NUCLEAR WEAPONS: THE STATE OF PLAY 2015

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Centre for Nuclear Non-Proliferation and Disarmament

Crawford School of Public Policy
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PREFACE

Five years ago hopes were high that the world was at last seriously headed towards a world free of nuclear weapons. President Barack Obama's Prague Speech in April 2009 had set the tone, and the United States and Russia were negotiating a new strategic arms reduction treaty (START). The report that year of the International Commission on Nuclear Non-Proliferation and Disarmament (ICNND), following others before it, had set an achievable global agenda, describing in detail all the building blocks that had to be constructed along the way. There was every sign, in the lead-up to the 2010 Non-Proliferation Treaty (NPT) Review Conference, that there would be significant forward movement on the whole disarmament and non-proliferation agenda.

By the end of 2012, however, as reported in our inaugural *State of Play* report, much of this sense of optimism had evaporated. And by the end of 2014, the fading optimism had given way to pessimism. New START was ratified and being implemented, but the treaty left stockpiles intact and disagreements about missile defence and conventional-arms imbalances unresolved, and the crisis in Ukraine has stalled further United States–Russia negotiations, while producing flawed conclusions about the folly of any state giving up its nuclear arsenal. Nuclear weapons numbers have decreased overall but increased in Asia; nuclear-weapons programs in India, Pakistan and China have accelerated.

The cautious initial doctrinal move by Washington towards accepting that the "sole purpose" of nuclear weapons is to respond to nuclear threats, not those of any other kind, has gone nowhere, inhibited by resistance from its more nervous North East Asian and Central and Eastern European allies. North Korea conducted its third nuclear test in early 2013 and the Comprehensive Nuclear Test Ban Treaty (CTBT) is yet to enter into force. The commencement of negotiations on a fissile material production cut-off treaty (FMCT) remains a consensus-free zone.

The outlook for a successful conclusion to the 2015 NPT Review Conference looks grim: there has been no movement on talks towards a nuclear-weapon-free zone in the Middle East, a make or break issue in past conferences, and the nuclear-weapon states have done little to encourage the non-weapon states that they are any more serious about moving towards disarmament than in the past. The world is no closer to resolving the challenge posed by North Korea, and a comprehensive agreement on Iran eluded negotiators by the extended deadline of 24 November 2014, which has now been pushed back to mid-2015. Cyber-threats to nuclear weapons systems have intensified, and outer space remains at risk of nuclearization.

There have been few rays of light to set against the gloom. One has been the modest success of the Washington, Seoul and Hague Nuclear Security Summits in generating some consensus about the need to ensure that nuclear weapons and fissile material do not get into terrorist or other wrong hands, but much remains to be done to implement a fully effective international nuclear security system, setting standards, including

military materials, and with an accountability mechanism – and Russia has declined to participate further in the summit process.

Another positive development has been the emergence of the humanitarian consequences movement, with successive conferences in Norway, Mexico and Austria mobilizing both governments and civil society to focus on the reality that any use of nuclear weapons, the most indiscriminately inhumane ever devised, would have a catastrophic human and environmental impact, beyond the capacity of any state's emergency systems to address. But it remains to be seen whether this movement will be capable of regenerating any of the optimistic momentum which was so evident in 2009. Levels of public engagement on nuclear weapons issues remain low, with the nuclear-armed states under little pressure to justify the claimed security benefits of nuclear deterrence, or to rigorously defend their vast expenditure on nuclear force retention and modernization as an effective use of public money.

A key recommendation of ICNND in 2009 was that, to help build and sustain the necessary momentum for change, a regular "report card" should be published and disseminated among policymakers and those who influence them. The present report is our second effort to implement that recommendation. It describes the progress – or lack of it – on the commitments and recommendations of the 2010 NPT Review Conference; the 2010, 2012 and 2014 Nuclear Security Summits; and the rather higher bars set by the recommendations of the ICNND report itself. While there are some similar publications in existence, or in preparation, aimed at tracking particular sets of recommendations or the performance of particular groups of states, we believe that the present volume and its 2013 predecessor are the most comprehensive of their kind.

The layout of the report should be self-evident, but it should be noted that its two parts are closely inter-related. Part I is intended to be a systematic analytical discussion of all the key issues, grouped into four chapters addressing, respectively, disarmament, non-proliferation, nuclear security and peaceful uses of nuclear energy. Part II then tabulates all the relevant NPT, NSS and ICNND commitments and recommendations, cross-references them to the discussion in the main text, and ranks each on a scale ranging from "No Progress" (red) to "Fully Implemented" (green). The Synopsis which follows this preface is intended to give no more than a quick, broad-brush, overview of our evaluations, area by area – gathering together the general assessments that are made in the "Overview" section introducing each chapter. Necessarily highly condensed, these snapshots should be seen as a quick introductory guide to the much more detailed text which follows, not a substitute for reading it!

Nuclear Weapons: The State of Play 2015 is published by the Centre for Nuclear Non-Proliferation and Disarmament (CNND), part of the Crawford School of Public Policy at The Australian National University (ANU) in Canberra, which was established in 2011. CNND gratefully acknowledge the generous support of the Government of Australia, in particular the Department of Defence; The Australian National University; and The Simons Foundation of Vancouver, Canada.

The Centre's Director is Ramesh Thakur and its Research Director Tanya Ogilvie-White, and Gareth Evans chairs its International Advisory Board, whose other members are former ICNND co-chair Yoriko Kawaguchi (Japan), James Acton (United Kingdom), Alexei Arbatov (Russia), Jayantha Dhanapala (Sri Lanka), Mark Fitzpatrick (United States), Bates Gill (United States), Francois Heisbourg (France), Pervez Hoodbhoy (Pakistan), Patricia Lewis (Ireland), Pan Zhenqiang (China) and Jennifer Allen Simons (Canada).

Nuclear Weapons: The State of Play 2015 was designed and written by the authors, with contributions and assistance from the Centre's part-time staff (John Page and Robert Luton), and consultants John Carlson and the Stockholm International Peace Research Institute (SIPRI). We hope it will advance the global nuclear policy debate by providing an informative and authoritative advocacy tool for governments, organizations and individuals committed to achieving a safer and saner nuclear-weapon-free world.

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Tanya Ogilvie-White
Ramesh Thakur

Canberra
1 January 2015

SYNOPSIS

1. Disarmament

Disarmament Objectives and Strategy [Paras 1.19–33]: Nuclear-armed states pay at best lip-service to the ultimate elimination of nuclear weapons, and none has committed to any "minimization objective," nor to any specific timetable for their major reduction – let alone abolition. On the evidence of the size of their weapons arsenals, fissile material stocks, force modernization plans, stated doctrine and known deployment practices, all nine nuclear-armed states foresee indefinite retention of nuclear weapons and a continuing role for them in their security policies.

No Progress

Disarmament Principles [Paras 1.34–54]: Some nuclear-weapon states (NWS) provide more information about their nuclear weapons than others, but none paints a full picture. The NWS are talking about improving transparency and have honoured their pledge to report against 2010 Non-Proliferation Treaty (NPT) Review Conference disarmament objectives to the 2014 NPT Preparatory Committee. But the reports mostly repeat previously released information.

Some Progress

Nuclear Arms Reductions [Paras 1.55–107]: The global stockpile stands at an estimated 16,372 nuclear weapons. While nearly half of these are earmarked for dismantlement, there is currently little prospect of major further reduction. Significant cuts in Russian and US stockpiles, mainly under previous treaty obligations, have continued, but no agreement on further cuts is likely while geopolitical tensions over Ukraine and divisions over missile defence and conventional weapons remain. France has met the limited disarmament objective it set itself in 2008, and the United Kingdom could complete planned reductions in warhead numbers by the mid-2020s. But elsewhere – in China, India, and Pakistan – nuclear arsenals are growing, and North Korea shows no willingness to reverse its nuclear weapons program.

Some Progress

Nuclear Doctrine [Paras 1.108–47]: There have been no significant publicly declared shifts in nuclear doctrine in recent years. Although US doctrine has given some acknowledgement to President Barack Obama's 2009 undertaking to "reduce the role of nuclear weapons in national security strategy," a 2013 interagency review that examined revised constructs of deterrence and stability took that process no further. India and Pakistan are, if anything, expanding the role of nuclear weapons in their respective national security strategies.

Minimal Progress

Nuclear Force Posture [Paras 1.148–74]: Apart from the reductions in deployed US and Russian strategic weapons under the New START, including through the deMIRVing of US ICBMs, the only significant changes in deployment practices elsewhere have been aimed at enhancing the survivability of nuclear weapons in case of attack. Only very modest progress has been made in reducing the dangerously high launch-alert status of large numbers of US and Russian weapons.

Minimal Progress

Parallel Security Issues [Paras 1.175–227]: Tensions between the United States and Russia and China are rising over ballistic missile defence and an emerging new generation of advanced US conventional weapons, and prospects for progress in conventional arms control have receded. This complicates an already very difficult environment for nuclear disarmament talks. The prospects for movement on regulating weapons in space are slightly more encouraging.

