all these existing mechanisms, however – which might collectively be described as "traditional arms control" – the question arises whether there is not some other way of really concentrating attention and energy on the ultimate, desired central outcome: nuclear disarmament. Isn't it the case that, for too long and for too many players in the multilateral system, process has mattered just as much, if not more, than the outcome? Can't we do any better than all the piecemeal steps discussed so far? Don't we *need* to find some new, more sharply focused way, of engaging core constituencies on the core disarmament task?

20.18 There is an alternative – or additional – approach which has many supporters, which focuses on nuclear disarmament through the lens not of traditional arms control, but rather international humanitarian law. The argument is that nuclear disarmament is at heart a humanitarian imperative because of the grotesquely inhumane and enormous impact of nuclear weapons; that the single most important thing is to prevent their use and the most certain way of achieving that objective is to eliminate them completely; and that the best way of achieving that in practice – motivating like-minded

governments and civil society alike – would be negotiations conducted through a humanitarian and human rights-focused process.

20.19 The models most often cited, which might be described as "campaign treaties", are the Ottawa process, producing the Anti-Personnel Mine Ban Convention of 1996, and the Oslo process, producing the Convention on Cluster Munitions in 2008. The particular vehicle most often advocated in the present context is an all-embracing "Nuclear Weapons Convention". This and other such options are discussed later in this section.

IDENTIFYING THE KEY ACTORS

20.20 **"Top down" actors.** The existing nuclear-armed states, both inside and outside the NPT, are inescapably the lead players, with none more important in the first instance than the U.S. and Russia, simply because of their hugely disproportionate share of the total global arsenal. As has been fully discussed elsewhere in this report, President Obama has led the way not only generally in clearly placing nuclear disarmament back on the international agenda in the Security Council and elsewhere, but more specifically with President Medvedev in committing to the negotiation in 2009 of a START follow-on treaty. It is crucial not only that this treaty be concluded, with a major reduction on each side in deployed strategic weapons, but followed by further intensive strategic dialogue and associated deep cuts in weapons stocks. It is also important that these two countries show the way on doctrine and deployment, contributing actively to reducing the salience of nuclear weapons in strategic thinking.

20.21 The other nuclear-weapon states have made some contributions of their own, with the UK recently deciding to reduce the number of submarines carrying its nuclear arsenal and playing a leading role in developing, with Norway, workable disarmament verification strategies, France leading the way on irreversibility in moth-balling its nuclear weapons tests sites and rendering fissile material production facilities unfit for weapons purposes, and China is remaining at least a constant advocate and leader on negative security assurances and no first use doctrine.

20.22 But each of the five original weapon states need to do more, not least in committing to active participation in a multilateral disarmament process of the kind that will be necessary to achieve what we have described as the 2025 minimization point target – and in bringing to the table in this respect the three nuclear-armed states outside the NPT. We have suggested that the Conference on Disarmament, for all its desolate lack of productivity in recent years, might be an appropriate forum, potentially acceptable to India and Pakistan and workable for Israel, for beginning such a serious multilateral dialogue.

20.23 "Peer group" actors. Leadership in nuclear disarmament and non-proliferation has been a hallmark of a significant number of non-nuclear weapons states, including those that have been members of groupings like the New Agenda Coalition and the Seven Nations Initiative, all the states that have negotiated nuclear weapon free zones and those governments – including the two sponsoring this report – that have had commissions and expert studies move the issue forward. In driving this process further, the role of like-minded core groups in providing peer pressure and demanding high standards will be vital.

20.24 Such groups have played a critical role in advancing disarmament negotiations in the past, not least in the broad-based and successful campaigns of recent years, in which they joined with strong civil society leadership, in producing the Mine Ban and Cluster Munitions Conventions. A like-minded representative core group of states, including not only committed non-nuclear weapons states but key, progressive nuclear armed-states and could begin a parallel track process to negotiate such agreements as reciprocal transparency measures, a way to approach excess fissile material stocks, and a draft no first use treaty or more general Nuclear Weapons Convention of the kind discussed below.

20.25 There are both advantages and disadvantages in the like-minded group approach to formal treaty negotiation. The advantages include a high level of commitment to the process and the outcome, increasing the stakeholder effect; the content of the treaty is usually far tougher – with less lowest-common-denominator, watered-down language – than one where states are reluctant negotiators; and once they get going the negotiations tend to be fast, concluding within a year or eighteen months. The basic disadvantage is that such groups are self-selecting, by definition including those who have already decided to move forward and not including the so-called "problem" states (although it is noteworthy that countries who self-exclude from treaty negotiations not infrequently have a later change of heart, as with France and China eventually joining the NPT in 1992).

20.26 Whatever the utility of peer group solidarity in treaty–making exercises, there do not appear to be any down-side risks in such pressure when it comes to pushing the disarmament agenda in all available forums. One way in which they can help to do so is by working equally hard and constructively on non-proliferation issues. Here, as everywhere else, there is an inexorable connection between the two objectives. Nuclear-armed states perceive that they are being asked to give up a great deal in moving toward nuclear abolition. They cannot be forced to do so, and will insist on significant security and political gains in return for nuclear disarmament – or at least the mitigation of insecurities that might otherwise arise. The most obvious return they would demand in transitioning toward nuclear

disarmament is much more robust guarantees that proliferation will not occur, or will be robustly defeated. For nuclear abolition to be realistic and not merely a slogan, important non-nuclear-weapon states must be willing not just to emphasise the nuclear-armed states' own responsibilities, but to cooperate with them in creating conditions conducive to this process. This includes states that do not possess nuclear weapons but which rely on extended nuclear deterrence.

20.27 There is an additional role to be played here by regional structures and political groupings within international organizations. For example, the Non-Aligned Movement contains two states – India and Pakistan – that possess nuclear weapons and have remained outside the NPT. Serious pressure on those two states (and indeed on North Korea as well) from leading NAM countries would matter a great deal.

20.28 **'Bottom up" civil society actors.** Since the first establishment of the political anti-nuclear weapons movements at the end of World War II, an extraordinarily diverse and international collection of civil society organizations have been working to end the nuclear arms race and recreate a world without such weapons. They have included women's groups, scientists, engineers, physicians, indigenous organizations, trade unions, city councils, mayors, writers, artists, musicians and actors and so on, and between them have initiated an immense range of actions including mass demonstrations, national and international campaigns, television documentaries, educational promotion, engagement in negotiation processes, model treaty drafting and scientific verification experiments. Among the most significant the current such advocacy groups are Pugwash (the 1995 Nobel Peace Prize winner), the Nuclear Threat Initiative (and its associated Nuclear Security Project), Global Zero, the Middle Powers Initiative and Article VI Forum (organized by the Global Security Institute), the International Luxembourg Forum on Preventing Nuclear Catastrophe, and a number of grassroots-focused campaign organizations like ICAN (the International Campaign to Abolish Nuclear Weapons, initiated by International Physicians for the Prevention of Nuclear War) and Mayors for Peace (with its advocacy of the Hiroshima-Nagasaki Protocol) .

20.29 Add to these activist advocacy groups the specialist think tanks, research institutes and many scholars working individually on these issues – including all the associated research centres and consultants working with this Commission – and it is apparent that there is a formidable body of expertise, experience and enthusiasm available to be harnessed, and indeed to play a leading role in energizing the necessary debate and driving practical outcomes. There is substantial interchange between officials and non-governmental experts around the world through a process of publication, international conferences and participation in official negotiations and

treaty reviews; in many countries, governmental officials have either come from civil bodies or will be working in them once they leave office; and there have been very close working relationships developed between some organizations and governments in the context of particular disarmament campaigns, including the major ones of the last decade on land mines and cluster bombs.

20.30 The Commission sees the main roles of civil society actors as being to inform wider publics about the issues, maintain pressure upon governments to act upon them, and to offer creative and constructive ideas to policymakers as to how to advance the disarmament agenda. We are realistic about their limitations as well as their strengths: there are some nuclear-armed states (France and Israel) where nuclear disarmament appears never to have been the subject of civil society mobilization, and others (China, Russia, and probably Pakistan – not to mention the outrider, North Korea) which are structurally less susceptible to such political pressure. Probably the most effective general strategy for civil society actors is to make common cause with like-minded governments – including nuclear-armed states where possible – and to try to extract real synergy from the integrated effort, as was very much the case (albeit with much narrower and more manageable briefs) with the Ottawa land mine and Oslo cluster bomb campaigns.

FOCUSING THE CAMPAIGN: A NUCLEAR WEAPONS CONVENTION?

20.31 As noted above, the question arises whether the cause of nuclear disarmament might be better advanced by a focused effort to advance a particular international-humanitarian-law oriented "campaign treaty", rather than concentrating only on the many different strategies, all of an essentially traditional-arms-control variety, which we have brought together in the short, medium and longer term action agendas identified in this report. The issue is not whether all the other detailed strategies and recommendations should be abandoned, but rather whether they should be supplemented by a focused campaign effort of this kind, in which the key actors would be a combination of like-minded governments and civil society organizations, on the model of the Ottawa land mines and Oslo cluster bomb campaigns.

20.32 The primary candidate for this role is an all-embracing "Nuclear Weapons Convention", for which a model draft treaty now exists and which we have already mentioned briefly in Sections 10 and 18. Other possible approaches are a "no use" convention, a "no first use" convention, and a "framework" rather than detailed nuclear weapons convention. These options are discussed in turn in the following paragraphs, after a brief

account of some of the humanitarian-law models on which they are all based.

20.33 **The Humanitarian Model.** Concern about the threat of the use and misuse of weapons is woven through the whole history of international humanitarian law, and a significant body of treaty law has been put in place to control and prohibit a range of both conventional weapons and weapons of mass destruction. Reinforcing this in recent years is the now well-developed concept of human security, which makes human beings rather than the state itself the primary focus of security concern, and emphasises the protection of populations and human rights generally. Two of the landmark global arms control agreements of the last decades – the Chemical and Biological Weapons Conventions – have their roots in international humanitarian law in the form of the 1925 Geneva Protocol. The most recent examples of a humanitarian-focused approach, successfully integrating efforts by both the technical arms control community and the humanitarian and development communities, are the 1997 Mine Ban Convention and the 2008 Convention on Cluster Munitions.

20.34 The anti-personnel mines treaty was a long time in the making, and followed an extended period of research by governments, NGOs, think-tanks, universities, militaries and international organizations in order to ascertain the problem and find ways to a solution, with the most influential findings for otherwise reluctant governments being general agreement on their limited military usefulness. It was born of frustration with the lack of will of key member states to apply to this problem the 1981 Convention on Certain Conventional Weapons (CCW), also known as the Inhumane Weapons Convention, which led a group of governments, international organizations and non-governmental organizations to meet in Ottawa in October 1996, starting a process with a small core group of energetic committed individuals and officials, and later expanding it to begin negotiation with a wider group of states. NGOs formed an umbrella group, the International Campaign to Ban Landmines (ICBL) and worked collectively and effectively.

20.35 The process was tight, with an agreed time-frame. Further meetings were held throughout 1997 in Vienna, Bonn, and Brussels, ending in adoption of the treaty text in Oslo in September 1997, banning anti-personnel landmines completely, and providing both for the destruction of stocks, and their removal from the conflict zones where they had been deployed. The Mine Ban Convention now has 156 parties – still excluding some major states with millions of anti-personnel mines stockpiled between them (the U.S., Russia, China, India and Pakistan), but the production, sale and use of such mines has decreased dramatically, through both formal adherence to it by many former mine-producing states, and widespread acceptance of its provisions by others.

20.36 The Convention on Cluster Munitions was similarly born from frustration with attempts to negotiate a ban on these inhumane weapons through the UN-based process. The government of Norway held a meeting in Oslo February 2007 that marked the beginning of negotiations; further meetings followed in Lima, Vienna, Wellington and Dublin, with a signing Ceremony in Oslo in December 2008. Again research was carried out by governments, NGOs, think-tanks, the military and international organizations to ascertain the problem and devise solutions, and the process involved a humanitarian approach, a core group of states, international organizations and NGOs (who formed an umbrella group, the Cluster Munitions Coalition, to maximise NGO cohesion and impact). The Convention now has 100 signatures and 22 ratifications, but several major producers of cluster munitions, including the U.S., Russia, China, India, Pakistan and Brazil, have not yet signed it.

20.37 In relation to nuclear weapons, the main product of humanitarian action to date has been the 1996 International Court of Justice (ICJ) Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons, requested by the UN General Assembly on the initiative of the Assembly of the World Health Organization. The fourteen judges examined current treaty law, customary rules and state practice with regard to nuclear weapons, and agreed that the threat or use of military weapons should "be compatible with …the principles and rules of international law". Their opinion also strongly reinforced Article VI of the NPT in finding unanimously that there exists an international obligation to achieve nuclear disarmament "in all its aspects". But on the core issue of actual breach of international humanitarian law, it was only on the casting vote of the President of the Court that it was determined that "the threat or use of nuclear weapons would generally be contrary to the rules of international law applicable in armed conflict, and in particular the principles and rules of humanitarian law" – and this paragraph went on to state that the Court could not definitively conclude that this would be so in every situation, including in situations of self defence where the very survival of a state was at stake. To this extent, the opinion has been cited by both opponents and proponents of nuclear weapons as supporting their case.

20.38 **Nuclear Weapons Convention.** Originally prepared in 1997, in response to the ICJ Advisory Opinion, and updated in 2007 by an international consortium of lawyers, scientists and physicians, with inputs from many disarmament experts, a very comprehensive draft model convention has been given wide circulation – including in the UN General Assembly on the initiative of Costa Rica and Malaysia – and enjoys considerable support from civil society groups around the world and a number of non-nuclear weapon states.

20.39 The model Nuclear Weapons Convention (NWC) would prohibit the development, testing, production, stockpiling, transfer, use and threat of use of nuclear weapons. States possessing nuclear weapons would be required to eliminate them in a series of phases over an (optimal) fifteen year period, involving taking nuclear weapons off alert, removing them from deployment, dismantling them and placing all fissile material under international control. The Convention would also prohibit the production of weapons-useable fissile material and require delivery vehicles to be destroyed or converted to make them non-nuclear capable. An International Monitoring System would be established to gather information, with mechanisms for information sharing and confidentiality. Verification would include, inter alia, declarations and reports from states, routine and challenge inspections, on-site and remote sensors, satellite imagery; environmental sampling, and information sharing. The model Convention is structured traditionally with a preamble, and includes articles on obligations; definitions of nuclear materials, devices and prohibited activities; elaborately described phases for implementation and deadlines; and a structure for implementation including a secretariat and states parties decision-making procedures.

20.40 The model NWC is a professionally crafted and thoughtful document, well described by its UN sponsors as "a useful tool in the exploration, development, negotiation and achievement of such an instrument or instruments". A comprehensive legal regime of this kind will be necessary, as we have noted in Section 18, to accompany the final move to elimination, and it is important that support be progressively built for it. Moreover, it is not too early to start now on further refining and developing the concepts in the model NWC, making its provisions as workable and realistic as possible, and building support for them, with the object of having a fully-worked through draft available to inform and guide the multilateral disarmament negotiations we see as gaining real momentum during our medium term time-frame, from 2012 to 2025. We recommend, accordingly, that interested governments support with appropriate resources the further development of the NWC.

20.41 The Commission doubts, however, whether an NWC can be of much immediate utility as a "campaign treaty" on the model of the Ottawa and Oslo processes. The primary difficulty is that the issues it addresses are simply too complicated and too controversial – certainly for all the existing nuclear-armed states, but for many others as well – to be able to command the immediate broad-based support from governments that has been characteristic of the other vehicles mentioned and made them so practically useful. To take just one example of the many drafting problems that will have to be worked through, the document embeds the distinction between NPT nuclear-weapon states and nuclear-armed states outside the NPT (described in the text as "nuclear capable states") by allowing the former

up to fifteen years to destroy all their nuclear weapons, but requiring the latter to eliminate theirs within five years of the treaty entering into force, not a solution likely to attract much support from those nuclear-armed now outside the NPT process who must become committed to disarmament. .

20.42 **"Framework" Convention.** Another approach, essentially a refinement of that just discussed, would be to negotiate a draft convention which is not itself comprehensive in scope, but in which there is a legally-binding commitment to the elimination of nuclear weapons, and where there is provision for the detail to be subsequently spelt out through regular negotiating meetings at which benchmarks are established and the next steps are negotiated as protocols or adjuncts to the basic "framework". The advantage of this approach is that there is actually a visible framework, such that next steps are not left just to good will and favourable climates: there would be a commitment to negotiate and a mechanism for new elements to be incorporated over time. The disadvantage is that not all states in the framework convention will join all the protocols at the same time, but they are part of the negotiations and thus can slow or water things down.