Minimal Progress

Mobilizing Political Will [Paras 1.228–53]: Work done to promote nuclear disarmament has had little impact outside specialist disarmament and non-proliferation circles. The UN Secretary-General's welcome calls to prioritize nuclear arms control and disarmament have so far fallen largely on deaf ears. Civil society organizations, however dedicated and active, have achieved little of the traction needed to put relevant governments under serious political pressure. But the recent new emphasis on the catastrophic humanitarian consequences of nuclear weapons could be a catalyst to a powerful new coalition of like-minded states and civil society actors.

Minimal Progress

2. Non-Proliferation

Safeguards and Verification [Paras 2.36–64]: Some more Comprehensive Safeguards Agreements and Additional Protocols have entered into force but there is still strong resistance by some states to endorsing the Additional Protocol as part of the current safeguards standard. The IAEA's evolving state-level approach to safeguards has been criticized – albeit not compellingly – as discriminatory by some states who want the emphasis to return from an information-driven and detection-focused approach to traditional nuclear material accounting.

Some Progress

Compliance and Enforcement [Paras 2.65–82]: The 2010 NPT Review Conference made no progress on non-compliance and withdrawal issues and little has been made since. Efforts by the five permanent members of the UN Security Council (P5) and Germany to negotiate a resolution of the stand-off with Iran made progress, but not enough to conclude a deal in 2014.

No Progress

IAEA Resources [Paras 2.83–91]: The IAEA's regular budget has seen some modest real growth in recent years but this has not been sustained and the budget is still insufficient to allow the agency to fulfil its responsibilities and to meet the expectations of member states.

Some Progress

Export Controls [Paras 2.92–118]: A growing number of countries are making use of multilateral guidelines in developing national export controls. But the Nuclear Suppliers Group's 2008 decision to exempt India from its comprehensive safeguards requirement, and China's determination to supply more nuclear reactors to Pakistan, have damaged this key mechanism's credibility, and no progress has been made towards adopting a criteria-based approach to cooperation agreements with states outside the NPT.

Some Progress

Nuclear-Weapon-Free Zones [Paras 2.119–45]: No new NWFZs have been established. There has been only modest movement on protocol ratifications. The Middle East NWFZ Conference mandated by the 2010 NPT Review Conference for 2012 was postponed. There has since been some limited progress on arrangements for the conference, but no agreement on holding it, with negative implications for the 2015 Review Conference.

Minimal Progress

Non-NPT Treaties and Mechanisms [Paras 2.146–60]: The Proliferation Security Initiative now has the support of over 100 countries and has helped make illicit weapons of mass destruction (WMD)-related transfers harder. However, despite many attempted constraints, ballistic missile technologies continue to proliferate.

Some Progress

Nuclear Testing [Paras 2.161–74]: Of nine Annex 2 states which had not ratified the Comprehensive Test Ban Treaty (CTBT) in May 2010, including the United States, China, India, Pakistan and Israel, only one, Indonesia, has since done so. That said, voluntary moratoriums on nuclear tests remain in place for all nuclear-armed states except North Korea, which conducted a further nuclear test in 2013 and has threatened more.

Minimal Progress

Fissile Material [Paras 2.175–220]: There has been no progress in beginning negotiations on a global ban on the production of fissile material for nuclear weapons purposes, a central non-proliferation and disarmament policy objective. Significant growth in such production is occurring in the non-NPT nuclear-armed states, but, as with nuclear weapon stockpiles, their total stock is still hugely below that of the five NPT-recognized nuclear-weapon states (NWS). The NWS have not produced highly enriched uranium (HEU) or weapon-grade plutonium for years and the facilities used for these purposes have been either shut down or converted to other uses in at least four of them; the status of facilities in China is unknown. Russia and the United States are reducing excess HEU stocks and have a bilateral surplus plutonium disposition agreement in force.

Minimal Progress

3. Nuclear Security

Global Architecture [Paras 3.32–75]: States have implemented many Nuclear Security Summit (NSS) commitments, additional states have ratified the Convention on the Physical Protection of Nuclear Material (CPPNM) and its Amendment, more are taking advantage of IAEA tools and services, and states have cooperated with one another. However, NPT 2010 and ICNND 2009-recommended support for universal application of the CPPNM and early entry-into-force through the requisite number of ratifications of the 2005 amendment are not in sight. Moreover, much of the architecture lacks any means to judge whether commitments are being met, and no sensitive nuclear materials held anywhere for military purposes – about 85 per cent of the total – are subject to international standards or assurance.

Some Progress

Role of the IAEA [Paras 3.76–100]: The IAEA is continuing to provide a wide range of advisory services and other assistance on nuclear security issues. The centrality of the IAEA's role makes a predictable and stable budget for nuclear security essential.

Some Progress

International Cooperation [Paras 3.101–19]: Significant international cooperation is taking place in detecting and thwarting illicit trafficking, but this needs to be expanded as gaps are identified. States need to commit more fully to cooperation in developing and sharing nuclear security best practices. The 2014 NSS built on earlier progress, but Russia's subsequent decision not to attend the next NSS in 2016, and uncertainties over the future of US–Russia nuclear security cooperation are potentially serious setbacks.

Some Progress

National Regulations [Paras 3.120–23]: UN Security Council Resolution 1540 has played a significant role in this area, resulting in a substantial increase in the number of states with legislative measures to prohibit proliferation of nuclear weapons. But states need to do more to implement and enforce national legislation.

Significant Progress

Sensitive Nuclear Materials: Civilian and Military [Paras 3.124–47]: While progress is being made on minimization of civil HEU use, states have been reluctant to ban outright HEU use in civilian applications. With the partial exception of UNSCR 1540, aimed at securing against access by non-state actors, and some US–Russia bilateral cooperation, no sensitive nuclear materials held anywhere for military purposes are subject to any international standards or assurance.

Some Progress

Nuclear Forensics [Paras 3.148–55]: In addition to significant work going on at the national level in some countries, the IAEA continues to provide assistance with building nuclear forensics capacity in member states, both through its own activities and by teaming with member states to hold workshops and other training.

Some Progress

Role of Nuclear Industry [Paras 3.156–60]: There is general understanding that effective nuclear security is strongly in the interests of the nuclear industry. More work is needed on identifying practical ways in which the nuclear industry and state authorities can work together to improve nuclear security.

Minimal Progress

Nuclear Security and Safety Interface [Paras 3.161–64]: The IAEA in cooperation with member states is providing training and other assistance in this area. A number of training centres have been established which emphasize an integrated approach to nuclear safeguards, safety and security.

Some Progress

Nuclear Security Culture [Paras 3.165–72]: Increasing organizational activity suggests some progress here, but the extent to which a genuine nuclear security culture exists is unclear because of the lack of monitoring and reporting on whether states are implementing best practice standards and recommendations.

Some Progress

4. Peaceful Uses

Nuclear Cooperation [Paras 4.24–48]: NPT 2010 commitments and ICNND 2009 recommendations are generally being met. Assessed funding for technical cooperation has not increased more – though it has increased substantially over the years – but the additional funding provided by a number of states is consistent with the increase called for in the NPT 2010 Action Plan.

Significant Progress

Mitigating Proliferation Risks [Paras 4.49–85]: Most states are meeting their NPT peaceful use commitments, but non-compliance cases – especially Iran and North Korea – are cause for concern. Issues of nuclear latency and hedging are not being addressed. The spread of sensitive nuclear technology and the prospective spread of fast reactors and plutonium fuels in the future will present serious challenges unless addressed. HEU minimization is proceeding, though large quantities of HEU remain in the civil cycle; but no effort has been made to minimize plutonium (as mixed oxide, or "MOX"). The establishment of two fuel banks and the work of the International Framework for Nuclear Energy Cooperation are positive developments, but further elaboration, and acceptance, of multilateral approaches have a long way to go.

Some Progress

Safety and Security Commitments [Paras 4.86–121]: Overall, international standards, transparency and accountability are lacking. Not all states with significant nuclear activities have joined the Convention on Nuclear Safety, and there is a lack of international standards, transparency and accountability. Many states with power reactors remain outside the liability regimes. On nuclear security, many states remain outside the CPPNM, and there are insufficient ratifications/accessions for the amended CPPNM to enter into force.

Some Progress

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The STOCKHOLM INTERNATIONAL PEACE RESEARCH INSTITUTE (SIPRI) is an independent international institute established in 1966 by the Government of Sweden to conduct dedicated research into conflict, armaments, arms control and disarmament. It has built a solid global reputation as an institution that provides impartial and reliable data, analysis and recommendations, based on open sources, to policymakers, researchers, media and the interested public. Its flagship annual yearbook, first published in 1969, is especially useful to both researchers and policymakers around the world as an authoritative compilation of data, trends and analysis. SIPRI cooperates closely with several intergovernmental organizations, in particular the United Nations and the European Union.

ABBREVIATIONS

ABM	anti-ballistic missile
AERB	Atomic Energy Regulatory Board
ANSN	Asian Nuclear Safety Network
AP	Additional Protocol
APLN	Asia Pacific Leadership Network for Nuclear Non-Proliferation and Disarmament
APSN	Asia Pacific Safeguards Network
ASEAN	Association of South East Asian Nations
AU	African Union
BASIC	British–American Security Information Council
BBC	British Broadcasting Corporation
BNFL	British Nuclear Fuels Limited
BWC	Biological Weapons Convention
CD	Conference on Disarmament
CFE	Conventional Armed Forces in Europe
CIRUS	Canadian-Indian Reactor, US
CNS	Convention on Nuclear Safety
CPGS	conventional prompt global strike
CPPNM	Convention on the Physical Protection of Nuclear Material
CSA	Comprehensive Safeguards Agreement
CSC	Convention on Supplementary Compensation for Nuclear Damage
CTBT	Comprehensive Nuclear-Test-Ban Treaty
CTBTO	Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization
CTC	Counter-Terrorism Committee
CTED	Counter-Terrorism Executive Directorate
CTR	Cooperative Threat Reduction (Nunn–Lugar) Program
CW	chemical weapons
CWC	Chemical Weapons Convention
DDPR	Deterrence and Defence Posture Review
DOE	US Department of Energy
DPRK	Democratic People's Republic of Korea
DRDO	Defence Research and Development Organization (India)
EEZ	Exclusive Economic Zones

ELN	European Leadership Network for Multilateral Nuclear Disarmament and Non-Proliferation
EPAA	European Phased Adaptive Approach
EU	European Union
EURATOM	European Atomic Energy Community
FAO	Food and Agriculture Organization
FMCT	Fissile Material Cut-off Treaty
FMWG	Fissile Materials Working Group
FY	Fiscal Year
G8	Group of Eight (industrialized) countries (Canada, France, Germany, Italy, Japan, Russia, United Kingdom, United States)
GC	(IAEA) General Conference
GCSP	Geneva Centre for Security Policy
GFMR	Global Fissile Material Report
GGE	Group of Governmental Experts
GICNT	Global Initiative to Combat Nuclear Terrorism
GIF	Generation IV International Forum
GNEII	Gulf Nuclear Energy Infrastructure Institute
GNEP	Global Nuclear Energy Partnership
GOV	(IAEA) Board of Governors
GSN	Global Security Newswire
GTRI	Global Threat Reduction Initiative
HCOC	Hague Code of Conduct against Ballistic Missile Proliferation
HEU	highly enriched uranium
IAEA	International Atomic Energy Agency
ICAN	International Campaign to Abolish Nuclear Weapons
ICBM	intercontinental ballistic missile
ICJ	International Court of Justice
ICNND	International Commission on Nuclear Non-Proliferation and Disarmament
ICSANT	International Convention for the Suppression of Acts of Nuclear Terrorism
IDSA	Institute for Defence Studies and Analyses (New Delhi)
IFNEC	International Framework for Nuclear Energy Cooperation
IISS	International Institute for Strategic Studies
IMS	International Monitoring System
INF Treaty	Intermediate-Range Nuclear Forces Treaty (1987)
INFCE	International Nuclear Fuel Cycle Evaluation
INFCIRC	Information Circular (from the International Atomic Energy Agency)
INPRO	International Project on Innovative Nuclear Reactors and Fuel Cycles
INSSP	Integrated Nuclear Security Support Plan
INSServ	International Security Advisory Service

INTERPOL	International Criminal Police Organisation
IPCS	Institute of Peace and Conflict Studies (New Delhi)
IPFM	International Panel on Fissile Materials
IPPAS	International Physical Protection Advisory Service
IPPNW	International Physicians for the Prevention of Nuclear War
IRBM	intermediate-range ballistic missile
IRRS	Integrated Regulatory Review Service
ISI	Inter-Services Intelligence (Pakistan)
ISIS	Institute for Science and International Security (Washington, DC)
ISO	International Organization for Standardization
ISSAS	IAEA SSAC Advisory Service
ITDB	Incident and Trafficking Database (formerly the Illicit Trafficking Database Programme)
ITE	International Team of Experts
IUEC	International Uranium Enrichment Centre
KCNA	Korean Central News Agency
LEU	low enriched uranium
MDGs	Millennium Development Goals
MENWFZ	Middle East Nuclear-Weapon-Free Zone
MIRV	multiple independently targetable re-entry vehicle
MNEPR	Multilateral Nuclear Environmental Programme in Russia
MOX	mixed oxide
MPI	Middle Powers Initiative
MRBM	medium-range ballistic missiles
MT	megatonne (one million metric tons)
MTCR	Missile Technology Control Regime
NAM	Non-Aligned Movement
NATO	North Atlantic Treaty Organization
NCNK	National Committee on North Korea
NDA	National Decommissioning Authority (UK)
NFU	no first use (of nuclear weapons)
NGO	non-governmental organization
NNSA	National Nuclear Security Administration (US)
NPDI	Non-Proliferation and Disarmament Initiative
NPR	Nuclear Posture Review
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
NPTREC	NPT Review and Extension Conference
NSA	Negative Security Assurance
NSG	Nuclear Suppliers Group

NSS	Nuclear Security Summit(s)
NTI	Nuclear Threat Initiative
NWC	nuclear weapons convention
NWFZ	nuclear-weapon-free zone
NWS	nuclear-weapon states
OECD	Organisation for Economic Co-operation and Development
OPCW	Organization for the Prohibition of Chemical Weapons
OSCE	Organization for Security Cooperation in Europe
P5	the five permanent members of the United Nations Security Council
PAA	Phased Adaptive Approach
PAL	permissive action link(s)
PAROS	prevention of an arms race in outer space
PMDA	US–Russia Plutonium Management and Disposition Agreement
PNND	Parliamentarians for Nuclear Non-Proliferation and Disarmament
PPRA	US–Russia Plutonium Production Reactor Agreement
PPWT	Treaty on the Prevention of the Placement of Weapons in Outer Space, and the Threat or Use of Force against Outer Space Objects
PrepCom	Preparatory Committee for the next scheduled NPT Review Conference
PSI	Proliferation Security Initiative
RSAC	regional system of accounting for and control of nuclear material
RUSI	Royal United Services Institute (UK)
SIPRI	Stockholm International Peace Research Institute
SLBM	submarine-launched ballistic missile
SLV	satellite launch vehicle
SORT	Strategic Offensive Reductions Treaty
SQP	Small Quantities Protocol
SRBM	short-range ballistic missile
SSAC	state system of accounting for and control of nuclear material
SSBN	nuclear-powered strategic ballistic-missile submarine
SSP	Stockpile Stewardship Program
START	Strategic Arms Reduction Treaty
TCF	Technical Cooperation Fund
TEPCO	Tokyo Electric Power Company
THAAD	Terminal High Altitude Area Defence
TTP	Tehreek-e-Taliban Pakistan
UAE	United Arab Emirates
UAV	unmanned aerial vehicle (drone)
UK	United Kingdom
UN	United Nations

UNEP	United Nations Environment Programme
UNFCC	United Nations Framework Convention on Climate Change
UNODC	United Nations Office on Drugs and Crime
UNSCR	United Nations Security Council Resolution
US	United States
VERTIC	Verification Research, Training and Information Centre
VOA	voluntary offer agreement
WANO	World Association of Nuclear Operators
WHO	World Health Organization
WILPF	Women's International League for Peace and Freedom
WINS	World Institute for Nuclear Security
WMD	weapons of mass destruction
WMDFZ	weapons of mass destruction-free zone

PART I
THE STATE OF PLAY: PROGRESS ON THE ISSUES

1. NUCLEAR DISARMAMENT

§1.1 Overview
§1.2 Objectives and General Strategy
§1.3 Disarmament Principles
§1.4 Reducing Weapons Numbers
§1.5 Nuclear Doctrine
§1.6 Nuclear Force Posture
§1.7 Parallel Security Issues
§1.8 Mobilizing Political Will

§1.1 Overview

1.1 In 2014, unhappily, there were still an estimated 16,372 nuclear warheads distributed among nine nuclear-armed states. More than 90 per cent of these are in Russian and US arsenals. There are many fewer nuclear weapons today than during the Cold War, and the risk of deliberate nuclear weapons use by the United States or Russia may well be negligible. Yet, paradoxically, the overall risks of nuclear war have grown – as more countries in more unstable regions have acquired these deadly weapons, terrorists continue to seek them, and as command and control systems in even the most sophisticated nuclear-armed states remain vulnerable not only to system and human error but, increasingly, to cyber attack. Even a "limited" regional nuclear war could have catastrophic global consequences.