20.43 At the 2005 NPT Review Conference, a number of states circulated a working paper which called for the commencement of negotiations leading either to the conclusion of a nuclear weapons convention or a framework of instruments for the complete abolition and elimination of nuclear weapons. It provided a negotiating model which combined the positive aspects of both the step-by-step approach favoured by some of the NPT nuclear weapon states and their allies, and the more comprehensive approach favoured by the Non-Aligned Movement. Malaysia called this a "comprehensive-incremental approach", as it included the achievement of disarmament steps within a comprehensive disarmament framework. Pursuant to such an approach the completion of disarmament steps in areas where agreement can be reached within a short to medium timeframe would be facilitated. More difficult issues requiring more complex arrangements would be resolved through continuing negotiations and achieved in subsequent steps.

20.44 Framework conventions have been embraced in other contexts, with mixed success. The Climate Change and Inhumane Weapons Conventions are other examples of negotiated frameworks in which there is a commitment to addressing the problem, regular negotiating meetings are agreed at which benchmarks are progressively established, and the next steps are negotiated as protocols or adjuncts to the basic treaty. The Commission believes that it would be appropriate for this approach to be carefully considered in the context of the further development, which we have indicated we support, of a model Nuclear Weapons Convention.

20.45 **"No Use" Convention.** A much shorter and simpler approach would be to craft a draft treaty which would, in its operative paragraphs, just ban outright the use or threat of nuclear weapons by anyone against anyone. The idea of such a treaty is not new, first arising in 1961 when the UN General Assembly adopted Resolution 1653 declaring the use of nuclear weapons "a crime against mankind and civilization" and being repeated in various forms since, most recently by India's National Security Adviser M.K. Narayanan at the Munich Security Conference in February 2009, noting that his proposal should be seen against the framework of the Action Plan proposed by Indian Prime Minister Rajiv Gandhi in 1988. Another way of advancing the "no use" objective might be to define use or threat of use of nuclear weapons as an indictable crime under the Rome Statute establishing the International Criminal Court.

20.46 One issue which divided the ICJ in its 1996 advisory opinion, is often avoided in discussions of a robust no use treaty, and on which it would be difficult to reach ready agreement in any "campaign treaty" drafting process, is whether nuclear weapons nonetheless could or should be used in self-defence, in response to an actual or perhaps imminent attack (bearing in mind that humanitarian law considerations relating to indiscriminate destruction, the targeting of civilians and aggravated and unnecessary suffering would certainly remain applicable). A more immediately practical consideration, from this Commission's perspective, is while we can see the possible utility of such a draft treaty as a rallying point for global civil society organizations, we do not see it as likely to be taken seriously enough by enough governments to accelerate in any way the actual move toward disarmament we advocate in our own phased action agendas.

20.47 **"No First Use" Convention.** Another approach again would be to craft a draft treaty which sought a binding legal commitment by nuclear-armed states that they would never, under any circumstances, be the first to use nuclear weapons. The objective of having credible such pledges from all relevant states is one this Commission strongly supports, we have supported this as a medium term objective in our discussion of the issue in Section 17, and there may well be a case for seeking to embody this in treaty form. But is not clear that anything much is to be gained in advancing this agenda now, by seeking to make no first use a "campaign treaty" exercise, given the complexity and sensitivity of the issues involved, not least in identifying any kind of workable enforcement mechanism, and the current resistance to making any such commitment by nearly all the nuclear-armed states. Moreover, it is clear from the soundings we have taken that international civil society organizations are not likely to be very enthusiastic about embracing as a major campaign vehicle a treaty which (even if no first use is acknowledged as a useful station on the say to zero) is not itself premised on the elimination of nuclear weapons.

SUSTAINING THE MOMENTUM: AN ONGOING MONITORING MECHANISM

20.48 The lesson of history is that even when momentum is generated around a major international policy issue – as was the case for nuclear disarmament and non-proliferation in the early 1990s – it is very difficult to sustain. As a Commission, we hope that our many recommendations – and in particular the short, medium and longer term action agendas within which we frame them – will have their own logic, and their own trajectory. To maximise exposure and understanding of them, we certainly intend to engage in a substantial program of international advocacy on our report and recommendations during the Commission's remaining life until mid-2010, and may accompany that with a further report assessing the state of play, looking forward, after the May 2010 Review Conference.

20.49 But the question arises whether there is any more formal, or informal, institutional process that could be put in place to help ensure, over a longer time frame, that the key actors keep playing their assigned or necessary roles, and help minimize the risk of issues dropping off the agenda through want of attention and encouragement. Given the centrality of the most of the issues addressed in this report to states' perception of their own and others' vital national security interests, it would be unrealistic to make too many claims for what could be achieved by any independent oversight, benchmark-monitoring and policy-creativity encouraging mechanism, but we are inclined to believe that, on balance, something of this kind would add value to what is at present a very ad hoc and unfocused scrutiny process.

20.50 We are certainly attracted by the idea, as one by-product of such an oversight enterprise, of some kind of regular "report card" in which a distinguished international panel would evaluate the performance of both nuclear-armed and non-nuclear-armed states against the action agendas we have identified. Such a report would be akin to the very useful "Space Security Index" that is produced annually by a non-governmental expert consortium led by the Canadian NGO Project Ploughshares and supported by the Canadian government. It may not be very plausible to contemplate any such robust reporting being carried out, in this highly politically and security-sensitive area, by a formal intergovernmental body, but other options are available: the likely impact of any such report card would depend on the quality and credibility of the panel itself, and that of the research and analysis on which it based its findings, and probably benefit from being seen as wholly independent of government.

20.51 At the institutional level, the model we have in mind would involve the creation of a new organization – or the adaptation of one or more existing ones – to perform functions at essentially two levels. The professional-foundation level would involve full-time researchers recording and

assessing the current state of play on nuclear disarmament, proliferation, security and fuel cycle related activities, in a physical location which could be almost anywhere, but which would need to be thoroughly integrated with the global research community, and preferably be constructed so as to draw directly on the resources of a wide international network of well-established associated research centres. The superstructure level would involve a governing or advisory board, drawn from distinguished and experienced figures worldwide – with backgrounds in government generally, science and industry, defence and arms control, and the humanitarian community – who would be finally responsible for any published evaluations made, reports issued, advocacy campaigns pursued or policy initiatives proposed.

20.52 At the professional-foundation level, there are many existing think tanks and research institutes around the world – including all those supporting this Commission – who have the unquestioned expertise to play the role here envisaged. One possible difficulty, however, is that almost all of them have strong national, rather than global, identities. At the superstructure level, in the nuclear context, there are a number of options that suggest themselves. One would be for this Commission to remain in existence in some such role, but it may be preferable to create a new body, or draw on the resources of some existing one, like the Nuclear Threat Initiative (chaired by Ted Turner and Sam Nunn, and very much U.S.-based, but worldwide in its operations and with a Board of Directors drawn equally from very distinguished U.S. and international figures), or the International Luxembourg Forum on Preventing Nuclear Catastrophe (established in 2007 as a largely Russian initiative, not as visibly active or well resourced as NTI, but again with a very distinguished cast of international experts and statespersons as members of its Supervisory Council and larger Advisory Council).

20.53 The institutional solution we are inclined to favour, and suggest for further consideration, is the establishment of a new "Global Centre on Nuclear Non-Proliferation and Disarmament", which could be quite small in terms of the number of professionals directly employed, but would work with researchers and research institutions around the world, and would have a governing board, directing and promoting its work, particularly its annual "report card" findings, drawn in balanced way from knowledgeable and influential figures from around the world. Its role would be essentially to act as a focal point and clearing house for the huge amount of work being done on nuclear non-proliferation and disarmament issues by many different institutions and organizations in many different countries, and to provide research and advocacy support for both like-minded governments on the one hand, and civil society organizations on the other.

20.54 The creation of a new global centre to carry out the combination of research, advocacy, monitoring and advisory roles we suggest will require substantial government or foundation support if it is to be professional

and effective. We hope that our sponsoring governments, and others like-minded, will find it possible to contribute to some ongoing process of the kind we suggest. The costs will not be trivial, but they may appear so when weighed against the incalculable costs to humanity if we do not now once and for all act effectively to eliminate the risks and threats with which the world has so uncomfortably and uncertainly lived since the dawn of the nuclear age.

Recommendations on Mobilizing and Sustaining Political Will

71. Sustained campaigning is needed, through both the traditional and new media and direct advocacy, to better inform policy-makers and those who influence them about nuclear disarmament and non-proliferation issues. Capable non-governmental organizations should be appropriately supported by governments and philanthropic foundations to the extent necessary to enable them to perform this role effectively. [20.7–10]

72. There should be a major renewed emphasis on formal education and training about nuclear disarmament and related issues in schools and universities, focusing on the history of nuclear weapons, the risks and threats involved in their continued deployment and proliferation, and possible ways forward. An associated need is for more specialized courses on nuclear-related issues – from the scientific and technical to the strategic policy and legal – in universities and diplomatic-training and related institutions. [20.11–12]

73. Work should commence now on further refining and developing the concepts in the model Nuclear Weapons Convention now in circulation, making its provisions as workable and realistic as possible, and building support for them, with the object of having a fully-worked through draft available to inform and guide multilateral disarmament negotiations as they gain momentum. Interested governments should support with appropriate resources the further development of the NWC. [20.38–44]

74. To help sustain political will over time, a regular "report card" should be published in which a distinguished international panel, with appropriately professional and broad based research support, would evaluate the performance of both nuclear-armed and non-nuclear-armed states against the action agendas identified in this report. [20.49–50]

75. Consideration should be given to the establishment of a new "Global Centre on Nuclear Non-proliferation and Disarmament" to act as a focal point and clearing house for the work being done on nuclear non-proliferation and disarmament issues by many different institutions and organizations in many different countries, provide research and advocacy support for both like-minded governments on the one hand, and civil society organizations on the other, and to prepare the "report card" described above. [20.53]

76. Such a centre might be constructed to perform functions at two levels:

    (a) a base of full time research and advocacy professionals, drawing directly on the resources of a wide international network of well-established associated research centres; and

    (b) a superstructure, in the form of a governing or advisory board drawn from distinguished global figures of wide-ranging experience, giving their imprimatur as appropriate to the centre's published reports, policy initiatives and campaigns. [20.51–54]

NOTES AND SOURCES

1. WHY THIS REPORT, AND WHY NOW?

Para 1.4: While the 1962 Cuban missile crisis was perhaps the best known nuclear near-miss, there were others, including the Berlin crisis of 1961 and the Yom Kippur War of 1973. On 26 September 1983 – three weeks after the Soviets shot down a Korean passenger jet – a Russian computer malfunction caused it to appear as though the U.S. had launched a nuclear attack on the Soviet Union. Fortunately, the Russian officer in charge did not launch an immediate retaliatory strike. The story was confirmed not only by the officer himself, but a number of other sources. (*Dateline*, NBC, 12 November 2000.) A little later that same year, the Soviets also apparently believed that the U.S. and NATO had begun the countdown for a nuclear attack against the USSR, though again, when the decision was taken to wait, no attack eventuated. (Robert M. Gates, *From the Shadows: The Ultimate Insider's Story of Five Presidents and How They Won the Cold War*, Simon & Schuster, New York, 1996). Other nuclear near-misses and accidents are listed in Scott D. Sagan's *The Limits of Safety*, Princeton University Press, 1993; and in Bruce G. Blair, "The Logic of Accidental Nuclear War", *Bulletin of Science Technology Society*, Brookings Institution, 1996:16. On the threat of cyber terrorism in a nuclear context see Jason Fritz, "Hacking Nuclear Command and Control", *ICNND Research Paper*, May 2009. http://www.icnnd.org See further at 2.39. ***Para 1.14:*** UNSCR 1887 (S/RES/1887 (2009) of 24 September 2009, the product of the unprecedented summit-level meeting of the Council chaired by the U.S. President to consider nuclear non-proliferation and disarmament, demonstrated support at the highest political level for progress on a wide range of current global nuclear issues. All three NPT pillars – nuclear disarmament, non-proliferation and peaceful uses – are addressed but the resolution's provisions on nuclear non-proliferation and security are more detailed, numerous and substantive than those on nuclear disarmament. For the most part the resolution did not break new ground, combining elements of many previous resolutions, but its provisions on NPT withdrawal, including a Security Council commitment to address without delay any State's notice of withdrawal, were strong and significant.

2. THE RISKS FROM EXISTING NUCLEAR ARMED STATES

Para 2.4: The references to 'nuclear winter' are drawn from a commissioned research paper by Steven Starr, "Catastrophic Climatic Consequences of Nuclear Conflict", August 2009. http://www.icnnd.org ***Paras 2.8, 2.10, 2.11, 2.23 and 2.24:*** References to START in these paragraphs are to the START-I treaty. ***Para 2.25:*** Regarding the announcement of a possible cut in the number of UK nuclear submarines, see Gordon

Brown's statement to the UN General Assembly, 23 September 2009, http://www.number10.gov.uk/Page20719 ***Para 2.36:*** The UN Panel of Government Experts on Missiles (UNPGE) presented its most recent report in 2008 and concluded, among other things, that it was important to have continued international efforts to deal with the increasingly complex issue of missiles in the interest of international peace and security and to focus attention on existing and emerging areas of consensus. The Panel also emphasized the important role of the United Nations in providing a more structured and effective mechanism to build such a consensus. ***Para 2.39:*** Perry made these (as yet unpublished) comments at the Helsinki Conference on Nuclear Weapons, 23 October 2009. ***General:*** This Section drew on a paper prepared by Commissioner Alexei Arbatov, "Existing Nuclear-Armed States and Weapons", August 2009. http://www.icnnd.org

Notes to Box 2-2

1 Most estimates agree on a lower figure of approximately 2000 reserve strategic warheads. However, due to discrepancies between the U.S. "operationally deployed" counting method and START-1 counting rules, U.S. strategic force may have up to 3,000 reserve warheads which could be quickly deployed.

2 Based on lower estimate. The type and yield of weapons in the higher estimate is not known.

3 Most of the sources used in this table agree on a figure of around 2800. However, both the Carnegie Endowment (3113) and CDI (3300 – 3400) give higher estimates.

4 Rough approximation due to lack of transparency on this category of weapon. The same applies to the figure given for Russian non-strategic weapons. It is also not clear how many are reserve weapons, and how many are scheduled to be dismantled. All observers agree that there are "many thousands" in storage, but the numbers vary. The figures given are derived from the FAS and IISS statistics, which are credible.

5 China releases no official figures on its nuclear forces. The above figures are thus approximations made from available sources. The FAS gives a figure of approx. 180 strategic warheads, but notes that some of these may not be fully operational. It also suggests that there may be some additional warheads in storage, for a total stockpile of approximately 240 warheads. SIPRI agrees with this total but gives a specific figure of 186 deployed warheads, the remainder (54) being in storage.

6 China strongly denies having tactical nuclear weapons, though this is queried by a number of observers who suggest there may be between 150 and 350 of them.

7 President Nicolas Sarkozy announced on 22 March 2008 that France would reduce the total number of nuclear warheads in its arsenal to under 300 in 2009, and that it would do so by removing a third of the weapons mounted on aircraft: http://www.iht.com/articles/ap/2008/03/21/europe/EU-GEN-France-Nuclear.php Although by START-1 classification French aircraft would be counted as tactical or medium-range delivery vehicles, they are considered an arm of the French strategic strike force. Approximately 60 nuclear-armed air-to-surface missiles fall into this category, and are included in the Strategic list.

8 According to the FAS, France is thought to have a small inventory of spare warheads but no reserve of the sort that the United States and Russia have.

9 All sources used in this table agree the UK has "fewer than 160" nuclear warheads which are said to be "operationally available". Forty-eight missiles are needed to arm three SSBNs with a maximum of 144 warheads. One submarine with "up to 48 warheads" is on patrol at any given time. In addition to the operationally available warheads, Britain probably has a small reserve.

10 Some warheads on British strategic submarines have sub-strategic missions previously covered by tactical nuclear weapons.

11 Israel maintains a policy of opacity as to whether it possesses nuclear weapons or not.

12 The arsenals of India, Pakistan and Israel are thought to be only partly deployed.

13 India and Pakistan release no official figures on their nuclear forces. The above figures are based on estimates derived from public statements by officials, media reports, projections made from analysis of known or suspected fissile material production and reserves, and data recorded at the time of the 1998 nuclear tests made by both countries. Indian atomic scientists were reported in September 2009 as saying that India had built weapons with yields of up to 200 kt.

14 North Korea conducted nuclear test explosions in October 2006 and May 2009. It is not publicly known if it has built operational nuclear weapons. The above figures are based on estimates of weapons-grade plutonium it may have produced and analysis of data recorded at the time of its nuclear tests. Some estimates suggest that plutonium reserves would be sufficient for twelve such weapons. North Korea has probably – although there are differing expert views on this – not yet been able to miniaturize any devices it may have produced sufficiently to allow their delivery by ballistic missile or aircraft.