1.2 While the need for total nuclear disarmament is more urgent than ever, its achievement remains little or no closer, both among the nuclear-weapon states (NWS) as defined in the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), viz. China, France, Russia, the United Kingdom and the United States; three nuclear-armed states outside the NPT, viz. India, Israel, and Pakistan; and North Korea, the world's only NPT breakout state. There has been some progress in reducing the overall US and Russian nuclear weapons stockpiles and the number of deployed strategic weapons, and in improving transparency among some NWS. But there has been only minimal progress in shifting nuclear doctrines and postures, and no progress in either taking weapons off high-alert launch status, or in addressing the issues of ballistic missile defence and conventional arms imbalances, differences over which are presently seriously inhibiting further disarmament movement. In 2014 the Russia–West stand-off over the crisis in Ukraine made early progress in the nuclear arms control agenda even less likely.

And, despite the efforts of many dedicated non-governmental organizations (NGOs) and research centres, the cause of nuclear disarmament has achieved very little of the civil society traction needed to put governments under serious political pressure.

1.3 **Objectives and General Strategy**. Derived from the language of the NPT itself, NPT Review Conference outcomes, and the recommendations of blue-ribbon international panels like the International Commission on Nuclear Non-Proliferation and Disarmament (ICNND), these might be described as:

- Rapid movement towards a major overall reduction in the global stockpile of all types of nuclear weapons;
- Such reduction to be accompanied, and assisted, by moves to further delegitimize nuclear weapons, reduce their role and significance in military doctrine and strategy, and dramatically curtail their operational deployment;
- The major reduction of nuclear weapons stockpiles to be followed as soon as possible thereafter by their complete elimination; and
- The disarmament process throughout to be irreversible, verifiable and transparent.

1.4 Such progress as there has been on specific issues – on reducing weapons numbers, curtailing their operational deployment, reducing their doctrinal salience, and on achieving acceptance of the principles of irreversibility, verifiability and transparency – is summarized in the following paragraphs and discussed in detail in the remaining sections of this chapter. As to the overall picture, progress in winning acceptance in practice from the nuclear-armed states for a two-phase objective – rapid major reduction followed by complete elimination – can be described as non-existent.

1.5 While nuclear disarmament continues to be very strongly supported by the overwhelming majority of non-nuclear-armed states, it remains for every nuclear-armed state at best an open-ended, incremental process, with broad and indeterminate links to global and regional stability. There is no appetite for a multilateral nuclear disarmament process and no disposition on the part of the NWS to discuss nuclear disarmament timelines. All nine nuclear-armed states have long-term nuclear-weapons system modernization programs under development and in progress. Based on current arsenals, deployments and force postures, and on planned expansions, upgrades and modernization, every nuclear-armed state is committed to the indefinite retention of significant nuclear-weapon capability.

Overall Evaluation of Acceptance of Disarmament Objectives and Strategy: **No Progress.** Nuclear-armed states pay at best lip-service to the ultimate elimination of nuclear weapons, and none has committed to any "minimization objective," nor to any specific timetable for their major reduction – let alone abolition. On the evidence of the size of their weapons arsenals, fissile material stocks, force modernization plans, stated doctrine and known deployment practices, all nine nuclear-armed states foresee indefinite retention of nuclear weapons and a continuing role for them in their national security policies.

1.6 **Disarmament Principles.** Of the five NWS, only the United States publishes official figures on aggregate warhead numbers (most recently on 1 October 2014). Consistent with the new Strategic Arms Reduction Treaty (New START) provisions, both Russia and the United States declare the number of deployed strategic warheads and deployed and non-deployed launchers captured by the treaty; but Russia does not release data on the overall size of its arsenal or the number of non-strategic weapons. France and the United Kingdom have provided information on stockpile ceilings. China and the non-NPT nuclear-armed states provide no information on the size and composition of their nuclear weapons inventories. Only the United States has provided figures for warhead dismantlement (most recently on 29 April 2014).

1.7 The NWS meet periodically to discuss nuclear weapons issues, giving particular attention to issues of "transparency, mutual confidence and verification," and have given at least initial consideration to a standard disarmament reporting form. While four of the five NWS (China is the exception) have taken steps in recent years to reduce the size of their nuclear arsenals, only the United States and Russia have international (in their case, bilateral) verification measures in place.

> *Overall Evaluation of Disarmament Principles:* **Some Progress.** Some NWS provide more information about their nuclear weapons than others, but none paints a full picture. The NWS are talking about improving transparency and have honoured their pledge to report against 2010 NPT Review Conference disarmament objectives to the 2014 NPT PrepCom. But the reports mostly repeat previously released information.

1.8 **Reduced Numbers of Nuclear Weapons.** The overall global stockpile in 2014 is assessed in this report as 16,372, which represents a further drawdown from the just under 18,000 we reported for 2012. While there has been a continuing reduction in United States and Russian stockpiles under the older bilateral START and SORT (Strategic Offensive Reductions) treaties, and some additional unilateral reductions by both these powers associated with the ageing of weapons stocks, reductions by other nuclear-armed states have either been modest (in the case of France and the United Kingdom), non-existent, or negative (in the sense that stocks have increased).

1.9 Although it does not affect the size of the total stockpile of existing weapons, the New START Treaty is on track to reduce significantly the number of strategic weapons deployed by the United States and Russia by 2018, from 2,200 to 1,550 weapons apiece. Assuming that these cuts are implemented by the 2018 deadline, the United States and Russia will find it hard to reach agreement on further cuts while divisions over the US development of ballistic missile defence and long-range conventional strike capability, and the geopolitical tensions in Ukraine, remain. China, too, believes "global" missile defence to be detrimental to the strategic balance and to prospects for nuclear disarmament. It seems that the more confident the United States becomes of the superiority of its conventional weapons, and of the efficiency of its anti-missile systems, the more reluctant Russia and China are likely to be to negotiate serious nuclear arms reductions.

1.10 In 2013 France met the objective, set in 2008, to reduce by one-third its nuclear deterrent's airborne component, and the United Kingdom expects its planned reduction in nuclear warhead numbers from 225 to 180 to be completed by the mid-2020s. But the nuclear arsenals of India, Pakistan and China meanwhile continue to grow, albeit modestly in terms of absolute numbers, and North Korea has also made clear its intention to expand, not dismantle, its small nuclear weapons stockpile.

> *Overall Evaluation of Nuclear Arms Reductions:* **Some Progress.** The global stockpile stands at 16,372 nuclear weapons. While nearly half of these are earmarked for dismantlement, there is currently little prospect of major further reduction. Significant cuts in Russian and US stockpiles, mainly under previous treaty obligations, have continued, but no agreement on further cuts is likely in the foreseeable future while geopolitical tensions over Ukraine and divisions over missile defence and conventional weapons remain. France has met the limited disarmament objective it set itself in 2008 and the United Kingdom is scheduled to complete planned reductions in warhead numbers by the mid-2020s. But elsewhere – in China, India, and Pakistan – nuclear arsenals are growing.

1.11 **Nuclear Doctrine.** There have been no significant publicly declared shifts in nuclear doctrine since the 2010 NPT Review Conference. Of the five NWS, only China is publicly committed to no first use of nuclear weapons. Of the other nuclear-armed states, only India has made a similar (albeit more qualified) commitment.

1.12 In its 2010 Nuclear Posture Review (NPR) the United States took some modest steps towards advancing the undertaking given by President Barack Obama in Prague in April 2009 to "reduce the role of nuclear weapons in [US] national security strategy": while "not prepared at the present time to adopt a universal policy that deterring nuclear attack is the sole purpose of nuclear weapons…[the United States] will work to establish conditions under which such a policy could be safely adopted." The "new guidance on US nuclear strategy," released in June 2013, did not alter the nuclear doctrine set out in the 2010 NPR.

1.13 NATO, at its Chicago Summit in May 2012, again affirmed its commitment to extended deterrence by declaring that "the strategic nuclear forces of the Alliance, particularly those of the United States" are the "supreme guarantee" of its security. This language was repeated in the 2014 Wales Summit Declaration, although it was acknowledged that "the circumstances in which any use of nuclear weapons might have to be contemplated are extremely remote."

1.14 Negative security assurances – not to use or threaten to use nuclear weapons against non-nuclear-armed states – remain unequivocal and unconditional again only in the case of China.

Overall Evaluation of Nuclear Doctrine: **Minimal Progress.** There have been no significant publicly declared shifts in nuclear doctrine in recent years. Although US doctrine has given some acknowledgement to President Obama's 2009 undertaking to "reduce the role of nuclear weapons in national security strategy," an interagency review that examined revised constructs of deterrence and stability took that process no further. India and Pakistan are, if anything, expanding the role of nuclear weapons in their respective national security strategies.

1.15 **Nuclear Force Posture.** While the New START treaty will bring significant reductions in the number of strategic weapons deployed by Russia and the United States, no risk-reducing changes have occurred in the deployment by either of non-strategic weapons. Such changes as have occurred or been foreshadowed in the disposition of their warheads by other nuclear-armed states, including a gradual shift towards land-mobile and sea-based weapons, appear to have been aimed at enhancing their survivability in the face of attack. This raises issues of attenuated command and control and adds to the risks of accidental and unauthorized use. China is actively modernizing the delivery systems of its nuclear triad, and India and Pakistan are also firmly on this path. The United States and Russia, alone among the nuclear-armed states, continue to keep most of their deployed intercontinental ballistic missiles (ICBMs), and in the case of the United States a majority of their submarine-launched ballistic missiles (SLBMs), on very high alert – meaning a dangerously short launch-decision time requirement of just a few minutes. More than 1,800 nuclear weapons are kept in a state of high operational alert: 920 US and 890 Russian warheads.

Overall Evaluation of Nuclear Force Posture: **Minimal Progress.** Apart from the reductions in deployed US and Russian strategic weapons under New START, including through the deMIRVing of US ICBMs, the only significant changes in deployment practice elsewhere have been aimed at enhancing the survivability of nuclear weapons in case of attack. Only very modest progress has been made in reducing the dangerously high launch-alert states of large numbers of US and Russian weapons.

1.16 **Parallel Security Issues.** Russia has taken strong exception to the planned deployment of US ballistic missile defence to Europe, interpreting it as a threat to its deterrent capability. Tensions are also rising in US relations with China over ballistic missile defence in Asia. The development of conventional prompt global strike (CPGS) weapons has also been complicating the environment for nuclear disarmament talks. There is little sign of any movement on new conventional arms control measures, but efforts to break the deadlock on regulating weapons in space show some promise, including a new draft treaty text from China and Russia on the Prevention of the Placement of Weapons in Outer Space, and the Threat or Use of Force against Outer Space Objects (PPWT), and diplomatic initiatives by the European Union and the UN Group of Governmental Experts.

Overall Evaluation of Parallel Security Issues: **Minimal Progress.** Tensions between the United States and Russia and China are rising over ballistic missile defence, and an emerging new generation of advanced US conventional weapons, and prospects for progress in conventional arms control have receded. This complicates an already very difficult environment for nuclear disarmament talks. The prospects for movement on regulating weapons in space are slightly more encouraging.

1.17 **Mobilizing Political Will.** The global strategic environment has deteriorated since 2010, especially sharply in 2014 because of events in Ukraine; Russia has reacted strongly to planned US missile defence deployments in Europe; Russia and the United States have both stepped back from earlier signs of willingness to return to conventional arms control talks; US–China security relations have similarly cooled, with implications both for strategic nuclear disarmament and prospects for non-proliferation and disarmament in North Korea; nuclear weapons arsenals are growing in Asia; proliferation pressures are increasing; and the risk of accident or miscalculation leading to a nuclear exchange is undiminished. Nuclear-armed states are not ready to negotiate a nuclear weapons convention and believe that, without them, negotiations would be meaningless. An annual resolution calling for the negotiation of such a convention is nonetheless supported by some two-thirds of the UN membership.

1.18 That said, nuclear disarmament and the possibility of nuclear war are not currently prominent public issues anywhere. Governments have been under no real pressure to respond to expressions of popular concern because truly popular concern barely exists. Despite the efforts of many dedicated NGOs and research centres, the cause of nuclear disarmament has in recent years achieved very little traction. But the new focus on the catastrophic humanitarian consequences of a nuclear detonation, and the lack of individual and collective state capacity to cope with them, accompanied by strong advocacy from a growing number of states in the UN General Assembly First (Disarmament) Committee and elsewhere, could be the catalyst for significant new civil society and political mobilization.

Overall Evaluation of Mobilizing Political Will: **Minimal Progress.** Work done to promote nuclear disarmament has had little impact outside specialist disarmament and non-proliferation circles. The UN Secretary-General's welcome calls to prioritize nuclear arms control and disarmament have so far fallen largely on deaf ears. Civil society organizations, however dedicated and active, have achieved little of the traction needed to put relevant governments under serious political pressure. But the recent new emphasis on the catastrophic humanitarian consequences of nuclear weapons could be a catalyst to a powerful new coalition of like-minded states and civil society actors.

§1.2 Objectives and General Strategy

1.19 The NPT, which was signed in 1968 and entered into force on 5 March 1970, contains the only global treaty-level commitment to nuclear disarmament. Article VI requires each of the parties to the treaty to undertake "to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control." The formulation is weak and the link to "general and complete disarmament" unhelpful and unrealistic, but it would be a mistake to underestimate the contemporary normative force of Article VI and the expectations of the international community, which have been clarified and strengthened in subsequent reaffirmations.

1.20 The 1995 NPT Review and Extension Conference made clear, for example, that the five NWS bore the primary responsibility for nuclear disarmament and that they were expected to take "systematic and progressive steps" to this end;[1] while the International Court of Justice (ICJ), in its July 1996 advisory opinion on the question concerning the legality of the threat or use of nuclear weapons concluded, inter alia, that there "exists an obligation to pursue in good faith *and to bring to a conclusion* negotiations leading to nuclear disarmament in all its aspects under strict and effective international control" (emphasis added).[2]

1.21 The eighth NPT Review Conference (May 2010), buoyed particularly by positive US re-engagement in multilateral disarmament diplomacy, reaffirmed the largely unrealized aspirations of previous years. The NWS promised to accelerate "concrete progress on the steps leading to nuclear disarmament" and, to this end, were called upon "to promptly engage" with a view to rapidly moving towards an overall reduction in the global stockpile of all types of nuclear weapons; further diminishing the role and significance of nuclear weapons in military doctrine and strategy; reducing the operational status of nuclear weapons in ways that promote international stability and security; and further enhancing transparency and mutual confidence.

1.22 The 2010 NPT Review Conference took place against the backdrop of a major speech in Prague in April 2009 in which then newly-elected US President Barack Obama pledged the United States "to seek the peace and security of a world without nuclear weapons" and to "reduce the role of nuclear weapons in [its] national security strategy." He promised, and delivered, a new Strategic Arms Reduction Treaty (New START) with the Russians; and foreshadowed further cuts in nuclear arsenals which, he hoped, would include all the NWS. He also undertook "immediately and aggressively" to pursue US ratification of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) and to support the negotiation of a fissile material cut-off treaty (FMCT).[3] Later in the year, President Obama chaired a United Nations Security Council session which unanimously adopted US-sponsored Resolution 1887 "to create the conditions for a world without nuclear weapons" (S/RES/1887, 24 September 2009).

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1. http://disarmament.un.org/wmd/npt/1995dec2.htm – NPT/CONF.1995/32 (Part I), Annex.
2. Summaries of Judgments, Advisory Opinions and Orders of the International Court of Justice, *Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion of 8 July 1996. The added emphasis indicates how the ICJ opinion interpreted and strengthened the article VI obligation.
3. Remarks by President Barack Obama, Hradcany Square, Prague, 5 April 2009; www.whitehouse.gov.

1.23 Over the years, a number of international commissions[4] have drawn very similar conclusions about the all-encompassing nature of the threat posed by nuclear weapons, their dubious utility, and the steps needed to get rid of them. The ICNND report, published shortly before the 2010 NPT Review Conference, introduced a number of new, including time-bound, elements to the nuclear disarmament agenda. It argued for the delegitimization of the role of nuclear weapons and for a two-phase approach to their elimination, recommending that "minimization" be achieved between 2012 and 2025, and "elimination" as soon as possible thereafter. The ICNND took the view that, given the myriad of difficult political, security and technical verification and enforcement issues that remained to be resolved before any state would be prepared to give up its last nuclear weapons, it would not be credible, and might well be counterproductive, to identify now a specific target date for abolition.

1.24 The ICNND's "minimization point," to be achieved by 2025 at the latest, would be characterized by:

- Low numbers: a global total of no more than 2,000 nuclear warheads, with the United States and Russia reducing to a total of 500 nuclear weapons each, and with at least no increase (and desirably significant reductions) in the arsenals of the other nuclear-armed states;
- Agreed doctrine: every nuclear-armed state committed to no first use of nuclear weapons (on the basis that their sole remaining purpose is to deter the use of nuclear weapons by others); and
- Credible force postures: verifiable deployments and alert status reflecting that doctrine.[5]

1.25 The ICNND Report emphasized the need to incorporate *all* the nuclear-armed states, not just the NPT nuclear-weapon states, in a fully inclusive nuclear disarmament process.[6] It called on the NWS to reaffirm their unequivocal commitment to nuclear disarmament (which they did, at the 2010 NPT Review Conference), and for the non-NPT nuclear-armed states to accept similar undertakings towards the eventual elimination of their nuclear arsenals, and the universal and binding nature of the norms against testing, acquisition and use or threat of use of nuclear weapons other than for defence against nuclear attack.[7] It also encouraged all nuclear-armed states to accept, and to announce as soon as possible, a diminishing role for nuclear weapons in their security policies and to make appropriate preparations for a multilateral disarmament process.

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4. The Canberra Commission on the Elimination of Nuclear Weapons, 1996; the Tokyo Forum for Nuclear Non-Proliferation and Disarmament, 1999; the UN Secretary-General's High-level Panel on Threats, Challenges and Change, 2004; and the Weapons of Mass Destruction (Blix) Commission, 2006.