3. THE RISKS FROM NEW NUCLEAR-ARMED STATES

Para 3.6*:* The quotation is from *A More Secure World: Our Shared Responsibility – Report of the Secretary-General's High-level Panel on Threats, Challenges and Change,* 2004, para 110. http://www.un.org/secureworld ***Para 3.10*****:** "Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions 1737 (2006), 1747 (2007), 1803 (2008) and 1835 (2008) in the Islamic Republic of Iran", Report by the Director General to the IAEA Board of Governors, GOV/2009/35, 5 June 2009, http://isis-online.org/publications/iran/IAEA_Iran_Report_5June2009.pdf ***Para 3.11***: Considerable detail on the Khan case can be found in "A.Q. Khan and Onward Proliferation from Pakistan", from *Nuclear Black Markets: Pakistan, A.Q. Khan and the Rise of Proliferation Networks*, IISS 2007, Chapter 3. This also includes factors leading to the conclusion in the last sentence. ***Para 3.12:*** The Report mentioned is *Reinforcing the Global Nuclear Order for Peace and Prosperity: The Role of the IAEA to 2020 and Beyond,* Report of the Commission of Eminent Persons chaired by Dr Ernesto Zedillo to the IAEA Director General, June 2008. http://www.iaea.org/NewsCenter/News/PDF/2020report0508.pdf ***Paras 3.14–22*** The paragraphs on surge risk draw on presentations by Dr Brad Roberts and Alexis Blanc, "Challenges to Military Operations in Support of U.S. Interests: Report of the Panel on Nuclear Proliferation", U.S. Defense Science Board 2007 Summer Study www.stimson.org/nuke/ppts/Roberts_Briefing_1-09.ppt and the Stanford study edited by William C. Potter and Gaukhar Mukhatzhanova "In Search of Proliferation Trends and Tendencies" (in William C. Potter, Editor (with the assistance of Gaukhar Mukhatzhanova), *Forecasting Nuclear Proliferation in the 21st Century: A Comparative Perspective* (Stanford University Press, forthcoming 2010). ***Para 3.14****:* The High-level Panel Report (*supra*) quotation is from para 111. The U.S. Congressional Commission on U.S. Strategic Posture warning about a nuclear "tipping point" is made is several places – pp. 11, 16, 20, 30 and 143, http://www.usip.org/files/America%27s_Strategic_Posture_Auth_Ed.pdf The ElBaradei comment was made during a media interview in May 2009. "IAEA chief sees nuclear states doubling: report", *Al Arabiya*, 15 May 2009.http://www.alarabiya.net/articles/2009/05 /15/zz72894.html ***Para 3.21:*** *Challenges to Military Operations in Support of U.S. Interests: Report of the U.S. Defense Science Board 2007 Summer Study,* Volume II, Main Report, Washington DC December 2008, at p. 122 (Figure 3.3).

4. THE THREAT OF NUCLEAR TERRORISM

Para 4.10: The reference to 'phantom' states is drawn from an International Crisis Group paper "Central African Republic: Anatomy of a Phantom State", Africa Report N° 136, 13 December 2007, http://www.crisisgroup.org/home/index.cfm?l=1&id=5259 ***Para 4.12:*** This paragraph drew on a paper prepared by Commissioner Alexei Arbatov, "Existing Nuclear-Armed States and Weapons**",** August 2009. http://www.icnnd.org The source of the first estimate list in the paragraph was C.D. Ferguson and W.C. Potter, "Improvised Nuclear Devices and

Nuclear Terrorism", Weapons of Mass Destruction Commission Research Paper No 2 (Stockholm, 2004,) p. 35. The source of the second estimate was *Weapons of Terror: Freeing the World of Nuclear, Chemical and Biological Weapons: Report of the Weapons of Mass Destruction Commission*, Stockholm *2006,* p. 70, www.wmdcommission.org ***Paras 4.16–19****:* Drawn from an input paper prepared by Stephen McIntosh, Australian Nuclear Science and Technology Organisation. ***Para 4.18:*** On the Argentina case see "Patagonia Crime Scene Plays role in Nuclear-Security Bid", *The Wall Street Journal,* 9 October 2009, http://online.wsj.com/article/SB125504219290974603.html ***Para 4.19:*** UNGA Resolution A/RES/63/67. ***Paras 4.20 ff:*** On the potential threat of cyber terrorism see Jason Fritz, "Hacking Nuclear Command and Control", ICNND Research Paper, May 2009. http://www.icnnd.org ***Para 4.24****:* The works referred to in this paragraph are Graham T Allison, Owen R. Coté Jr., Richard A Falkenrath, and Steven E Miller, *Avoiding Nuclear Anarchy: Containing the Threat of Loose Russian Nuclear Weapons and Fissile Material*. Cambridge, MA, MIT Press, 1996; Graham T. Allison, *Nuclear Terrorism: The Ultimate Preventable Catastrophe,* Times Books, New York, 2004; Siegfried Hecker, "Toward a Comprehensive Safeguards System: Keeping Fissile Materials out of Terrorists' Hands". *Annals of the American Academy of Political and Social Science*, Vol. 607, September 2006, page(s) 121–132. ***Para 4.25***: The works referred to in this paragraph are John Mueller, "The Atomic Terrorist: Assessing the Likelihood", Paper prepared for presentation at the Program on International Security Policy, University of Chicago, 15 January 2008; and Cass R. Sunstein, "The Case for Fear", *New Republic* 11 December 2006: 29–33 at p.32. ***Para 4.26****:* The work referred to in this paragraph is Michael Levi, *On Nuclear Terrorism*, Harvard University Press, 2007 at p.7.

5. THE RISKS ASSOCIATED WITH PEACEFUL USES OF NUCLEAR ENERGY

Para 5.2–3*:* World Nuclear Association, *WNA Nuclear Century Outlook*. ***Para 5.3****:* World Nuclear Association, *World Power Reactors 2008–09 and Uranium Requirements*, 1 October 2009. ***Para 5.4****:* The figures given for the likely expansion of nuclear power were drawn from Nuclear Energy Agency, *Nuclear Energy Outlook 2008*, p 60. ***Para 5.6:*** The references particularly to the issue of qualified personnel were drawn from Mycle Schneider and Antony Froggatt, *World Nuclear Industry Status Report 2007*, Paris, London, Brussels, Greens-EFA Group in the European Parliament, 2008, p 13; Sharon Squassoni, "Nuclear renaissance: is it coming? Should it?", *Policy Brief*, Carnegie Endowment for International Peace, 2008, pp 2–3; Sharon Squassoni, Charles D. Ferguson, and Alan Hanson, *Nuclear Energy, Non-Proliferation and Arms Control in the Next Administration: Is Nuclear Energy the Answer?* Washington DC, 29 October 2008; *Nuclear Energy Agency, Nuclear Energy Outlook 2008,* pp 322–324. ***Para 5.10****: The reference to 'influential policy circles' in the U.S. is* drawn from International Security Advisory Board, *Report on proliferation implications of the global expansion of civilian nuclear power,* United States Department of State, 7 April 2008: http://2001-2009.state.gov/documents/organization/105587.pdf. ***Para 5.11***: Some

argue that LWR fuel may still be useful for producing fissile material if the state in control of the reactor is 'bent on making bombs': see Victor Gilinksy, "A fresh examination of the proliferation dangers of light water reactors", in *Taming the Next Set of Strategic Weapons Threats*, Ed. Henry Sokolski. Carlisle, PA, Army War College Strategic Studies Institute, 2006. ***Para 5.12****:* Andrew Symon, "Nuclear power in Southeast Asia: implications for Australia and non-proliferation", *Lowy Institute Analysis*, Sydney, Lowy Institute for International Policy, 2008; David Albright and Andrea Scheel, "Unprecedented projected nuclear growth in the Middle East: now is the time to create effective barriers to proliferation", ISIS Report. Washington DC, 2008; Peter Crail and Jessica Lasky-Fink, "Middle East states seeking nuclear power", *Arms Control Today*, Arms Control Association, 11 June 2008: http://www.armscontrol.org/act/2008_05/MiddleEastEnergy ; Jay Solomon, "U.S. and U.A.E. to sign nuclear-cooperation pact", *The Wall Street Journal*, 13 December 2008. http://online.wsj.com/article/SB122904102094400097.html

6. DISARMAMENT: MAKING ZERO THINKABLE

Para 6.1: *The Advisory Opinion of the International Court of Justice on the Legality of the Threat or Use of Nuclear Weapons* can be found at http://www.lcnp.org/wcourt/opinion.htm It is discussed further in Section 20 ***Para 6.3****:* The Dulles quote is from Nina Tannenwald, *The Nuclear Taboo*, Cambridge University Press, 2007, p. 173. ***Para 6.10***: George Perkovich, "Nuclear Zero: Key Issues to be Addressed", *Security Index Journal*, Vol. 15, No. 3-4 (88–89), Summer/Fall 2009. ***Para 6.16***: Bernard F.W. Loo, "The Terrible Allure of Nuclear Weapons", *RSIS Commentaries* 87/2009, S. Rajaratnam School of International Studies, NTU, Singapore, 1 September 2009. ***Para 6.18:*** It has been argued on the basis of comments made by former Foreign Minister Tariq Aziz after the 1991 Gulf war that Iraq did not use its chemical weapons because it feared nuclear retaliation, whether from the U.S. or Israel. But there is little evidence to justify this claim, and many reasons to doubt it. Neither the U.S. nor Israel made explicit nuclear threats. The U.S. did warn against chemical use but the threatened response was largely about toppling the regime. And the Iraqis may not have used their chemical weapons for any one of a number of other reasons: their knowledge that Scud missiles lacked accuracy, the unavailability of artillery when and where needed, the knowledge that coalition forces were well protected against chemical attack, and the fear of individual force commanders that they would be tried for war crimes. ***Para 6.26*:** Dr Henry Kissinger, Speech at the 45th Munich Security Conference (untitled), 6 February 2009, http://www.securityconference.de/konferenzen/rede.php?menu_2009=&sprache=en&id=224&

7. DISARMAMENT: A TWO-PHASE STRATEGY FOR GETTING TO ZERO

Para 7.2: The Commission settled on "minimization point" as the best terminology for describing where we want to be by 2025. "Base camp" (as used by Sam Nunn, for

example, in remarks made during his presentation of the first "Robert S. McNamara Lecture on War and Peace", Harvard, 17 October 2008, http://news.harvard.edu/gazette/story/2008/10/nunn-wants-to-eliminate-nukes/ has its metaphorical attractions but implies still a long way to go rather than "one last push": in the real world of mountain climbing, on Mt Everest for example, that still leaves on the south side Camps I–IV before the summit, and on the north side Camps I–VII. 'Vantage point' (as used by George Shultz, William Perry, Henry Kissinger and Sam Nunn in their 15 January 2008 *Wall Street Journal* article "Toward a Nuclear-Free World", similarly implies distance from the goal, when we wanted to imply real proximity. 'Assembly station'/'assembly point' language, as in the D-Day landings jumping-off points on the English south coast, may be carrying the 'final assault' metaphor a bit far. And 'basement' conveys overtones for some that, if not trivial, may be more sinister than peaceful, as in 'keeping a bomb in the basement'. ***Para 7.4:*** The average negotiating time of 3.5 years was derived from averaging out the time taken to negotiate the main bilateral and multilateral nuclear-related treaties from the 1980s onward: SALT I and II (3 and 7 years); START I and II (9 and 1); the Anti-Ballistic Missile Treaty (3); the Intermediate Nuclear Forces Agreement (2); the Strategic Offensive Reductions Treaty (6 months); and the CTBT (3). In addition, a number of significant non-nuclear weapons treaties took an average of 3.3 years: the Chemical Weapons Convention (8); the Biological Weapons Convention (3); the Ottawa Landmines Convention (1); and the Oslo Cluster Munitions Convention (1.25). The overall average for these 12 treaties was 3.48 years. ***General:*** This section drew on George Perkovich, "Extended Deterrence on the Way to a Nuclear Free World", May 2009; and Alexei Arbatov, "Existing Nuclear-Armed States and Weapons", August 2009. These papers are available on http://www.icnnd.org

8. NON-PROLIFERATION: CONSTRAINING DEMAND AND SUPPLY

Para 8.4: There are 192 nations which are members of the United Nations, and a further two entities generally accepted as independent states (Kosovo and the Vatican) which are not UN members.

9. STRENGTHENING THE NUCLEAR NON-PROLIFERATION TREATY

Para 9.6: The figures given for the Additional Protocol were correct as of mid October 2009. The regularly updated list of Parties can be found at http://www.iaea.org/OurWork/SV/Safeguards/sg_protocol.htm ***Para 9.8***: The question of the IAEA's powers was the subject of the report *Reinforcing the Global Nuclear Order for Peace and Prosperity: The Role of the IAEA to 2020 and Beyond*, presented by the Commission of Eminent Persons chaired by Dr Ernesto Zedillo to the IAEA Director General in June 2008, http://www.iaea.org/NewsCenter/News/PDF/2020report0508.pdf

On compliance enforcement see James M. Acton, "Deterring Safeguards Violations", *Carnegie Policy Outlook*, 2009. See also Pierre Goldschmidt, "Exposing Nuclear Non-compliance", *Survival*, 51:1,143 – 164, 1 February 2009, and John Carlson, "NPT Safeguards Agreements – Defining Non-Compliance", *Arms Control Today*, May 2009. ***Para 9.15****:* The reference to the IAEA setting the bar higher than its own standard safeguards agreements is to INFCIRC/153 para 19 which provides that a state may be found in non-compliance if the Agency is not able to verify that there has been no diversion***. Para 9.22:*** The relevant provision of the IAEA/Albania safeguards agreement INFCIRC/359 is Article 25(b)(i). The agreement was originally entered into in 1986, but reconfirmed in 2002. ***Para 9.23****:* The condition relating to continuation of safeguards on nuclear materials and equipment if a state terminates its safeguards agreements is contained in OP 20 of UNSCR 1887 (S/Res/1887 (2009)) which urges states to include this as a condition for any nuclear export contracts. ***Paras 9.24–28****:* References to strengthening the IAEA are drawn from the Zedillo Report *supra*.

10. STRENGTHENING NON-PROLIFERATION DISCIPLINES OUTSIDE THE NPT

Para 10.10: The question of general vs. specific operation support is discussed in Mark J.Valencia, "The Proliferation Security Initiative: A Glass Half Full", *Arms Control Today*, June 2007, http://www.armscontrol.org/act/2007_06/Valencia

11 BANNING NUCLEAR TESTING

Para 11.2*:* These figures were given in "New impetus for test-ban treaty", *IISS Strategic Comments*, Vol 15, Issue 6, August 2009. This paper provides an excellent summary of the issues on which this section has drawn substantially. ***Para 11.7***: The Indian comment was made by Shyam Saran, the Indian Prime Minister's Special Envoy for Nuclear Issues and Climate Change, in Washington on 23 March 2009: "India links CTBT signing to nuclear disarmament", *The Times of India*, 24 March 2009. ***Para 11.9****:* Details of the verification regime of the CTBT can be found on the website of the CTBT Organization http://www.ctbto.org Information in the last sentence is derived from U.S. National Academy of Sciences, *Technical Issues Related to the Comprehensive Nuclear Test Ban Treaty*, The National Academies Press, Washington DC, 2002. ***Para 11.11****:* The final sentence relating to very small nuclear explosions is drawn from Malcolm Coxhead, David Jepsen and Adam Yeabsley, "Putting the CTBT into practice", CTBT Organization International Scientific Studies Conference, June 2009, http://www.ctbto.org/fileadmin/user_upload/ISS_2009/ISS09_Book_of_Abstracts.pdf at p. 140. ***Para 11.16****: America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States*, Washington DC, 6 May 2009, at p.42, http://www.usip.org/files/America%27s_Strategic_Posture_Auth_Ed.pdf ***Para 11.17:*** See Bernard

Sitt and Camille Grand, "Nuclear Stockpile Management: A Technical and Political Assessment", ICNND Research Paper, http://www.icnnd/org

12. LIMITING THE AVAILABILITY OF FISSILE MATERIAL

Para 12.19*:* The proposal was made by Robert J. Einhorn in his speech, "Controlling Fissile Materials and Ending Nuclear Testing, Achieving the Vision of a World Free of Nuclear Weapons", made to the International Conference on Nuclear Disarmament, Oslo, 26–27 February 2008, http://www.ctbto.org/fileadmin/user_upload/pdf/External_Reports/paper-einhorn.pdf ***General:*** This Section drew on "Fissile Material Cut-Off Treaty: A Discussion", by John Carlson, Director General of the Australian Safeguards and Non-Proliferation Office and member of the ICNND Advisory Board, 6 July 2009, www.icnnd.org