5. ICNND (Gareth Evans and Yoriko Kawaguchi co-chairs), *Eliminating Nuclear Threats: A Practical Agenda for Global Policymakers*. Report of the International Commission on Nuclear Non-Proliferation and Disarmament (Canberra and Tokyo: ICNND, 2009), pp. 72–78.

6. For an update of the argument, see John Carlson, "Challenges and Opportunities for Extending NPT-Related Commitments to the Non-NPT States," APLN/CNND *Policy Brief* No. 15 (Canberra: Centre for Nuclear Non-Proliferation and Disarmament, September 2014), https://cnnd.crawford.anu.edu.au/sites/default/files/publication/cnnd_crawford_anu_edu_au/2014-10/policy_brief_no_15_-_challenges_and_opportunities_for_extending_npt-related_commitments_to_the_non-npt_states.pdf.

7. ICNND, *Eliminating Nuclear Threats*, p. 153.

1.26 In 2009 the worldwide campaign organization, Global Zero, launched a four-phase Action Plan, much more ambitious than ICNND's, setting 2023 as the target date for negotiating a legally binding international agreement, signed by all nuclear-capable countries, that would lead to the phased, verified and proportionate reduction of all nuclear arsenals, with complete dismantlement of all the world's nuclear weapons to be achieved by 2030.[8] Part of the plan called for the United States and Russia to negotiate bilaterally to achieve reductions of their stockpiles to 1,000 weapons each by 2018 and, in a wider multilateral context, to achieve further reductions to 500 each by 2021.

1.27 The credibility of the argument of both ICNND and Global Zero that, with the appropriate political will, a massive reduction in global arsenals could be achieved by the early 2020s (however long it might take thereafter to get to zero) was reinforced by a 2012 study done for Global Zero by a panel under the leadership of retired US General James Cartwright, the former Vice Chairman of the Joint Chiefs of Staff, and including then-Senator Chuck Hagel.[9] This recommended a dramatic drawdown over one decade of US and Russian nuclear forces to 900 total nuclear weapons (including both strategic and non-strategic) each, divided equally between deployed (450) and held in reserve on de-alerted status (450). For the United States, the total would consist of 360 strategic missile warheads deployed on ten ballistic missile submarines and 360 held in reserve; plus 18 B52 bombers armed with 90 deployed gravity bombs and 90 held in reserve. All US land-based ICBMs would be completely dismantled. Stocks in reserve could be regenerated to launch readiness within 24–72 hours for offensive strikes. The alternative deterrence construct would thus require a robust command, control, communications and early warning system that can withstand the shock of the initial strike and manage the transition to regenerated nuclear forces.

1.28 The Cartwright study argued that once the two major nuclear powers had reduced their arsenals to these levels, China could be drawn into the negotiations followed by the other nuclear-armed states. Dialogue with China could begin with information sharing on numbers, types and locations of nuclear stocks as laying the groundwork for drawing Beijing into the formal arms control talks.[10] With each new entrant into the multilateral arms control negotiations, it would become progressively more difficult for the remainder to stay outside the process.

1.29 The study described bilateral drawdown by the United States and Russia to 900 weapons each as being wholly consistent with the maintenance of a full deterrence – and extended deterrence – posture, and as being desirable and possible for five reasons:

- Mutual nuclear deterrence is no longer a cornerstone of the bilateral US–Russia relationship;
- Nuclear weapons are irrelevant to a broad range of contemporary threats – rogue and failed states, terrorism, organized crime and drug trafficking, conflict and environmental refugees, climate change and the like;

8. Global Zero Action Plan, http://www.globalzero.org/files/pdf/gzap_3.0.pdf.
9. James Cartwright, et al., *Modernizing U.S. Nuclear Strategy, Force Structure and Posture*. Global Zero U.S. Nuclear Policy Commission Report (Washington DC: Global Zero, 2012), www.globalzero.org/en/us-nuclear-policy-commission-report.
10. Cartwright, et al., *Modernizing U.S. Nuclear Strategy*, p. 4.

- Only deep reductions in the nuclear arsenals to the levels of the other nuclear-armed states will remedy a basic deficiency in the framework of nuclear arms talks, namely the exclusion of the rest;
- At a time of economic stagnation and in a fiscally constrained environment, it seems irrational to spend in excess of $1 trillion per decade on producing and maintaining nuclear weapons (Table 1.1) and mitigating their health and environmental consequences; and
- The launch-ready nuclear postures of Russia and the United States are very high-risk (see §1.6 below).[11]

Table 1.1: Military and Nuclear Weapons Expenditures (US $ bn, 2013 (military) and 2010 (nuclear weapons) exchange rates)

	Total Military Spending (2013)	Nuclear Weapons (2011, estimated)*	
		Core Costs	Full Cost
USA	640	34.0	61.3
Russia	[87.8]	9.8	14.8
China	[188]	6.4	7.6
France	61.2	4.7	6.0
UK	57.9	4.5	5.5
India	47.4	3.8	4.9
Israel	[16]	1.5	1.9
Pakistan	7.6	1.8	2.2
North Korea	-	0.5	0.7
Total	**1105.9**	**67.0**	**104.9**

* Latest estimates available on http://www.globalzero.org/files/gz_nuclear_weapons_cost_study.pdf.

Sources:

SIPRI Fact Sheet 2014: Trends in World Military Expenditure 2013, http://books.sipri.org/product_info?c_product_id=476#

SIPRI Yearbook 2014: Armaments, Disarmament and International Security, pp. 229ff.

1.30 Even these greatly reduced numbers may be surplus to any conceivable military need. A study in 2010 by Colonel B. Chance Saltzman, Chief of Strategic Plan and Policy Division at US Air Force Headquarters and his colleagues – none of them believers in nuclear elimination – came to the dramatic conclusion that the United States could meet all its perceived national security and extended deterrence requirements with just 311 nuclear weapons: 192 single-warhead submarine launched ballistic missiles (SLBMs), hard to detect and highly survivable and accurate, aboard 12 Ohio class submarines, each of which can hold 24 missiles; 100 single-warhead intercontinental ballistic missiles (ICBMs); and 19 air-launched cruise missiles aboard stealth B-2 bombers.[12]

11. Cartwright, et al., *Modernizing U.S. Nuclear Strategy*, pp. 1–5.
12. James Wood Forsyth, B. Chance Saltzman, and Gary Schaub, "Remembrance of Things Past: The Enduring Value of Nuclear Weapons," *Strategic Studies Quarterly* 1 (Spring 2010), pp. 74–89.

Whether Russia followed suit or not is irrelevant. A substantial numerical superiority in nuclear warhead stockpiles is of no military-operational consequence, although it could have political-psychological effects.

1.31 CNND suggests that the overall objectives and strategy that the international community should be pursuing in relation to nuclear disarmament might realistically be described as:

- Rapid movement towards a major overall reduction in the nuclear warhead numbers of Russia and the United States who hold 93 per cent of global stockpiles;
- An immediate freeze in the stockpiles of the Asian nuclear-armed states, the only countries presently still increasing their nuclear arsenals;
- Such reduction and freeze to be accompanied, and assisted, by moves to further delegitimize nuclear weapons, reduce their role and significance in military doctrine and strategy, and dramatically curtail their operational deployment;
- The major reduction of nuclear weapons stockpiles to be followed as soon as possible thereafter by their complete elimination; and
- The disarmament process throughout to be irreversible, verifiable, and transparent.

1.32 The unhappy reality is that by the end of 2014 very little progress has been made towards realizing any of these broad objectives. The optimism and energy that marked the year leading up to the 2010 NPT Review Conference have largely evaporated. Currently there is little appetite for further US–Russian nuclear arms reduction negotiations and none for a multilateral nuclear disarmament process; no inclination to embrace no first use or sole purpose doctrine on the part of nuclear-armed states that have not already done so; no willingness on the part of Russia and the United States to lower the launch alert status of their ballistic missiles; and no sign of any agreement on issues like ballistic missile defence and perceived conventional force imbalances which are seen as inhibiting further disarmament progress.

1.33 Specific questions relating to progress, or lack of it, on disarmament principles, reducing weapons numbers, nuclear doctrine, nuclear force posture and parallel security issues like ballistic missile defence and outer space are addressed in the following sections. For present purposes, the important point is that no visible progress has been made in extracting any kind of serious practical commitment to complete disarmament, or even to any kind of "minimization" target. There has been no disposition on the part of any NWS or other nuclear-armed states to discuss nuclear disarmament timelines of any kind – either modest, like the ICNND and Cartwright studies, or highly ambitious, like Global Zero's 2030 abolition target. All nuclear-armed states have long-term nuclear weapons system modernization programs under development and in progress. Based on current arsenals, deployments and force postures, and on planned expansions, upgrades and modernization, every one of them is committed to the indefinite retention of significant nuclear-weapon capability.