13. SUSTAINING AN EFFECTIVE COUNTER-TERRORISM STRATEGY

Para 13.1: For further details on the "5 Ps", see Gareth Evans, "The Global Response to Terrorism", Wallace Wurth Lecture, University of New South Wales, Sydney, 27 September 2005, http://gevans.org/speeches/speech122.html ***Para 13.2:*** On the Indonesian example, see for example International Crisis Group reports "Indonesia: Tackling Radicalism in Poso", *Asia Briefing* N° 75, 22 January 2008 http://www.crisisgroup.org/home/index.cfm?id=5266&l=1; and "'Deradicalisation' and Indonesian Prisons", *Asia Briefing* No 142, 19 November 2007, http://www.crisisgroup.org/home/index.cfm?id=5170&l= ***Para 13.3:*** The objectives of the Global Initiative are contained in a White House Press Release, 15 July 2006. http://www.whitehouse.gov/news/releases/2006/07/20060715-2.htm Its statement of Principles can be found at http://www.state.gov/t/isn/rls/fs/75845.htm ***Para 13.5:*** The term 'loose nukes' was popularised by Graham Allison – see Graham T. Allison, Testimony to the (U.S.) Senate Committee on Governmental Affairs, Permanent Subcommittee on Investigations, 13 March 1996, http://www.globalsecurity.org/wmd/library/congress/1996_h/s960313ksg.htm ***Para 13.8***: For details of ITDB see http://www.iaea.org/NewsCenter/News/2008/itdb.html ***Para 13.10****:* See Senator Richard G. Lugar, "Revving Up The Cooperative Nonproliferation Engine", *The Nonproliferation Review,* July 2008, Volume 15, No. 2, http://cns.miis.edu/pubs/npr/vol15/152_viewpoint_lugar.pdf; and two papers by Michael Krepon, "Prisms and Paradigms", *The Nonproliferation Review*, March 2002, Volume 9, No. 1, http://cns.miis.edu/npr/pdfs/91krep.pdf; and "The Mushroom Cloud that Wasn't", *Foreign Affairs*, May–June 2009, http://www.foreignaffairs.com/articles/64995/michael-krepon/the-mushroom-cloud-that-wasnt ***Para 13.11****:* For European programs see Ian Anthony, *Reducing Threats at the Source: A European Perspective on Cooperative Threat Reduction*, SIPRI Research Report No. 19, Oxford University Press, 2004, http://

books.sipri.org/files/RR/SIPRIRR19.pdf See also Stephen Pullinger and Gerrard Quille, "The European Union: Seeking Common Ground for Tackling Weapons of Mass Destruction", *Disarmament Diplomacy*, No. 74, December 2003, http://www.acronym.org.uk/dd/dd74/74europe.htm

14. RESPONSIBLE NUCLEAR ENERGY MANAGEMENT

Para 14.4: Ambassador Tetsuya Endo, "Countries Planning to Introduce Nuclear Power Generation and the 3 Ss", ICNND Research Paper www.icnnd.org ***Para 14.16:*** Prior to the India deal in 2008, Russia had been building two light water reactors in India since 2002, but based on a grandfathered agreement that preceded Russia's membership of the NSG. Similarly, China sold reactors to Pakistan in 2000 before joining the NSG in 2004, and in 2005 based on a grandfathered contract. Israel has not developed a civilian nuclear energy sector. ***Para 14.18***: On the WNA Charter of Ethics, see World Nuclear Association, "WNA Charter of Ethics", 2008. http://www.world-nuclear.org/uploadedFiles/org/about/pdf/ WNA%20Charter%20of%20Ethics.pdf ***General:*** This Section drew on a commissioned research paper prepared by John Carlson, "Introduction to the Concept of Proliferation Resistance", 3 June 2009, www.icnnd.org

15. MULTILATERALIZING THE FUEL-CYCLE

Para 15.4: *Multilateral Approaches to the Nuclear Fuel Cycle: Expert Group Report submitted to the Director General of the International Atomic Energy Agency,* INFCIRC/640, 22 February 2005, http://www.iaea.org/Publications/Documents/Infcircs/2005/infcirc640.pdf ***Para 15.8:*** Most recent evaluations of all fuel cycle proposals have counted twelve proposals: see Tariq Rauf and Zoroyana Vovchok, "Fuel for Thought", *IAEA Bulletin* 49:2, March 2008.This report does not include the EU Non-Paper, which provides criteria for evaluating the proposals rather than a distinct multilateralization proposal. ***Para 15.10***: World Nuclear Association, "Ensuring Security of Supply in the International Nuclear Fuel Cycle", May 2006, http://www.world-nuclear.org/reference/pdf/security.pdf ***Para 15.12****:* IAEA, "Concept for a Multilateral Mechanism for Reliable Access to Nuclear Fuel", Proposal to the IAEA from France, Germany, the Netherlands, Russia, Ireland, and the United States, 31 May 2006, IAEA GOV/INF/2006/10, http://www-pub.iaea.org/MTCD/Meetings/PDFplus /2006/cn147_ConceptRA_NF.pdf ***Para 15.14***: IAEA, "Communication Received from Japan Concerning Its Policies Regarding the Management of Plutonium", INFCIRC/549/ Add.1/9 Date: 14 November 2006, http://www.iaea.org/Publications/Documents/Infcircs/2006/infcirc549a1-9.pdf ***Para 15.16:*** IAEA, "Communication Dated 30 May 2007 From the Permanent Mission of the United Kingdom of Great Britain and Northern Ireland to the IAEA Concerning Enrichment Bonds", INFCIRC/707, 30 May 2007, http://www.iaea.org/Publications/Documents/Infcircs/2007/infcirc707.pdf ***Para 15.20****:* IAEA, "Communication dated 28 September 2005 from the Permanent Mission of the

United States of America to the Agency", INFCIRC/659 28 September 2005, http://www.iaea.org/ Publications/ Documents/Infcircs/2005/infcirc659.pdf ***Para 15.21:*** Nuclear Threat Initiative Commits $50 Million to Create IAEA Nuclear Fuel Bank", IAEA/NTI Press Release, Vienna, 19 September 2006, http://nti.org/c_press/release_IAEA_fuelbank_091906.pdf ***Para 15.31:*** "Statement by Ambassador Valery Loshchinin, Permanent Representative of the Russian Federation at the Plenary Meeting of the Conference on Disarmament", Geneva, 31 January 2006, http://www.geneva.mid.ru/speeches/37.html ***Para 15.32****:* IAEA, "Communication received from the Resident Representative of the Russian Federation to the IAEA on the Establishment, Structure and Operation of the International Uranium Enrichment Centre", INFCIRC/708, 8 June 2007. http://www.iaea.org/Publications/Documents/Infcircs/2007/infcirc708.pdf See also Anya Loukianova, "The International Uranium Enrichment Center at Angarsk: A Step Towards Assured Fuel Supply?" *NTI Issue Brief*, October 2007, updated November 2008. http://www.nti.org/e_research/e3_93.html ***Para 15.34****:* GNEP was announced by U.S. President George W. Bush on "The President's Radio Address", 18 February 2006, http://www.presidency.ucsb.edu/ws/index.php?pid=65275 See further U.S. Department of Energy, *Global Nuclear Energy Partnership: Industry involvement,* 2008, http://www.gnep.energy.gov/afciparticipants/industryinvolvement.html ***Para 15.36***: IAEA, "Communication received from the Resident Representative of Germany to the IAEA with regard to the German proposal on the Multilateralization of the Nuclear Fuel Cycle", INFCIRC/704, 4 May 2007, http://www.iaea.org/Publications/Documents/Infcircs/2007/infcirc704.pdf ***Para 15.38****:* IAEA, "Communication dated 26 May 2009 received from the Permanent Mission of Austria to the Agency enclosing a working paper regarding Multilateralization of the Nuclear Fuel Cycle", INFCIRC/755, 2 June 2009, http://www.iaea.org/Publications/Documents/Infcircs/2009/infcirc755.pdf ***General:*** This Section drew on an input paper, "Fuel Cycle Management", prepared by Martine Letts, Deputy Director of the Lowy Institute, Sydney, and an ICNND Research Consultant.

16. A PACKAGE FOR THE 2010 NPT REVIEW CONFERENCE

Para 16.3*:* The original 13 steps can be found in para 15 of the Final Document of the 2000 NPT Review Conference, http://www.un.org/disarmament/WMD/Nuclear/2000-NPT/pdf/FD-Part1and2.pdf ***Para 16.6:*** The New Agenda Coalition consists of Brazil, Egypt, Ireland, Mexico, New Zealand, South Africa, and Sweden. Regarding the current relevance of the 13 steps, see Sharon Squassoni, "Grading Progress on 13 Steps Toward Disarmament", *Policy Outlook*, Carnegie Endowment for International Peace, May 2009, http://www.carnegieendowment.org/files/13_steps.pdf See also the UN Secretary-General's speech to the EastWest Institute conference "The United Nations and Security in a Nuclear-Weapon-Free World", delivered in New York, 24 October 2008, http://www.un.org/apps/

news/infocus/sgspeeches/search_full.asp?statID=351 ; and Hirafumi Nakasone, "Conditions towards Zero – 11 Benchmarks for Global Nuclear Disarmament", Tokyo, 27 April 2009, http://www.mofa.go.jp/POLICY/un/disarmament/arms/state0904.html ***Para 16.7***: Regarding the reference to no one arguing for reaffirmation of the 13 steps without change, see Rebecca Johnson, "Enhanced Prospects for 2010: An Analysis of the Third PrepCom and the Outlook for the 2010 NPT Review Conference", *Arms Control Today*, Arms Control Association, June 09, http://www.armscontrol.org/act/2009_6/Johnson ***Para 16.16:*** Existing nuclear weapon free zones were created by the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (Treaty of Tlatelolco 1967); the South Pacific Nuclear-Free Zone treaty (Treaty of Rarotonga 1985); Southeast Asian Nuclear-Weapon-Free-Zone treaty (Treaty of Bangkok 1995); African Nuclear-Weapon-Free-Zone treaty (Treaty of Pelindaba 1996); and the Central Asian Nuclear-Weapon-Free-Zone (Treaty of Semipalatinsk 2006). As mentioned in the paragraph, the 1959 Antarctic Treaty in effect establishes that continent as a NWFZ, banning nuclear explosions and the disposal of radioactive waste (Art. 5). In addition, Mongolia in 1992 unilaterally declared itself to be a NWFZ. ***Para 16.19****:* Discussion of a Middle East NWFZ drew on commissioned papers by two Members of the ICNND Advisory Board – Dr Shlomo Ben Ami, "Nuclear Weapons in the Middle East: the Israeli Perspective", and Ambassador Nabil Fahmy, "The Middle East Nuclear Paradigm and Prospects", www.icnnd.org

17. SHORT TERM ACTION AGENDA: TO 2012 – ACHIEVING INITIAL BENCHMARKS

Para 17.2: The suggestion of a UN General Assembly Special Session on Disarmament was drawn from an ICNND commissioned research paper by Professor John Langmore, "The possibility and potential value of holding a Fourth Special Session of the UN General Assembly on Disarmament", http://www.icnnd.org ***Para 17.8*****:** The 80 per cent figure is given in a press report "New RF–U.S. agreement to replace START to be concluded before year end – FM", Itar–TASS, Moscow, 3 September 2009, http:// www.itar-tass.com/txt/eng/level2.html; and also in the START I entry in Wikipedia. http://en.wikipedia.org/wiki/START_I ***Para 17.9:*** The figures given are drawn from the more detailed figures in Box 2-2. ***Para 17.21:*** See "Decision for the establishment of a Programme of Work for the 2009 session", Conference on Disarmament, CD/1864, 29 May 2009 ***Para 17.36:*** The proposal for a UN Security Council Resolution was made in a commissioned paper prepared by Fahmy, Ambassador Nabil, "The Middle East Nuclear Paradigm and Prospects", August 2009, http://www.icnnd.org ***Paras 17.51–61:*** These paragraphs were drawn from a number of reports by the International Crisis Group contained in "North Korea's nuclear impasse", http://www.crisisgroup.org/home/index.cfm?id=4985 and "Iran's nuclear impasse" http://www.crisisgroup.org/home/index.cfm?id=4984 See also IAEA, "Application of Safeguards in the Democratic People's Republic of Korea (DPRK)", Report by the IAEA Director General,

GOV/2009/45-GC(53)/13, 30 July 2009, http://www.iaea.org/About/Policy/GC/GC53/GC53Documents/English/gc53-13_en.pdf; and IAEA, "Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions 1737 (2006), 1747 (2007), 1803 (2008), and 1835 (2008) in the Islamic Republic of Iran", Report by the IAEA Director General, GOV/2009/55, 28 August 2009, http://www.iaea.org/Publications/Documents/Board/2009/gov2009-55.pdf ***General:*** This Section draws on input papers prepared by ICNND Commissioners Alexei Arbatov, "Existing Nuclear-Armed States and Weapons", and François Heisbourg, "The Medium Term Action Agenda to 2025: Reaching the Nuclear Risk Minimization Point", http://www.icnnd.org

18. MEDIUM TERM ACTION AGENDA: TO 2025 – GETTING TO THE MINIMIZATION POINT

Para 18.26: The CTR figure is from the Nunn-Lugar scorecard found at http://lugar.senate.gov/nunnlugar/ The figure for dismantlement of Marcoule and Pierrelatte is contained in a French working paper submitted to the 2009 NPT PrepCom "Nuclear Disarmament: France's Practical Commitment", NPT/CONF.2010/PC.III/WP.36, 13May 2009 http://daccessdds.un.org/doc/UNDOC/GEN/N09/336/62/PDF/N0933662.pdf?OpenElement. The actual and projected U.S. costs for dismantlement and verification under these two treaties can be found in "Economic Aspects of Conversion", http://www.nuclearfiles.org/menu/key-issues/ethics/issues/military/economic-aspects-conversion.htm A similar figure is given in Stephen I. Schwartz, "Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940", April 2008, http://www.ipb.org/AtomicAudit%20Schwartz%20presentation.pdf. ***General:*** This Section draws on input papers prepared by ICNND Commissioners Alexei Arbatov, "Existing Nuclear-Armed States and Weapons", and François Heisbourg, "The Medium Term Action Agenda to 2025: Reaching the Nuclear Risk Minimization Point", http://www.icnnd.org. See also George Perkovich, "Nuclear Zero: Key Issues To Be Addressed", Carnegie Endowment for International Peace *Security Index Journal*, Vol. 15, No. 3-4 (88-89), Summer/Fall 2009, http://www.carnegieendowment.org/publications/index.cfm?fa=view&id=23719. On chemical weapons, see the Report of the Weapons of Mass Destruction Commission, *Weapons of Terror; Freeing the World of Weapons of Mass Destruction* (the Blix Commission), Stockholm, 2006, http://www.wmdcommission.org

19. LONGER TERM ACTION AGENDA: BEYOND 2025 – GETTING TO ZERO

Para 19.3*:* The reference to public goods is drawn from the *Report of the International Task Force on Global Public Goods* 2006, chaired by Ernesto Zedillo, http://www.gpgtaskforce.org/bazment.aspx?page_id=268#bazAnchor ***Para 19.7***: The references

in this para were drawn from Professor Andrew Mack, *Global Security Report,* Human Security Centre, University of British Columbia, 17 October 2005, http://www.humansecurityreport.info/ index.php?option=content&task=view&id=28&Itemid=63; and from the summaries of the Mack group's important findings given in various speeches given by Gareth Evans when President of the International Crisis Group (see, e.g., http://www.gevans.org/ speeches/speech310.html) and in his recent book, *The Responsibility to Protect: Ending Mass Atrocity Crimes Once and For All,* Brookings Institution Press, Washington DC, 2008, at pp.233-5. ***Para 19.11****:* The dead-end reference is drawn from George Perkovich and James M. Acton, *Abolishing Nuclear Weapons: A Debate,* cited immediately below, p.291. ***General:*** This Section draws on two papers by Perkovich and Acton, "Abolishing Nuclear Weapons", IISS *Adelphi Paper 396*, 2008, http://www.iiss.org/publications/adelphi-papers/adelphi-papers-2008/abolishing-nuclear-weapons/; and, as editors, *Abolishing Nuclear Weapons: A Debate,* Carnegie Endowment Report, February 2009, http://www.carnegieendowment.org/publications/index.cfm?fa=view&id=22748

20. MOBILIZING AND SUSTAINING POLITICAL WILL

Para 20.3: This draws on Chapter 10 "Mobilizing Political Will" in Gareth Evans, *The Responsibility to Protect: Ending Mass Atrocity Crimes Once and For All,* Brookings Institution Press, Washington DC, 2008. ***Para 20.4:*** George Shultz, William Perry, Henry Kissinger and Sam Nunn, "A World Free of Nuclear Weapons", *The Wall Street Journal*, 4 January 2007; and "Toward a Nuclear-Free World", *The Wall Street Journal***,** 15 January 2008. See also "Start Worrying and Learn to Ditch the Bomb. It Won't Be Easy, but a World Free of Nuclear Weapons is Possible" by former UK Secretaries of State for Foreign and Commonwealth Affairs and for Defence, Douglas Hurd, Malcolm Rifkind, David Owen and George Robertson (who was also NATO Secretary-General), *The Times***,** 30 June 2008; "A World Free of Nuclear Weapons" by Italian statesmen former Prime Minister Italy Massimo D'Alema, Speaker of the Italian Chamber of Deputies Gianfranco Fini, former Minister of European Affairs Giorgio La Malfa, former Minister of Defence Arturo Parisi, and Secretary-General of the Pugwash Conference Professor Francesco Calogero, *Corriere Della Sera*, 24 July 2008; "Toward a Nuclear-Free World: a German View" by German statesmen former Chancellor Helmut Schmidt, former President Richard von Weizsäcker, former Federal Minister for Special Affairs Egon Bahr, and former Foreign Minister Hans-Dietrich Genscher, *International Herald Tribune*, 9 January 2009; "A Nuclear Weapon Free World", by former Norwegian Prime Ministers Kjell Magne Bondevik, Gro Harlem Brundtland, Odvar Nordli and Kåre Willoch, and former Foreign Minister Thorvald Stoltenberg, Oslo *Aftenposten*, 4 June 2009; "Pour un désarmement nucléaire mondial, seule réponse à la prolifération anarchique" by French former Prime Ministers Alain Juppé and Michel Rocard, former Defence Minister Alain Richard, and former Commander of the French Air Combat Force Bernard Norlain, in *Le Monde*, 15 October 2009, http://www.lemonde.fr/archives/article/2009/10/14/

pour-un-desarmement-nucleaire-mondial-seule-reponse-a-la-proliferation-anarchique_1253834_0.html; and Australian former statesmen, scientists, senior military officers and NGO campaigners, respectively Malcolm Fraser, Gustav Nossal, Barry Jones, Peter Gration and John Sanderson, and Tilman Ruff, "It's time to get serious about ridding the world of nuclear weapons", *Sydney Morning Herald*, 8 April 2009. ***Para 20.14:*** In his speech "World Free of Nuclear Weapons", at the United Nations General Assembly on 9 June 1988 Rajiv Gandhi urged "the international community to immediately undertake negotiations with a view to adopting a time-bound Action Plan to usher in a world order free of nuclear weapons and rooted in nonviolence", http://www.indianembassy.org/ policy/ Disarmament/disarm15.htm. Creative as this was, it unintentionally served to polarize disarmament advocates and distract states into an argument as to whether deadlines should be imposed or whether nuclear disarmament would happen naturally at its own pace. ***Para 20.23:*** As listed above in 16.6, the New Agenda Coalition consists of Brazil, Egypt, Ireland, Mexico, New Zealand, Sweden, and South Africa. The members of the Seven Nation Initiative are Australia, Chile, Indonesia, Norway, Romania, South Africa, and the United Kingdom. ***Para 20.28:*** See generally Randy Rydell, "The Future of Nuclear Arms: A World United and Divided by Zero – Getting to Zero: Some Recent Initiatives", *Arms Control Today*, April 2009, http://www.armscontrol.org/act/2009_04/Rydell Pugwash nuclear-related documents can be found at http://www.pugwash.org/reports/nw/nwlist.htm The Nuclear Security Project was set up by Messrs Shultz, Perry, Kissinger and Nunn to pursue their initiative. Details can be found at http://www.nuclearsecurityproject.org/site/c.mjJXJbMMIoE/b.3483737/k.4057/Nuclear_Security_Project_Home.htm Global Zero, a "campaign for the phased, verified elimination of nuclear weapons", was launched in Paris, December 2008, http://www.globalzero.org/en/about-campaign The Middle Power Initiative now operates under the aegis of the Global Security Institute, which also set up the Article VI Forum. Further details can be found at http://www.gsinstitute.org/mpi/ The International Luxembourg Forum on Preventing Nuclear Catastrophe was a Russian Initiative in 2007 and has held several meetings since then – see http://luxembourgforum.org/eng/ Details about ICAN can be found on its website at www.icanw.org/ *Mayors for Peace was launched by the Mayor of Hiroshima in 1982*. As of 1 October, 2009, membership stood at 3,147 cities in 134 countries and regions – see http://www.mayorsforpeace.org/english/index.html See also the Hiroshima-Nagasaki Declaration of Nobel Peace Laureates, 17 May 2009, http://www.hiroshimapeacemedia.jp/mediacenter_d/en/hiroshima-nagasaki/ ***Para 20.33:*** See further the ICNND research paper by Patricia M. Lewis, "A New Approach to Nuclear Disarmament: Learning from International Humanitarian Law Success", January 2009, www.icnnd.org See also J. Borrie and A. Thornton, "The Value of Diversity in Multilateral Disarmament Work", UNIDIR, United Nations, December 2008, ISBN: 978-92-9045-193-8 ***Para 20.37:*** The Advisory Opinion of the International Court of Justice on the Legality of the Threat or Use of Nuclear Weapons can be found at http://www.lcnp.org/wcourt/opinion.htm ***Para 20.38:*** International

Association of Lawyers against Nuclear Arms, International Network of Engineers and Scientists against Proliferation and International Physicians for the Prevention of Nuclear War, *Securing Our Survival (SOS):The Case for a Nuclear Weapons Convention – The Updated Model Convention on the Prohibition of the Development, Testing, Production, Stockpiling, Transfer, Use and Threat of Use of Nuclear Weapons and on their Elimination*, Cambridge, Mass., 2007. This is accessible at the website of ICAN, www.ican.org , which has been actively promoting the draft convention. Costa Rica/Malaysia transmission letter: UNGA A/62/650. See also Tim Wright, "Negotiations for a Nuclear Weapons Convention: Distant Dream or Present Possibility?", *Melbourne Journal of International Law,* Vol 10, 2009. ***Para 20.43:*** "Follow-up to the Advisory Opinion of the International Court of Justice on the Legality of the Threat or Use of Nuclear Weapons: Legal, technical and political elements required for the establishment and maintenance of a nuclear weapon-free world", Working Paper submitted by Malaysia, Costa Rica, Bolivia, Democratic Republic of Timor-Leste, Nicaragua, and Yemen to the 2005 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, NPT/CONF.2005/WP.41. http://daccessdds.un.org/doc/UNDOC/GEN/N05/348/17/PDF/N0534817.pdfOpen Elemen ***Paras 20.45 ff:*** See two research papers by ICNND Research Coordinator Ken Berry, "A Draft Convention Prohibiting the Use or the Threat of Use of Nuclear Weapons", and "Draft Treaty on the Non-First Use of Nuclear Weapons", April 2009, both at http://www.iccnnd.org ***Para 20.45****:* In 1961 the UN General Assembly adopted Resolution 1653 (XVI) (55–20–26) which declared the use of nuclear weapons "a crime against mankind and civilization". The Assembly also requested that the UN Secretariat sound out members on the idea of convening a conference to negotiate a convention banning the use of nuclear weapons. However, these soundings were inconclusive and no such conference was ever convened. The Narayanan reference was made in "Non-Proliferation, Arms control and future of nuclear weapons; is zero possible?", Munich Security Conference, 6 February 2009, http://www.securityconference.de/konferenzen/rede.php?menu_2009=&menu_konferenzen=&sprache=en&id=227& See also Jozef Goldblatt, "Prospects for a Ban on the Use of Nuclear Weapons", *Arms Control and Disarmament*, No. 51, Center for Security Studies, Zurich, 1999, http://se1.isn.ch/serviceengine/FileContent?serviceID=PublishingHouse&fileid=9E854A8F-7D05-B418-482B-D249B34EDCEF&lng=en ***Para 20.50:*** Compare with the proposal made by Michael Krepon of the Stimson Center, "Getting to Zero", 9 February 2009, www.stimson.org, in which, "to generate near-term traction for nuclear disarmament", a "distinguished panel might list the menu of immediate actions required of states – nuclear, non-nuclear, and hedgers – to match words with deeds. ...[D]oing nothing would warrant a failing grade." For the Space Security Index, see www.spacesecurity.org. ***Para 20.53:*** Such a model already exists, e.g. with the Global Centre on the Responsibility to Protect (GCR2P), www.globalr2p.org, recently established in New York – with the support of a number of governments and foundations – to act as a research and advocacy centre for governments, intergovernmental organizations and non-governmental organizations worldwide on the issue of mass atrocity crimes (genocide, ethnic

cleansing, crimes against humanity and war crimes) in the aftermath of the UN General Assembly's embrace of the "responsibility to protect" concept at the 2005 World Summit. The Centre is itself quite small in terms of the number of professionals directly employed, but works with a number of associated research centres around the world. The GCR2P also has an International Advisory Board, again drawn from a worldwide pool of senior, experienced and well-known figures in this area: it does not directly govern or take responsibility for the work of the Centre, but on a different organizational model such a board could, and indeed usually does.

ANNEX A: COMMISSION RECOMMENDATIONS

ON OVERALL DISARMAMENT STRATEGY

1. Nuclear disarmament should be pursued as a two-phase process: with "minimization" to be achieved no later than 2025, and "elimination" as soon as possible thereafter. Short (to 2012), medium (to 2025) and longer term (beyond 2025) action agendas should reflect those objectives. [7.1–5; see also Sections 17,18, 19]

2. Short and medium term efforts should focus on achieving the general delegitimation of nuclear weapons, and on reaching as soon as possible, and no later than 2025, a "minimization point" characterised by:

   (a) low numbers: a world with no more than 2,000 warheads (less than 10 per cent of present arsenals);

   (b) agreed doctrine: every nuclear-armed state committed to no first use of nuclear weapons; and

   (c) credible force postures: verifiable deployments and alert status reflecting that doctrine. [7.6–15; see also Sections 6 (on delegitimation) and 17–18]

3. Analysis and debate should commence now on the conditions necessary to move from the minimization point to elimination, even if a target date for getting to zero cannot now be credibly specified. [7.15–17; see also Section 19]

ON OVERALL NON-PROLIFERATION STRATEGY

4. Nuclear non-proliferation efforts should focus both on the demand side – persuading states that nuclear weapons will not advance their national security or other interests – and the supply side, through maintaining and strengthening a comprehensive array of measures (addressed in following recommendations) designed to make it as difficult as possible for states to buy or build such weapons. [8.9–16; see also Sections 9–15]

ON NPT SAFEGUARDS AND VERIFICATION

5. All states should accept the application of the Additional Protocol. To encourage universal take-up, acceptance of it should be a condition of all nuclear exports. [9.7]

6. The Additional Protocol and its annexes should be updated and strengthened to make clear the IAEA's right to investigate possible weaponization activity, and by adding specific reference to dual-use items, reporting on export denials, shorter notice periods and the right to interview specific individuals. [9.8–9]

7. With safeguards needing to move from a mechanistic to an information-driven system, there should be much more information sharing, in both directions, on the part of both states and the IAEA, with the agency re-evaluating its culture of confidentiality and non-transparency. [9.10–11]

ON NPT COMPLIANCE AND ENFORCEMENT

8. In determining compliance, the IAEA should confine itself essentially to technical criteria, applying them with consistency and credibility, and leaving the political consequences for the Security Council to determine. [9.15]

9. The UN Security Council should severely discourage withdrawal from the NPT by making it clear that this will be regarded as prima facie a threat to international peace and security, with all the punitive consequences that may follow from that under Chapter VII of the UN Charter. [9.20]

10. A state withdrawing from the NPT should not be free to use for non-peaceful purposes nuclear materials, equipment and technology acquired while party to the NPT. Any such material provided before withdrawal should so far as possible be returned, with this being enforced by the Security Council. [9.21–22]

11. All states should make it a condition of nuclear exports that the recipient state agree that, in the event it should withdraw from the NPT, safeguards shall continue with respect to any nuclear material and equipment provided previously, as well as any material produced by using it. [9.23]

ON STRENGTHENING THE IAEA

12. The IAEA should make full use of the authority already available to it, including special inspections, and states should be prepared to strengthen its authority as deficiencies are identified. [9.24]

13. If the IAEA is to fully and effectively perform its assigned functions, it should be given, as recommended in 2008 by the Zedillo Commission:

    (a) a one-off injection of funds to refurbish the Safeguards Analytical Laboratory;

    (b) a significant increase in its regular budget support, without a "zero real growth" constraint, so as to reduce reliance on extra-budgetary funding for key functions;

    (c) sufficient security of future funding to enable medium to long-term planning; and

    (d) support from both states and industry in making staff secondments and offering training opportunities. [9.25–27]

14. Consideration should be given to an external review, by the Zedillo Commission or a successor panel, of the IAEA's organizational culture, in particular on questions of transparency and information sharing. [9.28]

ON NON-NPT TREATIES AND MECHANISMS

15. The Nuclear Suppliers Group (NSG) should develop a criteria-based approach to cooperation agreements with states outside the NPT, taking into account factors such as ratification of the CTBT, willingness to end unsafeguarded fissile material production, and states' records in securing nuclear facilities and materials and controlling nuclear-related exports. [10.3–9]

16. The Proliferation Security Initiative (PSI) should be reconstituted within the UN system as a neutral organization to assess intelligence, coordinate and fund activities, and make both generic and specific recommendations or decisions concerning the interdiction of suspected materials being carried to or from countries of proliferation concern. [10.10–12]

ON EXTENDING OBLIGATIONS TO NON-NPT STATES

17. Recognizing the reality that the three nuclear-armed states now outside the NPT – India, Pakistan and Israel – are not likely to become members any time soon, every effort should be made to achieve their participation in parallel instruments and arrangements which apply equivalent non-proliferation and disarmament obligations. [10.13–16]

18. Provided they satisfy strong objective criteria demonstrating commitment to disarmament and non-proliferation, and sign up to specific future commitments in this respect, these states should have access to nuclear materials and technology for civilian purposes on the same basis as an NPT member. [10.17]

19. These states should participate in multilateral disarmament negotiations on the same basis as the nuclear-weapon state members of the NPT, and not be expected to accept different treatment because of their non-membership of that treaty. [10.18]

ON BANNING TESTING

20. All states that have not already done so should sign and ratify the CTBT unconditionally and without delay. Pending entry into force, all states should continue to refrain from nuclear testing. [11.1–8]

21. All signatories should provide the necessary financial, technical and political support for the continued development and operation of the CTBTO, including completing the global coverage of its monitoring systems, facilitating on-site inspection when warranted, and establishing effective national data centres and information gathering systems. [11.9–12]

ON LIMITING THE AVAILABILITY OF FISSILE MATERIAL

22. All states should negotiate to an early conclusion in the Conference on Disarmament a non-discriminatory, multilateral, internationally and effectively verifiable and irreversible Fissile Material Cut-off Treaty (FMCT), banning the production of fissile material for nuclear weapons or other nuclear explosive devices. [12.1–14]

23. All nuclear-armed states should declare or maintain a moratorium on the production of fissile material for weapon purposes pending the entry into force of such a treaty. [12.15]

24. On the question of pre-existing stocks, a phased approach should be adopted, with the first priority a cap on production; then an effort to ensure that all fissile material other than in weapons becomes subject to irreversible, verified non-explosive use commitments; and with fissile material released through dismantlement being brought under these commitments as weapon reductions are agreed. [12.18]

25. As an interim step, all nuclear-armed states should voluntarily declare their fissile material stocks and the amount they regard as excess to their weapons needs, place such excess material under IAEA safeguards as soon as practicable, and convert it as soon as possible to forms that cannot be used for nuclear weapons. [12.19]

26. The use of HEU in civil research programs should be ended as soon as possible, and the availability and use of separated plutonium in energy programs phased out as viable alternatives are established. [12.20–27]

ON NUCLEAR SECURITY

27. All states should agree to take further measures to strengthen the security of nuclear materials and facilities, including early adoption of the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM) and the most recent international standards, accelerated implementation of the Cooperative Threat Reduction (CTR) and associated programs worldwide, and greater commitment to international capacity building and information sharing. [13.1–16, 22–23]

28. At the Global Summit on Nuclear Security in April 2010, and in subsequent follow-up activity, priority attention should be given to the implementation-focused issues identified in Box 13-1. [13.4]

29. On the control of material useable for "dirty bombs", further efforts need to be made to cooperatively implement the Code of Conduct on the Safety and Security of Radioactive Sources, with assistance to states in updating legislation and licensing practice, promoting awareness among users, and generally achieving a safety and security culture. [13.17–21]

30. Efforts should continue to be made to establish an intelligence clearing house which would provide a mechanism by which countries might be willing not only to share their intelligence, but also provide the know-how for other countries to interpret and deal with it. [13.22]

31. Strong support should be given to the emerging science of nuclear forensics, designed to identify the sources of materials found in illicit

trafficking or used in nuclear explosions, including through providing additional resources to the Nuclear Smuggling International Technical Working Group. [13.24–25]

ON NUCLEAR ENERGY MANAGEMENT

32. The use of nuclear energy for peaceful purposes should continue to be strongly supported as one of the three fundamental pillars of the NPT, along with disarmament and non-proliferation. Increased resources should be provided, including through the IAEA's Technical Cooperation Programme, to assist developing states in taking full advantage of peaceful nuclear energy for human development. [14.1–3]

33. Support should be given to the initiative launched at the 2008 Hokkaido Toyako G8 Summit for international cooperation on nuclear energy infrastructure, designed to raise awareness worldwide of the importance of the three Ss – safeguards, security and safety – and assist countries concerned in developing the relevant measures. [14.4–6]

34. Proliferation resistance should be endorsed by governments and industry as an essential objective in the design and operation of nuclear facilities, and promoted through both institutional and technical measures – neither is sufficient without the other. [14.7–8]

35. The increasing use of plutonium recycle, and the prospective introduction of fast neutron reactors, must be pursued in ways which enhance non-proliferation objectives and avoid adding to proliferation and terrorism risks. In particular, a key objective of research and development on fast neutron reactors should be to design and operate them so that weapons grade plutonium is not produced. [14.9–15]

36. International measures such as spent fuel take-back arrangements by fuel suppliers, are desirable to avoid increasing spent fuel accumulations in a large number of states. Particular attention should be paid in this respect to take-back of fuel from initial core loads. [14.13]

37. New technologies for spent fuel treatment should be developed to avoid current forms of reprocessing altogether; and, as they are established, use of MOX fuel in thermal reactors, and conventional reprocessing plants, can be phased out. [12.26]

38. Nuclear industry, and government-industry collaboration, will need to play a greater role in mitigating the proliferation risks associated with a growing civilian nuclear sector worldwide. Industry should become a more active partner with governments in the drafting of regulations

and treaties that affect its activities, to ensure that they make operational sense and to encourage compliance. [14.16–24]

ON MULTILATERALIZING THE NUCLEAR FUEL CYCLE

39. Multilateralization of the nuclear fuel cycle – in particular through fuel banks and multilateral management of enrichment, reprocessing and spent fuel storage facilities – should be strongly supported. Such arrangements would play an invaluable role in building global confidence in the peaceful uses of nuclear energy, and provide an important foundation for a world free of nuclear weapons, for which a necessary requirement will be multilateral verification and control of all sensitive fuel cycle activities. [15.48]

40. Pending the acceptance of more far-reaching proposals, support should be given to voluntary arrangements whereby, in return for assurances of supply, recipient states would renounce the national construction and operation of sensitive fuel cycle facilities for the duration of the agreement. [15.47]

ON PRIORITIES FOR THE 2010 NPT REVIEW CONFERENCE

41. The following should be the major priority issues for the 2010 NPT Review Conference:

    (a) *Action for Disarmament.* Agreement on a twenty-point statement, "A New International Consensus for Action on Nuclear Disarmament" (see Box 16-1), updating and extending the "Thirteen Practical Steps" agreed in 2000.