§1.3 Disarmament Principles

1.3.1 Irreversibility

1.34 The 2010 NPT Review Conference committed all states "to apply the principles of irreversibility, verifiability and transparency in relation to the implementation of their treaty obligations" (Action 2). The concept of "irreversible nuclear disarmament" first seems to have been used in the framework of efforts to denuclearize the Korean peninsula. However, the term entered the multilateral disarmament lexicon after it was incorporated into the 13 practical steps towards nuclear disarmament elaborated at the 2000 NPT Review Conference. While the term was used in this context, it was not defined and there does not seem to be general agreement on what it means. The recollections of participants at the 2000 NPT Review Conference suggest that the expression should probably be interpreted in a broad manner and seen as a series of measures that, taken together, can reduce the likelihood of backsliding on agreed commitments.

1.35 Irreversible nuclear disarmament is here understood to encompass warhead dismantlement, the removal from nuclear weapons programs of fissile material no longer required for military purposes, and the decommissioning and dismantling of weapon-grade fissile material production plants. Fissile material production and disposition are covered in Chapter 2, although it may be noted here that four of the five NWS have declared an end to the production of fissile material for weapons purposes; and the exception, China, is thought not to have produced such material for more than two decades. Russia, the United Kingdom and the United States have each declared some weapon-grade fissile material excess to defence requirements. Non-NPT states India, Pakistan and North Korea all continue to produce fissile material for nuclear weapons; and Israel may do so. France, the United Kingdom and the United States have closed and are in the process of decommissioning their fissile material production facilities. In 2008, France invited international experts to observe the dismantlement of its facilities at Marcoule and Pierrelatte.

1.36 China and France provide no information on warhead dismantlement. The United Kingdom has recently released some information, in response to Freedom of Information requests to show that nuclear warheads are being disassembled (in a way that prevents them being reassembled) at the Atomic Weapons Establishment in Burghfield, Berkshire at a rate of three per year.[13] Russia is dismantling retired warheads but provides no details of this activity. It currently has two operating nuclear weapon assembly/dismantlement plants, at Lesnoy (formerly Sverdlovsk-45) and Trekhgorny (Zlatoust-36).[14]

1.37 From 1994 through 2013, the United States dismantled 9,952 nuclear warheads – an 85 per cent reduction since the peak number of 31,255 warheads at the end of fiscal year 1967. Since 30 September 2009, the US has dismantled 1,204 nuclear warheads. The number of US non-strategic nuclear weapons has fallen by around 90 per cent since

13. Rob Edwards, "UK Nuclear Weapons Being Dismantled Under Disarmament Obligations," *Guardian*, 12 August 2013.
14. International Panel on Fissile Materials (IPFM), *Global Fissile Material Report 2011*, p. 5, www.fissilematerials.org.

30 September 1991. The Fact Sheet adds: "Several thousand additional nuclear weapons are currently retired and awaiting dismantlement."[15]

1.3.2 Transparency

1.38 Transparency in this context refers to the willingness of a state to voluntarily expose credible information about its strategic aims, intentions, doctrines and current and prospective nuclear weapon capabilities and deployments. Transparency in relation to nuclear weapons doctrine, numbers and deployment can promote reciprocity and boost mutual confidence, and is a necessary condition for serious disarmament negotiations.

1.39 Public statements of the intent to pursue total elimination of nuclear weapons are hedged with so many caveats and qualifications as to render them meaningless in practice. Seven of the nine nuclear-armed states have at various times published statements of doctrine. None of them has said explicitly, however, when and how its nuclear weapons would be used. Of the exceptions (North Korea and Israel) little can be said. Israel shows no sign of relaxing its policy of nuclear opacity, while North Korea's periodic warnings of nuclear annihilation would appear to signal a willingness to use nuclear weapons against its enemies, real or imagined.

1.40 China provides no details of the size, composition and deployment of its nuclear arsenal. It claims that, given the small size and limited capabilities of that arsenal, it needs to rely relatively more than Russia and the United States on secrecy with respect to the survivability of its nuclear arsenal, infrastructure and national command authority. Chinese leaders and experts appear to believe that, with a small stockpile, transparency is the enemy of confidence in survivability and retaliatory capability.

1.41 France has declared a stockpile ceiling of less than 300 operational nuclear warheads, with no warheads in reserve.[16] The United Kingdom has gone further, announcing revised target ceilings for its stockpile and the number of operationally available warheads, including the number of warheads deployed on each submarine.

1.42 Consistent with New START Treaty provisions, Russia and the United States declare numbers of deployed strategic warheads and deployed and non-deployed launchers covered by the treaty. The United States has also published (most recently as of 1 April 2014) an aggregate figure for its nuclear weapons stockpile.[17] Russia does not release data on the overall size of its arsenal, including warheads in reserve, or on the number of non-strategic weapons.[18]

1.43 Neither India nor Pakistan provides details of the size, composition and deployment of its nuclear arsenal. At a 2012 conference at the Institute of World Economy and International Relations in Moscow, Russian experts advised India and Pakistan to do

15. *Fact Sheet: Transparency in the U.S. Nuclear Weapons Stockpile*, 29 April 2014, www.state.gov/documents/organization/225555.pdf.
16. http://www.francetnp. fr/spip. php?article94.
17. http://www.state.gov/documents/organization/224449.pdf.
18. Gaukhar Mukhatzhanova, *Implementation of the Conclusions And Recommendations for Follow-On Actions Adopted at the 2010 NPT Review Conference Disarmament Actions 1–22: Monitoring Report* (Monterey, CA: James Martin Center for Nonproliferation Studies, Monterey Institute of International Studies, April 2012), p. 18.

more to enhance mutual transparency and set up verification mechanisms to build on confidence-building measures already agreed to, like the commitment not to attack each other's civil nuclear installations. When the Indian participants responded that the Russians needed a reality check because of the prevailing levels of distrust between India and Pakistan, they were reminded that the trust divide was just as stark between Moscow and Washington when they began their nuclear arms talks in the 1970s.[19]

1.44 Israel does not admit to the possession of nuclear weapons. North Korea provides no details of the number, composition and deployment of its nuclear weapons.

1.45 The 2010 NPT Review Conference encouraged states parties to "submit regular reports" on implementation of the conference action plan and previous commitments (Action 20); and encouraged NWS "to agree as soon as possible on a standard reporting form and to determine appropriate reporting intervals for the purpose of voluntarily providing standard information without prejudice to national security" (Action 21). At the same time, the UN Secretary-General was "invited to establish a publicly-accessible repository" to include information provided by the NWS.

1.46 The twelve-nation (Australia, Canada, Chile, Germany, Japan, Mexico, Netherlands, Nigeria, Philippines, Poland, Turkey and the United Arab Emirates)[20] Non-Proliferation and Disarmament Initiative (NPDI) conveyed a draft standard reporting form to the five permanent members of the UN Security Council (P5), who happen also to be the five NWS recognized as such by the NPT, prior to their meeting in Paris in July 2011. The P5 rejected the NPDI form (which was made available to all states at the First Preparatory Committee of the 2015 NPT Review Conference in Vienna in May 2012). However, under France's leadership, they united around their own reporting framework, which they adopted by consensus at the P5 Conference in Beijing in April 2014.[21] All five NWS subsequently submitted national reports to the 2014 PrepCom (Preparatory Committee for the 2015 NPT Review Conference), consistent with their commitments under Actions 5, 20, and 21 of the 2010 RevCon final document.[22] These reports, which varied considerably in the level of detail provided, consolidated information that was already available in a range of official statements and government documents in the five NWS.

1.47 The International Panel on Fissile Materials (IPFM) presented a number of proposals on transparency to the 2012–14 PrepComs. These included baseline declarations on nuclear weapons numbers and fissile material holdings by the NWS to the 2014 PrepCom and a commitment by them "to develop information on the histories of their nuclear warhead and fissile material stockpiles, which could later provide the basis for public declarations" at the 2015 Review Conference.[23] To date, however, only the United States has released detailed declarations, with regular updates, of its fissile material stockpiles.[24]

19. Vladimir Radyuhin, "Cold War lessons for India and Pakistan," *Hindu* (Chennai), 19 November 2012.
20. Seven of the twelve NPDI members shelter under the US nuclear umbrella. The exceptions are Chile, Mexico, Nigeria, the Philippines and the UAE.
21. *Joint Statement on the P5 Beijing Conference: Enhancing Strategic Confidence and Working Together to Implement the Nuclear Non-Proliferation Review Outcomes*, 15 April 2014, http://www.state.gov/r/pa/prs/ps/2014/04/224867.htm.
22. http://www.un.org/disarmament/WMD/Nuclear/Repository/submissions_2014.shtml.
23. *Increasing Transparency of Nuclear-warhead and Fissile-material Stocks as a Step Toward Disarmament*, International Panel on Fissile Materials, Vienna, 3 May 2012, http://fissilematerials.org/blog/2012/05/ipfm_presents_proposals_o.html.
24. *Global Fissile Material Report 2013*, p. 6, http://fissilematerials.org/library/gfmr13.pdf.