    (b) *Strengthening Safeguards and Enforcement.* Agreement:

    - that all states should accept the application of the Additional Protocol and that, to encourage its universal take-up, acceptance should be made a condition of all states' nuclear exports;
    - to declare that a state withdrawing from the NPT is not free to use for non-peaceful purposes nuclear materials, equipment and technology acquired while party to the NPT;
    - to recommend that the Security Council make it clear that any withdrawal will be regarded prima facie as a threat to international peace and security; and

- to recommend to states that they make it a condition of nuclear exports that safeguards agreements continue to apply after any such withdrawal.

(c) *Strengthening the IAEA.* Agreement that the IAEA's budget be significantly increased – without any "zero real growth" constraint, and so as to reduce reliance on extra-budgetary support for key functions – as recommended in 2008 by the Zedillo Commission.

(d) *Middle East Weapons of Mass Destruction Free Zone.* Agreement that the Secretary-General of the UN should convene an early conference of all relevant states to address creative and fresh ways to implement the 1995 resolution, including the identification of confidence building measures that all key states in the region can embrace, and to commence early consultations to facilitate that.

(e) *Nuclear security.* Agreement that states should take further measures to strengthen the security of nuclear materials and facilities, including early adoption of the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material and the most recent international standards, accelerated implementation of the cooperative threat reduction and associated programs worldwide, and greater commitment to international capacity building and information sharing.

(f) *Peaceful uses.* Agreement that the inalienable right to the use of nuclear energy for peaceful purposes remains one of the fundamental objectives of the NPT and to dedicate increased resources, including through the IAEA's Technical Cooperation Programme, to assist developing states in taking full advantage of peaceful nuclear energy for human development.

ON REDUCING WEAPON NUMBERS: BILATERAL AND MULTILATERAL PROCESSES

42. The "minimization point" objective should be to achieve no later than 2025 a global total of no more than 2,000 nuclear warheads, with the U.S. and Russia reducing to a total of 500 nuclear weapons each, and with at least no increases (and desirably significant reductions) in the arsenals of the other nuclear-armed states. The objective must be to cut not only strategic but all classes of weapons, and not only deployed weapons but those in storage and those awaiting destruction (but still capable of reconstitution and deployment) as well. [7.8; 18.1–3]

43. To bring the bilateral target within achievable range, the U.S. and Russia should accelerate implementation of the START follow-on treaty now being negotiated, bringing forward the envisaged reductions under this to no later than 2015. [17.13]

44. Once this treaty is ratified, the U.S. and Russia should resume intensive negotiations with a view to reaching a further START agreement no later than 2015, which would bring the total number of warheads down to no more than 1000 for each, and hopefully much less, by the year 2020. [17.12–13]

45. To achieve the minimization point objective of a global maximum of no more than 2,000 warheads, with the nuclear-armed states other than the U.S. and Russia having no more than 1,000 between them, the highest priority need is for all nuclear-armed states to explicitly commit *not to increase* the number of their nuclear weapons, and such declarations should be sought from them as soon as possible. [17.15–16]

46. To prepare the ground for multilateral disarmament negotiations, strategic dialogues should be initiated by all the nuclear-armed states with each other, and systematic and substantial national studies conducted of all the issues – including missile defence, conventional imbalances and disarmament verification – that will arise at all stages of the process. [17.17–19, 22–24]

47. Consideration should be given to the Conference on Disarmament in Geneva as an appropriate forum for initial consultations, on a formal or informal basis, between all the nuclear-armed states, given the need, if the multilateral disarmament process is to advance, for there to be early agreement on an appropriate negotiating process. [7.9; 17.20–21]

48. To facilitate future verification processes, in the credibility of which all nuclear-armed states will have a mutual interest, "nuclear archaeology" steps should be taken now by them to ensure that all relevant records are identified, secured and preserved, and relevant measurements and samples are taken. [17.25–26]

ON NUCLEAR DOCTRINE: NO FIRST USE, EXTENDED DETERRENCE, AND NEGATIVE SECURITY ASSURANCES

49. Pending the ultimate elimination of nuclear weapons, every nuclear-armed state should make an unequivocal "no first use" declaration, committing itself to not using nuclear weapons either preventively or pre-emptively against any possible nuclear adversary, keeping them

available only for use, or threat of use, by way of retaliation following a nuclear strike against itself or its allies. [17.28]

50. If not prepared at this stage to make such a declaration, every nuclear-armed state should at least accept the principle that the sole purpose of possessing nuclear weapons – until such time as they can be eliminated completely – is to deter others from using such weapons against that state or its allies. [7.10; 17.28–32]

51. The allies in question – those presently benefiting from extended deterrence - should be given firm assurances that they will not be exposed to unacceptable risk from other sources, including especially biological and chemical weapons. In this context, continuing strong efforts should be made to promote universal adherence to the Biological and Toxin Weapons Convention and the Chemical Weapons Convention, and to develop more effective ways of ensuring compliance with the former. [17.29]

52. It is particularly important that at least a "sole purpose" statement be made in the U.S. Nuclear Posture Review due for publication early in 2010, placing pressure as this would on other nuclear-armed states to be more forthcoming, and undermining "double standards" arguments at the 2010 NPT Review Conference. [17.32]

53. New and unequivocal negative security assurances (NSAs) should be given by all the nuclear-armed states, supported by binding Security Council resolution, that they will not use nuclear weapons against non-nuclear weapon states. The only qualification should be that the assurance would not extend to a state determined by the Security Council to be in non-compliance with the NPT to so material an extent as to justify the non-application of any NSA. [17.33–39]

54. All NPT nuclear-weapon state members should sign and ratify the protocols for all the Nuclear Weapon Free Zones, and the other nuclear-armed states (so long as they remain outside the NPT) should issue stand-alone negative security assurances for each of them. [16.16]

ON NUCLEAR FORCE POSTURE: LAUNCH ALERT STATUS AND TRANSPARENCY

55. The basic objective is to achieve changes to deployment as soon as possible which ensure that, while remaining demonstrably survivable to a disarming first strike, nuclear forces are not instantly useable. Stability should be maximized by deployments and launch alert status being transparent. [7.12–15; 17.40–50]

56. It is crucial that ways be found to lengthen the decision-making fuse for the launch of any nuclear weapons, and in particular – while recognizing the difficulty and complexity of the negotiating process involved between the U.S. and Russia – that weapons be taken off launch-on-warning alert as soon as possible. [17.43]

57. In order to achieve strategic dialogues capable of making real progress on disarmament, maximum possible transparency in both nuclear doctrine and force postures should be offered by all nuclear-armed states. [17.44]

58. A relaxation of Israel's policy of complete opacity would be helpful in this respect, but continued unwillingness to do so should not inhibit its engagement in multilateral disarmament negotiations (given that nuclear disarmament can be defined as a process of taking unsafeguarded fissile materials and putting them under international safeguards). [17.45–50]

ON NORTH KOREA AND IRAN

59. Continuing efforts should be made, within the framework of the Six-Party Talks, to achieve a satisfactory negotiated solution of the problem of North Korea's overt pursuit of a nuclear weapons program, involving verifiable denuclearization and resumed commitment to the NPT in return for security guarantees and economic assistance. [17.52–56]

60. Continuing efforts should be made by the P5+1, Security Council and IAEA member states to achieve a satisfactory negotiated resolution of the issue of Iran's nuclear capability and intentions, whereby any retention of any element of its enrichment program would be accompanied by a very intrusive inspection and verification regime, giving the international community confidence that Iran neither has nor is seeking nuclear weapons. [17.57–60]

ON PARALLEL SECURITY ISSUES: MISSILES, SPACE, BIOLOGICAL AND CONVENTIONAL WEAPONS

61. The issue of anti-ballistic missile (ABM) systems should be revisited, with a view to allowing the further development of theatre ballistic missile defence systems, including potential joint operations in areas of mutual concern, but setting severe limits on strategic ballistic missile defences. It should be recognized that while, in a world without nuclear weapons, strategic missile defences could play an important stabilizing role as an insurance policy against potential cheaters, they

now constitute a serious impediment to both bilateral and multilateral nuclear disarmament negotiations. [18.28–30; see also 2.30–34, 17.18]

62. International efforts to curb missile proliferation should continue, but continued failure to multilateralize the INF should not be used as an excuse for either present party to withdraw from it. [2.35–37]

63. Ongoing attempts to prevent an arms race in outer space (PAROS) at the Geneva Conference on Disarmament, and work at the Vienna-based UN Committee on the Peaceful Uses of Outer Space, should be strongly supported. [18.31]

64. Continuing strong efforts should be made to promote universal adherence to the Biological and Toxin Weapons Convention and the Chemical Weapons Convention, and to develop more effective ways of defending against potential biological attacks, including – for all its difficulties – building a workable Convention verification regime. [17.29; 18.32–33]

65. The issue of conventional arms imbalances, both quantitative and qualitative, between the nuclear-armed states, and in particular the relative scale of U.S. capability, needs to be seriously addressed if it is not to become a significant impediment to future bilateral and multilateral nuclear disarmament negotiations, including by revisiting matters covered in the Treaty on Conventional Armed Forces in Europe (CFE). The development of more cooperative approaches to conflict prevention and resolution may well prove more productive in this context than focusing entirely on arms limitation measures. [18.34–36]

ON ACTION AGENDAS: SHORT, MEDIUM AND LONGER TERM

66. The Short Term Action Agenda, for the period between now and 2012 – and including the 2010 NPT Review Conference – should focus on the issues we identify in Box 17-1.

67. Consideration should be given to the possibility of the United Nations General Assembly holding a Special Session on Disarmament late in 2012, as a way of benchmarking the achievements of the short term and defining the way forward. Any decision should be deferred until mid-2010, to allow for reflection on the outcome of the 2010 Review Conference, and whether enough momentum is building to justify the resources and effort involved. [17.2–3]

68. The Medium Term Action Agenda, for the period between 2012 and 2025, should focus on the issues we identify in Box 18-1.

69. The Longer Term Action Agenda, for the period beyond 2025, should focus on establishing the conditions we identify in Box 19-1.

70. Given that questions of cost-burden sharing are likely to arise as disarmament momentum builds over the longer term, it may be helpful for interested states to commission a detailed study on the calculation of disarmament and non-proliferation costs and possible ways of funding them. [18.26–27]

ON MOBILIZING AND SUSTAINING POLITICAL WILL

71. Sustained campaigning is needed, through both the traditional and new media and direct advocacy, to better inform policy-makers and those who influence them about nuclear disarmament and non-proliferation issues. Capable non-governmental organizations should be appropriately supported by governments and philanthropic foundations to the extent necessary to enable them to perform this role effectively. [20.7–10]

72. There should be a major renewed emphasis on formal education and training about nuclear disarmament and related issues in schools and universities, focusing on the history of nuclear weapons, the risks and threats involved in their continued deployment and proliferation, and possible ways forward. An associated need is for more specialized courses on nuclear-related issues – from the scientific and technical to the strategic policy and legal – in universities and diplomatic-training and related institutions. [20.11–12]

73. Work should commence now on further refining and developing the concepts in the model Nuclear Weapons Convention now in circulation, making its provisions as workable and realistic as possible, and building support for them, with the objective of having a fully-worked through draft available to inform and guide multilateral disarmament negotiations as they gain momentum. Interested governments should support with appropriate resources the further development of the NWC. [20.38–44]

74. To help sustain political will over time, a regular "report card" should be published in which a distinguished international panel, with appropriately professional and broad-based research support, would evaluate the performance of both nuclear-armed and non-nuclear-armed states against the action agendas identified in this report. [20.49–50]

75. Consideration should be given to the establishment of a new "Global Centre on Nuclear Non-proliferation and Disarmament" to act as a focal point and clearing house for the work being done on nuclear non-proliferation and disarmament issues by many different institutions and organizations in many different countries, to provide research and advocacy support for both like-minded governments on the one hand, and civil society organizations on the other, and to prepare the "report card" described above. [20.53]

76. Such a centre might be constructed to perform functions at two levels:

    (a) a base of full time research and advocacy professionals, drawing directly on the resources of a wide international network of well-established associated research centres; and

    (b) a superstructure, in the form of a governing or advisory board drawn from distinguished global figures of wide-ranging experience, giving their imprimatur as appropriate to the centre's published reports, policy initiatives and campaigns. [20.51–54]

ANNEX B: MEMBERS OF THE COMMISSION

Gareth Evans (Australia) (Co-chair)

Professor Evans is Chancellor of the Australian National University, an Honorary Professorial Fellow at the University of Melbourne and President Emeritus of the Brussels-based International Crisis Group, the independent global NGO working with some 120 full-time staff on five continents to prevent and resolve deadly conflict, which he directed from 2000 to 2009. He is the recipient of the 2010 Roosevelt Institute's Freedom from Fear award for his pioneering work on the concept of the responsibility to protect against mass atrocity crimes, and on nuclear non-proliferation and disarmament. He spent 21 years in Australian politics, thirteen of them as a Cabinet Minister in the positions of Attorney-General (1983–84), Minister for Resources and Energy (1984–87), Minister for Transport and Communications (1987–88) and Foreign Minister (1988–96), where he was associated, among other things, with the negotiation of the Chemical Weapons Convention and the establishment of the Canberra Commission on the Elimination of Nuclear Weapons. He has written or edited nine books (most recently *The Responsibility to Protect: Ending Mass Atrocity Crimes Once and for All*, Brookings Institution Press, 2008) and published over 100 journal articles and book chapters on foreign relations, human rights and legal and constitutional reform. He was Co-chair of the International Commission on Intervention and State Sovereignty (2001), and a member, inter alia, of the UN Secretary General's High-level Panel on Threats, Challenges and Change (2004), the Blix Commission on Weapons of Mass Destruction (2006), and the Zedillo Commission on the Future of the IAEA (2008). He has degrees in Law and Arts from Melbourne and Oxford, and Honorary Doctorates from Melbourne, Sydney and Carleton, universities, and is an Honorary Fellow of Magdalen College, Oxford.

Yoriko Kawaguchi (Japan) (Co-chair)

Ms Kawaguchi has been a Member of the House of Councillors for the Liberal Democratic Party since 2005. She was Special Adviser to the Prime Minister of Japan, responsible for foreign affairs, from 2004 to 2005; Minister for Foreign Affairs from 2002 to 2004 and Minister for the Environment from 2000 to 2002. Previously, Ms Kawaguchi was a Managing Director of Suntory Ltd, Director General of Global Environmental Affairs at the Ministry of International Trade and Industry, and Minister at the Embassy of Japan to the United States. From 1976 to 1978 she was an economist at the World Bank. Ms Kawaguchi currently holds a

variety of senior positions in the House of Councillors and the Liberal Democratic Party of Japan including Vice-Chair of the Policy Research Council (Environment). In addition to her role as Co-chair of ICNND she is a Member of the Board of Trustees on the United States-Japan Foundation, Chairperson of the Asia-Pacific Forum for Environment and Development, a Foundation Board Member of the Forum of Young Global Leaders, a Member of the Advisory Board of the Energy and Climate Change Working Group of the Clinton Global Initiative, Special Advisor to the Provost at the United Nations University and Councillor of the International Committee of Parliamentarians for Global Action. Ms Kawaguchi holds an M.Phil in Economics from Yale University and a BA in International Relations from the University of Tokyo. In 2008, Ms Kawaguchi was awarded Yale's Wilbur Cross Medal.

Turki Al Faisal (Saudi Arabia)

HRH Prince Turki Al Faisal is currently Chairman of the Board of the King Faisal Center for Research and Islamic Studies in Riyadh. Educated at Georgetown, Princeton and Cambridge Universities, Prince Turki was appointed Adviser to the Royal Court in 1973, and held the post of Director General of the General Intelligence Directorate from 1977 to 2001. Subsequently he was appointed Ambassador to the United Kingdom and Northern Ireland (2003–05) and to the United States (2005–2006). Currently Prince Turki is a member of the Board of Trustees of the Oxford Islamic Center in the United Kingdom, a founder of the King Faisal Foundation, and a member of the Board of Trustees of the Center for Contemporary Arab Studies at Georgetown University. He has been a benefactor of the arts as former Chairman of the Board of the Prince Charles Visual Islamic and Traditional Arts Centre.

Alexei Arbatov (Russia)

Dr Arbatov is currently Head of the Center for International Security of the Institute of World Economy and International Relations of the Russian Academy of Sciences, Chair of the Nonproliferation Program at the Carnegie Moscow Center and a member of the Political Council of the YABLOKO Party. Educated at the Moscow State Institute of International Relations, Dr Arbatov has been involved with Russian strategic issues as a consultant to the government on START I negotiations and an adviser on START II and START III negotiations. He was a member of the Duma from 1994–2003 as Deputy Chair of the Defense Committee. He is a corresponding member of the Russian Academy of Sciences; Chair of the Strategic Planning Group of the Advisory Board of the Russian Security Council; and a member

of the Advisory Council of the Russian Ministry of Foreign Affairs. Currently he also is on the boards of various international bodies including the Nuclear Threat Initiative (NTI) and Stockholm International Peace Research Institute (SIPRI).

Gro Harlem Brundtland (Norway)

Dr Brundtland served as Prime Minister of Norway in 1981, 1986–89 and 1990–96, and as a Member of Parliament from 1977 to 1997. A medical doctor, she studied medicine at the University of Oslo, completed a Master of Public Health at Harvard University in 1964, and from 1968 to 1974 was Deputy Director of School Health Services for the city of Oslo. From 1974 to 1979 she was Minister for the Environment in Norway, and from 1983 to 1987 served as Chair of the United Nations World Commission on Environment and Development. Dr Brundtland was elected Director-General of the World Health Organisation in 1998 for a five year term to 2003. She is currently a Member of the Board of the United Nations Foundation and is the UN Secretary-General's Special Envoy on Climate Change.

Frene Noshir Ginwala (South Africa)

Dr Ginwala was Chancellor of the University of KwaZulu-Natal until June 2009, and is currently Chairperson of the Advisory Board of the African Union Convention on Corruption, and a member of the Advisory Board of the Coalition for Dialogue on Africa. Having studied law at the Universities of London and Oxford, she became Head of African National Congress (ANC) Research and its spokesperson for Western Europe (1974–90). From 1987 to 1988 she served on the Panel preparing UNESCO's Programme on Peace and Conflict Research. She returned to South Africa as a member of Mr Mandela's Office (1991–94), and was a member of the ANC negotiating team at the Convention for a Democratic South Africa and the Multi-Party Talks (1992–93). Dr Ginwala was a Member of Parliament from 1994 to 2004 and concurrently elected to the ANC's National Executive. During that period she served as Speaker of the National Assembly. She has served on numerous African regional and UN advisory panels including to the High Commissioner for Refugees and the Human Security Commission.

François Heisbourg (France)

Mr Heisbourg is currently Chairman of the Foundation Council of the Geneva Centre for Security Policy, Chairman of the Council of the International Institute for Strategic Studies and Special Adviser, Fondation pour la Recherche Stratégique, Paris. He served in the French Foreign Ministry's Policy Planning Staff in charge of nuclear non-proliferation issues and at the French Permanent Mission to the United Nations in New York (1979–81). He was subsequently International Security Adviser to the Minister of Defence (1981–84), Vice-President at Thomson-CSF, Director of the International Institute for Strategic Studies (until 1992), Senior Vice-President (Strategic Development) at MATRA-Défense-Espace (1992–98), head of an inter-agency group on strategic affairs in France (1999–2000), Professor at Sciences-Po University, Paris (1999–2001), Director of the Fondation pour la Recherche Stratégique, Paris (2001–05), Member of the European Commission's Group of Personalities on Security Research and Development (2003–04) and Member of the International Commission on the Balkans (2004–06). Most recently, Mr Heisbourg served as a Member of the Presidential Commission on the 2008 French Defence and National Security White Paper.

Jehangir Karamat (Pakistan)

General Karamat retired as Chairman of the Joint Chiefs of Staff Pakistan Armed Forces and Chief of Army Staff Pakistan Army in October 1998 and is currently the Director of the Spearhead Research Institute. He is also a member of the Executive Council of the Institute of Public Policy at Beaconhouse National University and is on the Board of Governors of the Institute for Policy Research, Islamabad as well as the Senate of the National Defence University, Islamabad. General Karamat is a graduate of the National Defense College in Rawalpindi, the Command and Staff College in Quetta and the U.S. Army Command and General Staff College at Fort Leavenworth, and holds an MA in international relations. In 1999 he was visiting fellow at the Center for International Security and Cooperation at Stanford University and was a Visiting Fellow at the Brookings Institution in Washington, DC in 2000. Between 2004 and 2006 he served as Ambassador to the United States of America.

Brajesh Mishra (India)

Mr Mishra served from 1998–2004 as National Security Adviser and Principal Secretary to the then Prime Minister A.B. Vajpayee. He joined the Indian Foreign Service in 1951, and has served in Karachi (Third Secretary 1955–56), Rangoon (Second Secretary 1956–57), Brussels (First Secretary 1957–60), Ministry of External Affairs (Deputy Secretary 1960–64), New York (Deputy Permanent Representative, 1964–69), Beijing (Chargé d' Affaires 1969–73), Geneva (Ambassador and Permanent Representative 1973–77), Jakarta (Ambassador 1977–79) and New York (Permanent Representative 1979–81). He subsequently became UN Commissioner for Namibia from 1981 to 1987. In 1991, Mr Mishra joined the Bharatiya Janata Party, and was appointed to the role of Convenor of the Bharatiya Janata Party's Foreign Affairs Cell where he served from 1991 to 1998, resigning from the party in March 1998 upon his appointment as National Security Adviser.

Klaus Naumann (Germany)

General Naumann was elected in 1996 as the Chairman of the NATO Military Committee, a position he held until 1999. Over this period he was involved with NATO in Bosnia, the start of the Partnership for Peace, the 1999 enlargement of NATO, approval of a new NATO command structure and the Kosovo War. He joined the German Army in 1958, graduated in 1972 from the German Armed Forces Staff and Command College, and went on to study at the Royal College of Defence Studies in 1983. He held various command posts within the German military, leading to his appointment as Chief of Defence from 1991 to 1996. Following his retirement from military service General Naumann was a Member of the Panel on United Nations Peace Operations (2000), the International Commission on Intervention and State Sovereignty (2001), and on the support team to the High-level Panel on the United Nations. He has published two books, and received an honorary PhD from the University of Budapest. He is on the Senate of the German National Foundation.

William Perry (United States)

Dr Perry is a former U.S. Secretary for Defense and currently the Michael and Barbara Berberian Professor at Stanford University, with a joint appointment at the Freeman Spogli Institute for International Studies (FSI) and the School of Engineering. As a distinguished expert in U.S. foreign policy, national security and arms control he is a senior fellow at FSI and serves as Co-Director of the Preventive Defense Project. He received BSc and MSc degrees from Stanford, followed by a PhD from Penn

State University, all in mathematics. He began his career in the Army Corps of Engineers before taking on a succession of management and research positions within the technology and electronics industry. Dr Perry served as the Under Secretary of Defense for Research and Engineering (1977 to 1981), Executive Vice-President of Hambrecht & Quist Inc. (1981–1985) and as founder and Chairman of Technology Strategies and Alliances (1985–1993). Dr Perry served as Deputy Secretary (1993–1994) and then Secretary of Defense (1994–1997).

Wang Yingfan (China)

Ambassador Wang was appointed Assistant Foreign Minister and Vice Foreign Minister over the period 1993 to 2000. He then went on to become China's Ambassador and Permanent Representative to the United Nations from 2000 to 2003. Born in Tuquan, Inner Mongolia, Ambassador Wang studied English at the Beijing Foreign Languages Institute. He joined the Chinese Ministry of Foreign Affairs in 1964, serving between 1978 and 1993 at ranks up to and including Director General of the Asian Department. He was the Co-Chair of expert group talks over the China-Vietnam border negotiations, and served as China's Ambassador to the Philippines from 1988 to 1990. From 2003 to 2008, Ambassador Wang was a member of the Standing Committee of the National People's Congress, the Vice Chairman of the Foreign Affairs Committee, and Chairman of the China-Europe Parliamentary Relations Group. He is now a member of the Foreign Policy Advisory Group of China's Foreign Ministry.

Shirley Williams (United Kingdom)

Baroness Williams has been a member of the House of Lords since 1993, including as leader of the Liberal Democrats from 2001 to 2004. She is currently an Emeritus Professor of Electoral Politics at the Kennedy School of Government, and adviser on nuclear proliferation to Prime Minister Gordon Brown. Baroness Williams was educated at Somerville College, Oxford, and Colombia University. Starting her political career as a Member of Parliament in 1964, she has held a variety of roles including Shadow Home Secretary (1971–73), Secretary of State for Prices and Consumer Protection (1974–76), Paymaster General (1976–79), and Secretary of State for Education and Sciences (1976–79). Baroness Williams co-founded the Social Democrat Party in 1981, and served as the President of the Social Democrat Party between 1982 and 1987. From 1988 until 2000, Baroness Williams was a Professor at the Kennedy School of Government, Harvard.

Wiryono Sastrohandoyo (Indonesia)*

Ambassador Wiryono served as Ambassador to Austria and simultaneously as Permanent Representative of Indonesia to the United Nations in Vienna and the IAEA from 1988 to 1989. He was Director General of Political Affairs (1990–1993) and subsequently Ambassador to France (1993–96) and to Australia and Vanuatu (1996–99). Ambassador Wiryono was educated at the Academy of Foreign Service (Jakarta), L'Institute des Hautes Études Internationales (Geneva), Gajah Mada University (Yogyakarta), the University of Indonesia (Jakarta) and Johns Hopkins University (Washington, DC). He joined the Indonesian Foreign Service in 1957 and served in Buenos Aires, Washington, Paris and at the United Nations in New York. Ambassador Wiryono is currently a Senior Fellow at the Centre for Strategic and International Studies in Jakarta, and a Member of the Board of the Indonesian Council on World Affairs. He has also served on the Board of Governors for the Asia-Europe Foundation and the Institute of Peace and Democracy at Udayana University in Bali.

** Pak Wiryono was appointed to the Commission in January 2009 following the death of his Indonesian predecessor **Ali Alatas** in December 2008. Mr Alatas was Foreign Minister of Indonesia from 1988 to 1999, and was adviser to and special envoy of the President of the Republic of Indonesia at the time of his death. The Commission was deeply saddened by the news of the passing of our colleague, who participated in the first meeting in October 2008, and whose wise advice and wealth of experience will be sorely missed internationally.*

Ernesto Zedillo Ponce de León (Mexico)

Dr Zedillo was President of Mexico from 1994 to 2000, and is currently the Frederick Iseman '74 Director of the Yale Center for the Study of Globalization; he is concurrently Professor of International and Area Studies; and Professor Adjunct of Forestry and Environmental Studies at Yale University. He is also Chairman of the Board of the Global Development Network, based in New Delhi; and a member of the Foundation Board of the World Economic Forum, the Trilateral Commission, the International Advisory Board of the Council on Foreign Relations, the G30, the Board of Directors of the Institute for International Economics, the Board of Trustees of the International Crisis Group and the Board of Directors of the Inter-American Dialogue. He has served on numerous international commissions, most recently as Chair of the Commission on the Role of the IAEA to 2020 and Beyond, Co-Chair of the Partnership of the Americas Commission and Chair of the High-level Commission on World Bank Governance.

ANNEX C: HOW THE COMMISSION WORKED

ORIGINS AND MANDATE

The International Commission on Nuclear Non-proliferation was established in 2008 as a joint initiative of the Australian and Japanese Governments. Its creation was proposed by Australian Prime Minister Kevin Rudd in a speech in Kyoto on 9 June 2008 in which he described how moved he had been by his visit a day earlier to Hiroshima, whose peace memorial, he said, "reminds all humanity that each generation must commit itself afresh to the cause of peace because the cost of war is beyond any new generation's imagining." Japanese Prime Minister Yasuo Fukuda warmly embraced the idea (as have his successors Taro Aso and Yukio Hatoyama), and he and his Australian counterpart announced the appointment of the Commission's Co-chairs on 9 July 2008. The new Commission was formally launched in New York on 25 September 2008 by Prime Ministers Rudd and Aso.

The stated aim of the Commission was to reinvigorate, at a high political level, global debate on nuclear non-proliferation and disarmament, in the context both of the forthcoming 2010 Nuclear Non-Proliferation Treaty (NPT) Review Conference, and beyond. The NPT remains the most significant and successful arms control instrument of the nuclear age, but has been under strain from a number of directions, not least North Korea and Iran, and is manifestly in need of revitalisation. The Commission was tasked to advise how that might best be done (focusing on disarmament as much as non-proliferation), but also to closely address related issues like how best to bring the nuclear-armed states outside the NPT into the global system, and how to meet growing concerns about the proliferation implications of a dramatic increase in civil nuclear energy. It was asked to complete its main report well in time for its efforts to shape a new global consensus to feed into the May 2010 NPT Review Conference, but its mandate – including international advocacy, and possibly further reporting – will continue at least until mid 2010.

The Commission was intended to build upon, and take further, the work of distinguished earlier commissions and panels, notably the 1996 Canberra Commission on the Elimination of Nuclear Weapons, the 1999 Tokyo Forum for Nuclear Non-Proliferation and Disarmament, the 2004 UN High-level Panel on Threats, Challenges and Change, the 2006 Blix Weapons of Mass Destruction Commission, and the 2008 Zedillo Commission of Eminent

Persons on the future of the International Atomic Energy Agency (IAEA). It was hoped that its analysis and recommendations would be seen by policymakers as comprehensive, sharp-edged and practically useful; the Commission recognised from the outset that its report would not be likely to make much impact if they were not.

Although initiated by two Asia-Pacific countries, the Commission's work was conceived as being necessarily global rather than regional in scope, and its composition and methodology, as described below, clearly reflect that. And although initiated by two governments, and primarily funded by the government of Australia, its work from the outset has been understood to be completely independent of government positions, with its members appointed in their personal capacity rather than as representatives of their respective countries.

COMMISSIONERS

The Australian and Japanese prime ministers in July 2008 jointly invited to head the Commission as its Co-chairs former Foreign Ministers Gareth Evans and Yoriko Kawaguchi. On their advice, following widespread consultations, the appointment of thirteen other Commissioners was announced in September 2008 – all of them eminent and outstanding individuals from around the world, including former heads of government and ministers, military strategists and disarmament experts, and all uniquely placed to bring fresh and imaginative vision to the undertaking. The Commission was deeply saddened by the death in December 2008 of former Indonesian Foreign Minister and global statesman Ali Alatas, who participated in its first meeting and would certainly have made an outstanding contribution to its work, as has his Indonesian successor. A full list of Commissioners, with biographical summaries, is in Annex B.

ADVISORY BOARD MEMBERS

The Commission has been greatly assisted in its work by an Advisory Board, comprising a further 27 distinguished experts from around the globe, who accepted the invitation of the Co-chairs to play this role. They brought further high-level expertise in a full range of disciplines relevant to the broad mandate of the Commission, and added an even wider range of perspectives to the Commission's thinking. A number of Advisory Board members (identified by * in the list below) played a dual role as Research Consultants, most participated in at least one Commission meeting (and many in most meetings), and all were consulted at various stages of the Commission's deliberations by the Co-chairs or other commissioners.

The members of the Advisory Board are *Nobuyasu Abe* (Japan)*, UN Under-Secretary-General for Disarmament Affairs 2003–06, Director of the Center for the Promotion of Disarmament and Non-Proliferation of the Japan Institute of International Affairs; *Shlomo Ben-Ami* (Israel), Minister of Foreign Affairs 2000–01, Vice-President of the Toledo International Centre for Peace; *Hans Blix* (Sweden), Director General of the IAEA 1981–97, Executive Chairman of UN Monitoring, Verification and Inspection Commission 2000–03, Chairman, Weapons of Mass Destruction Commission 2006; *Lakhdar Brahimi* (Algeria), Minister of Foreign Affairs 1991–93, UN Under-Secretary-General, Special Representative, Envoy and Adviser 1997–2006; *John Carlson* (Australia), Director General of Australian Safeguards and Non-Proliferation Office since 1989; *Nabil Fahmy* (Egypt), Ambassador of Egypt to the United States 1999–2008, to Japan, 1997–1999, Political Adviser to the Egyptian Foreign Minister, 1992–1997, Founding Dean of the School of Public Affairs at the American University in Cairo, 2009; *Louise Fréchette* (Canada), Deputy Secretary-General of the United Nations 1998–2006, Distinguished Fellow at the Centre for International Governance Innovation; *Lawrence Freedman* (United Kingdom), Professor of War Studies at King's College London since 1982; *Roberto García Moritán* (Argentina), Secretary of Foreign Affairs 2005–2008, President of the Conference on Disarmament 1992, 2009, Member of the Board of the Argentine Atomic Energy Commission; *Han Sung-Joo* (Republic of Korea), Minister of Foreign Affairs 1993–94, Professor Emeritus of International Relations at Korea University, Chairman of the Asian Institute for Policy Studies; *Prasad Kariyawasam* (Sri Lanka), Additional Secretary, Ministry of Foreign Affairs of Sri Lanka 2008–09, Permanent Representative to the United Nations in New York 2005–08 and Geneva 2001–04; *Henry Kissinger* (United States), Secretary of State 1973–77, National Security Advisor 1969–75, Chairman of Kissinger Associates Inc.; *Shunsuke Kondo* (Japan), Chairman of the Japan Atomic Energy Commission since 2004; *Anne Lauvergeon* (France), Chief Executive Officer of AREVA since 1999; *Martine Letts* (Australia)*, former Australian Ambassador, Secretary General of the Australian Red Cross 2001–04, Deputy Director of the Lowy Institute for International Policy; *Patricia Lewis* (Ireland)*, Deputy Director and Scientist-in-Residence at the James Martin Center for Nonproliferation Studies, Monterey, Director of UNIDIR 1997–2008; *Andrea Margelletti* (Italy), Chairman of the Centre for International Studies, Rome; *Sam Nunn* (United States), Senator from Georgia 1972–97, Chairman of the Senate Armed Services Committee 1987–1995, Co-Chairman and CEO of the Nuclear Threat Initiative; *Robert O'Neill* (Australia), Chichele Professor for the History of War at Oxford University 1987–2000, Director of IISS 1982–87, then Council Member and Chairman 1996–2001, Member of the Canberra Commission 1995–96; *George Perkovich* (United States)*, Vice-President of Studies and Director of the Non-Proliferation Program at the Carnegie Endowment for International Peace; *V.R. Raghavan* (India)*, Director General of Military

Operations 1992–94, Adviser, Delhi Policy Group; *George Robertson* (United Kingdom), Secretary of Defence 1997–99, Secretary General of NATO 1999–2004; *Michel Rocard* (France), Prime Minister 1988–91; *Adam Daniel Rotfeld* (Poland), Foreign Minister of Poland 2005, Director of the Stockholm International Peace Research Institute (SIPRI) 1990–2002, Member of the UN Secretary General's Advisory Board on Disarmament Matters since 2008; *Yukio Satoh* (Japan), Permanent Representative of Japan to the United Nations 1998–2002, President of the Japan Institute of International Affairs, 2003–09; *George Shultz* (United States), Secretary of State 1982–89, Distinguished Fellow at the Hoover Institution for War, Revolution and Peace, Stanford University; and *Hans van den Broek* (Netherlands), Minister of Foreign Affairs 1982–1993, European Commissioner for External Relations 1993–1999.

RESEARCH SUPPORT

Rather than seeking to build any substantial in-house research capability, the Commission decided from the outset to draw on existing resources worldwide, with a number of Associated Research Centres – in the event, nine of them – being appointed to lead the effort in their respective countries or regions; a number of members of the Advisory Board (and several Commissioners) contributing substantial papers or drafts on request; and a number of specific pieces of research being commissioned from experts around the world as the need arose (to elaborate particular issues not adequately covered in existing work, to provide alternative views and specific national and regional insights where thought needed, or to provide overviews of existing literature). In all, over 50 pieces of new research were commissioned and most of these papers have been placed on the Commission website, www.icnnd.org. In addition the Commission of course drew extensively on the great body of research already available in the open literature. Former Australian diplomat Ken Berry acted as Research Coordinator for the Commission, pulling all these threads together and himself writing a number of research papers.

The Commission's Associated Research Centres are the *Carnegie Endowment for International Peace*, Washington DC (President: Jessica T. Mathews, Vice President for Studies: George Perkovich) and Moscow (Director, Research Council Chair: Dmitri Trenin); *Centre for International Governance and Innovation*, Waterloo, Canada (Executive Director: Dr John English, Distinguished Fellow in Nuclear Energy: Louise Fréchette); *Delhi Policy Group*, New Delhi (Chairman: Shankar Bajpai, Adviser: Lt.Gen. (Retd.) V.R. Raghavan); *Facultad Latinoamericana de Ciencias Sociales* (FLACSO), San Jose, Costa Rica (Secretary General: Francisco Rojas); *Fondation pour la Recherche Stratégique*, Paris (Directeur: Camille Grand, Conseiller Spécial du Président: François Heisbourg, Maître de recherche: Bruno Tertrais); *Japan Institute of International Affairs,* Tokyo (President: Yoshiji Nogami); *King's College,*

London (Vice-Principal (Research): Professor Sir Lawrence Freedman, War Studies Group); *Lowy Institute for International Policy*, Sydney (Executive Director: Michael Wesley, Deputy Director: Martine Letts, Program Director, International Security: Rory Medcalf); and *Tsinghua University*, Beijing (Director of the Institute of International Studies: Yan Xuetong, Director of the Arms Control Program: Professor Li Bin).

COMMISSION MEETINGS

The Commission met four times from October 2008 to October 2009. The focus of the initial meeting in Sydney from 19 to 21 October 2008 was on the mandate of the Commission, its working methods and the structure and content of reports. The second and third meetings, in Washington DC from 13 to 15 February and Moscow from 19 to 21 June 2009, elaborated a detailed structure for the report and involved a wide-ranging examination of all the issues. In light of those discussions, drafts of different sections of the report were commissioned from a range of experts, including from among the Commissioners, Advisory Board and Secretariat members. A draft prepared by the Co-chairs themselves on the basis of those inputs was reviewed in detail, and a final text was agreed, by the fourth Commission meeting in Hiroshima from 17 to 20 October 2009.

REGIONAL MEETINGS

Working in close association with the relevant Associated Research Centres, the Co-chairs convened Regional Meetings which brought together available Commissioners and Advisory Board members with participants from key regional countries from government, universities and research institutes, and where appropriate the nuclear energy sector. These meetings allowed the Commission to examine regional dimensions of the disarmament and non-proliferation challenge, as well as to gain regional perspectives on global security issues. The Commission also used these meetings to develop a broader base of understanding of and support for the goal of reinvigorating dialogue on the eventual elimination of nuclear weapons. The meetings were conducted under the Chatham House confidentiality rule. Press releases issued before and after the meetings, and transcripts of related press conferences are available at the Commission website, www.icnnd.org, as are full lists of those attending.

- ***Latin America (Santiago, 2–3 May 2009):*** This meeting, chaired by Commission Co-chair Evans, was attended by seven Commissioners and Advisory Board members, and 23 regional representatives involved in nuclear issues from four countries (Argentina, Brazil, Chile and Mexico), the Organization of American States (OAS) and the Argentine-Brazil

Agency for Accounting and Control of Nuclear Materials (ABACC). It considered global and regional aspects of nuclear disarmament, non-proliferation and the safe and secure management of the peaceful uses of nuclear energy. The Commission was briefed on the experience of Latin America with regional non-proliferation arrangements including the nuclear weapon free zone created by the Treaty of Tlatelolco and ABACC, and the supplementary bilateral safeguards arrangement between Argentina and Brazil. The meeting explored the scope for securing the adherence of all Latin American regional countries to the IAEA's Additional Protocol, and the prospects for early entry into force of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) and for commencement of negotiations on a Fissile Material Cut-off Treaty (FMCT). Regional civil nuclear energy plans were also reviewed along with the scope for regional and international approaches to sensitive technology – issues of particular interest in a region such as Latin America with a number of countries with a rapidly growing and sophisticated technological base.

- **North East Asia (Beijing, 22–23 May 2009):** This meeting, jointly chaired by Commission Co-chairs Evans and Kawaguchi, was attended by nine Commissioners and Advisory Board members, and 22 regional representatives from six countries (China, Japan, Republic of Korea, Mongolia, Russia and the United States). North Korea did not accept the Commission's invitation to participate. An intensive interaction with a wide range of experts provided insights into the regional nuclear security dynamic including managing the regional proliferation threat posed by North Korea. The meeting focused on issues of nuclear doctrine: the nature and continuing utility of extended deterrence, and the potential value and credibility of no first use undertakings, sole purpose declarations and negative security assurances. It also considered the implications of missile defence developments, the conditions for China to engage other nuclear weapons states in the process of nuclear disarmament, and the scope for early entry into force of the CTBT and commencement of negotiations on an FMCT. It reviewed regional plans for the expanded use of nuclear energy from an already large base, with various ideas advanced for ensuring that the regional and global expansion of nuclear power use was accompanied by enhanced arrangements for ensuring the exclusively peaceful use of nuclear technology.

- **Middle East (Cairo, 29–30 September 2009):** This meeting, jointly chaired by Commission Co-chairs Evans and Kawaguchi, was attended by ten Commissioners and Advisory Board members, and 24 regional representatives from ten countries (Algeria, Egypt, Iran, Iraq, Israel, Jordan, Morocco, Tunisia, Turkey and the United Arab Emirates) and from the League of Arab States. The meeting considered regional approaches to a range of specific measures: CTBT ratification, resumption of FMCT

negotiations and the prospects for further cuts to existing nuclear weapon arsenals. Many participants welcomed the new undertakings of a number of key countries to revive disarmament processes. The meeting also examined various options for creating a Middle East nuclear weapon, or weapons of mass destruction, free zone and the circumstances that would facilitate commencement of discussions in the region on such an arrangement. Short of nuclear disarmament or achieving universality of the NPT, there was lively debate over the possible shape and potential value of assurances by nuclear weapon states about non-use of nuclear weapons against countries without such weapons. Discussion covered a range of measures being considered to strengthen and universalize international standards. In particular, the meeting reviewed recent regional developments, including Israel's policy of "nuclear opacity" and the challenges posed by Iran's nuclear activities. The contribution of export controls, barriers to the illegal transfer of nuclear technology and materials, and strengthening the IAEA safeguards system were also discussed. The meeting was briefed on various national plans for considering the possible adoption of nuclear power to meet the Middle East's expanding demand for electricity. Cost, safety and security factors were explored, including the potential for multilateral mechanisms to ensure supply while mitigating possible security concerns.

- **South Asia (New Delhi, 3–4 October 2009):** This meeting, jointly chaired by Commission Co-chairs Evans and Kawaguchi, was attended by ten Commissioners and Advisory Board members, and 20 regional representatives from five countries (Bangladesh, India, Nepal, Pakistan and Sri Lanka) and from the UN Regional Centre for Peace and Disarmament in Asia and the Pacific. On disarmament, the meeting reviewed the international agenda as well as regionally specific nuclear security issues, and noted strong linkages between the two. Various views were expressed on the renewed focus of major powers on disarmament, led by the U.S. and Russia. Some participants saw an opportunity for progress in this context. It was broadly recognised that a near term priority was bringing the CTBT into force, and commencing negotiations on an FMCT. Support was expressed for a successful review of the NPT in May 2010. While the NPT had near universal acceptance, it was widely recognised that the contributions of the three states outside the treaty, India, Israel and Pakistan, were vital to global efforts to stem proliferation. Regional security dynamics were analysed along with the scope for confidence building measures. Views were divided on whether regional nuclear arsenals could be contained in the absence of progress in resolving regional tensions. Meeting participants registered strong support for the role of nuclear technology for peaceful purposes and were briefed on the ambitious plans of India and Pakistan for safeguarded

nuclear power, seen as an essential developmental right. In this context the meeting considered how sensitive nuclear activities could be managed to ensure their safety and security.

DIALOGUE WITH CIVIL SOCIETY

In October 2008 the Co-chairs appointed as NGO advisers Akira Kawasaki of Peace Boat Japan and Tilman Ruff of the International Campaign to Abolish Nuclear Weapons of Australia, to ensure that the Commission was fully briefed on the views of civil society and disarmament activists not only in Australia and Japan but globally. A session of the Commission meeting in Moscow was dedicated to hearing and discussing civil society inputs, including a presentation from the Mayor of Hiroshima Tadatoshi Akiba. At its Washington DC meeting, the Commission heard from three atomic bomb victims of Hiroshima and Nagasaki (*hibakusha*). And at its Hiroshima meeting, the Commission had the opportunity to visit the Hiroshima Peace Memorial Museum, participate in some moving welcoming events, hear further *hibakusha* testimony, and engage in a round table meeting with Japanese and international civil society activists and the Mayors of Hiroshima and Nagasaki.

DIALOGUE WITH NUCLEAR INDUSTRY (MOSCOW, 22 JUNE 2009)

Associated with the Commission meeting in Moscow, the Commissioners held a day-long round-table consultation with representatives of the world's nuclear power industry ranging over six continents – in addition to host institutions in Russia, the experts came from firms based in South Africa, Brazil and Argentina, Australia and Japan, Canada and the U.S., and from France and the UK. The Commission explored industry views on measures adopted globally to reduce the threat of the proliferation of nuclear weapons – particularly international inspections and controls on trade in nuclear related equipment and materials. Discussions also covered ideas for enhanced proliferation resistance through the adoption of multilateral fuel cycle facilities and for closer collaboration between industry and government on nuclear issues including the development and promotion of standards. A full list of those participating may be found on the Commission's website, www.icnnd.org/releases/090622_is_cochairs_icnnd_moscow.html.

OTHER CONSULTATIONS

Co-chairs Evans and Kawaguchi and Commissioners have conducted an extensive program of consultations and briefings with a range of governments, international organisations, academics, think tanks and civil society and disarmament activists. In association with formal Commission and Regional Meetings, discussions have been held at head of government or senior ministerial level, or both, with the governments of Australia, the United States, Russia and Japan, and with Chile, China, Egypt and India, and many other bilateral meetings explaining and seeking input and support for the Commission's work have been conducted by the Co-chairs in the course of their respective travels since mid-2008.

Key international institutions briefed by the Co-chairs on the work of the Commission included the Secretary-General of the United Nations and missions accredited to the United Nations in New York; the Conference on Disarmament and accredited missions in Geneva; the Director General of the International Atomic Energy Agency, the Executive Secretary of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization and accredited missions to the United Nations in Vienna.

ADMINISTRATIVE SUPPORT

The work of the Commission was supported by a small Secretariat operating from the International Security Division of the Australian Department of Foreign Affairs and Trade in Canberra, and a parallel unit in the Disarmament, Non-Proliferation and Science Department of the Japanese Ministry of Foreign Affairs in Tokyo.

The Secretary of the Commission, and head of the Australian team, has been Ian Biggs, supported by Melissa Hitchman, Louise Holgate, Leona Landers, John Page and John Tilemann, and a rotating group of graduate assistants, with Ken Berry acting as Research Coordinator. The Australian Secretariat assumed the primary responsibility for organizing Commission meetings (other than in Japan) and Regional Meetings, managing the research program, and arranging for the publication and distribution of this report.

The head of the Japanese team has been Toshio Sano, supported by Yasunari Morino and his successor Hideo Suzuki, Junichiro Otaka and his successor Tomosaburo Esaki, Shigeru Umetsu, Haruna Abe, Shoko Haruki, Koichi Nakamura and Masako Yamashita. Staff of Australian and Japanese Embassies around the world provided additional and much appreciated support to the Secretariats.

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ELIMINATING NUCLEAR THREATS

REPORT OF THE INTERNATIONAL COMMISSION ON NUCLEAR NON-PROLIFERATION AND DISARMAMENT

Eliminating nuclear threats is a matter of necessity, not choice. The world's 23,000 nuclear weapons – many still deployed on high alert – can destroy life on this planet many times over. That the horror of Hiroshima and Nagasaki has not so far been repeated owes far more to luck than to good policy management.

Even with the U.S. and Russia showing welcome new leadership, the policy challenges are immense. Every state with nuclear weapons has to be persuaded to give them up. States without nuclear weapons have to neither want nor be able to acquire them. Terrorists must be stopped from getting anywhere near them. And rapidly expanding peaceful nuclear energy use must be security risk-free.

This report, the work of an independent commission of global experts sponsored by Australia and Japan, seeks to guide global policymakers through this maze. It comprehensively maps both opportunities and obstacles, and shapes its many recommendations into a clearly defined set of short, medium and longer term action agendas.

The tone throughout is analytical, measured and hard-headedly realistic. But the ultimate ideal is never lost sight of: so long as any nuclear weapons remain, the world can never be safe.

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