1.3.3 Verification

1.48 "Verification" refers to the process, established or approved in a bilateral agreement or multilateral arms control treaty, by which individual states parties or an appropriately empowered international body determine the degree to which the parties to the agreement have implemented its provisions. In the context of nuclear disarmament, it refers to the checks carried out by competent authorities using qualified personnel, technical means, or a combination of the two, to confirm that agreed commitments on numbers, stockpiles, force postures, deployments and the like have been implemented. The task can be undertaken outside the governmental or intergovernmental framework. For example, VERTIC (the Verification Research, Training and Information Centre), set up in London in 1986, is an independent NGO with the mission "to support the development, implementation and effectiveness of international agreements and related regional and national initiatives, with particular attention to issues of monitoring, review, implementation and verification."[25]

1.49 At the 2010 NPT Review Conference, in addition to committing to the principles of irreversibility, verifiability and transparency, all states agreed on "the importance of supporting [international] cooperation … aimed at increasing confidence, improving transparency and developing efficient verification capabilities related to nuclear disarmament" (Action 19).

1.50 China has taken no steps to reduce the size of its nuclear arsenal. It has made no claims to have shifted nuclear warheads from deployed to reserve status or to have dismantled any. The question of verification therefore is not currently relevant.

1.51 Neither France's nor the United Kingdom's unilateral nuclear arms reduction measures are subject to independent verification. UK Foreign Office Minister Alistair Burt told Parliament on 9 June 2010 that the United Kingdom had "no plans to establish procedures to allow the international community to verify the UK's nuclear warhead stockpile."[26]

1.52 However, since 2007 the United Kingdom and Norway have been conducting joint research into possible methodologies for nuclear warhead dismantlement. The UK–Norway Initiative has "focused on the joint development of effective and mutually trusted solutions to technical and procedural disarmament hurdles which will not breach our respective non-proliferation obligations under the NPT."[27] The two countries hosted a "managed access exercise" in the United Kingdom in 2010 and have since held a series of briefings for officials and technical experts from the NWS and non-NWS, and the NGO community, on the lessons learned from their research. The United Kingdom has also been working on a joint verification initiative with the United States. Findings from this 10-year project were presented to the other three NWS at the third P5 conference in Washington in June 2012. The work has since been presented to a wider audience at an

25. http://www.vertic.org/.

26. Beatrice Fihn, ed., *The 2010 NPT Action Plan Monitoring Report* (Geneva: Geneva Centre for Security Policy, Swiss Federal Department of Foreign Affairs, and Reaching Critical Will, 2012), p. 41.

27. Statement by UK Head of Delegation (under Cluster 1 – Disarmament) at the 2012 Preparatory Committee of the 2015 NPT Review Conference, Vienna, 3 May 2012.

NGO side-event at the 2014 NPT PrepCom. This included discussion of a recent, year-long monitored US–UK dismantlement exercise, which took place in an operational nuclear facility with representative quantities of fissile material and simulated high explosives.[28] On 4 December 2014 the United States announced an initiative for an International Partnership for Nuclear Disarmament Verification. In 2015, the United Kingdom will host a confidential P5 expert-level meeting on verification, which will discuss these and other cooperative verification efforts.[29]

1.53 New START incorporates a range of bilateral US–Russia verification measures, including data exchanges, inspections and notifications.[30] To date, the two states have exchanged more than 6,000 notifications through their Nuclear Risk Reduction Centers via a secure government-to-government communications link. They also exchange comprehensive data on the strategic forces covered by the treaty every six months, and use the Bilateral Consultative Commission to discuss and settle implementation issues.[31] This cooperation has continued notwithstanding the deterioration in US-Russia relations over Ukraine, and it is to be hoped that it will continue for the lifetime of the Treaty.

1.54 In order to provide confidence that states do not retain undeclared nuclear weapons or fissile material and to facilitate future verification, the ICNND Report recommended that "nuclear archaeology" steps be taken now by the nuclear-armed states "to ensure that all relevant records are identified, secured and preserved, and relevant measurements and samples are taken" (Recommendation 48). All states have a shared interest "in ensuring that future verification is able to provide credible results."[32] Since most states with nuclear weapons have stopped production of both highly enriched uranium (HEU) and plutonium, "nuclear archaeology" in this context takes the form of historical materials accountancy. Documenting the total production of HEU and/or plutonium over a few decades is a large and time-consuming effort, and the results are inevitably presented in aggregated form with significant associated uncertainties. The United States and the United Kingdom have made such efforts. The United States published the results of its historical accounting for both HEU and plutonium, while the United Kingdom has published a report on HEU.[33]

28. http://www.nnsa.energy.gov/blog/us-and-uk-discuss-efforts-improve-technical-verification-nuclear-disarmament. Presentation slides are available at http://nnsa.energy.gov.

29. http://israelforeignaffairs.com/60991/uk-norway-nuclear-disarmament-verification-initiative-workshop/.

30. http://www.state.gov/t/avc/newstart/index.htm.

31. Katarzyna Kubiak, "NATO and Russia experiences with nuclear transparency and confidence-building measures," Background paper for the workshop on Non-Strategic Nuclear Weapons in Europe: Transparency and Confidence-Building Measures in Practice, SWP, Berlin, 27–28 March 2014, p. 8.

32. ICNND, *Eliminating Nuclear Threats*, p. 171.

33. US Department of Energy (DOE), *Highly Enriched Uranium, Striking a Balance: A Historical Report on the United States Highly Enriched Uranium Production, Acquisition, and Utilization Activities from 1945 through September 30, 1996* (DOE: Washington, DC, 2001); DOE, *Highly Enriched Uranium Inventory: Amounts of Highly Enriched Uranium in the United States* (DOE: Washington, DC, 2012); DOE, *Plutonium: the First 50 Years* (DOE: Washington, DC, 1996); DOE, *The United States Plutonium Balance, 1944–2009* (DOE: Washington, DC, 2012); UK Ministry of Defence, "Historical accounting for UK defence highly enriched uranium," March 2006, http://www.mod.uk/DefenceInternet/AboutDefence/CorporatePublications/HealthandSafetyPublications/DepletedUranium/.

§1.4 Reducing Weapons Numbers

1.4.1 Current Nuclear Arsenals

1.55 Forty-five years after the NPT entered into force, there are still almost 16,400 nuclear warheads distributed among nine states. The size and distribution of the current global stockpile are shown in Table 1.2. On the one hand, as the table shows, 93 per cent of the world's stocks of nuclear weapons are held in Russian and US arsenals. On the other hand, to be discussed below there are concerns about the *growth* in nuclear weapons stockpiles in China, India, North Korea and Pakistan.

Table 1.2: The World's Nuclear Arsenals (2014 estimates)

	Strategic		Other			Total by Country	Yield Range (kt)	Total Yield (Mt)
	Deployed	Reserve	Deployed	Reserve	To be Dismantled			
USA	1920[a]	2407[b]	180	278	2515	7300[c]	Sub-kt-475	535
Russia	1600[d]	700[e]	1000	1000[f]	3700	8000	Sub-kt-1000	773
China	188	62[g]	-	-	-	250	184-240	294
France	290	10	-	-	-	300	100-300	55
UK	160	65	-	-	-	225[h]	100	21
Israel	80[i]	-	-	-	-	80[j]	-	1.6-12
India	90-110[i]	-	-	-	-	90-110	15-200	1
Pakistan	100-120[i]	-	-	-	-	100-120[k]	Sub-kt 50	1.7
DPRK	-	-	-	-	-	6-8[l]	Sub-kt-8	0.05
Totals	**4448**	**3244**	**1180**	**1278**	**6215**	**16372**		**1690**

Source: *SIPRI Yearbook 2014: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 2014), pp. 287–351.

Notes to Table 1.2

a. These deployed warheads are fielded on 794 active ICBMs, SLBMs and bombers. The number has decreased from 2,200 reported in the ICNND report of November 2009 due to the continued implementation of strategic arms reduction agreements. The United States will have to offload approximately 92 further warheads by 2018 in order to meet the New START limit. Note that the number of deployed strategic warheads in this table is higher than the number released by New START.[34] This is because SIPRI counts weapons on bomber bases as deployed, whereas the counting rules adopted by New START do not. Methodologies for calculating warhead numbers vary across organizations, resulting in significantly different estimates. For the sake of consistency, CNND has chosen to continue using the same methodology applied by SIPRI in the first edition of *Nuclear Weapons: The State of Play*. For further information, see section 1.57 below.

34. See *Fact Sheet, New Start Treaty Aggregate Numbers of Strategic Offensive Arms*, 1 October 2014, http://www.state.gov/documents/organization/232561.pdf.

b. The United States has a total of 2,685 warheads held in reserve.[35] Of these, an estimated 2,407 are strategic and 278 are non-strategic.[36] The non-strategic warheads of the United States include approximately 184 B61 gravity bombs deployed in Europe, and about 278 US-based bombs on reserve. The total number of non-strategic warheads has been decreasing partly due to steps delineated in the 2010 NPR including the planned retirement of nuclear-armed, sea-launched cruise missiles. The latter were retired because they became redundant (their role can be performed by ICBMs, SLBMs and bombers).

c. Reductions in the US total stockpile can be attributed to obligations under bilateral arms control treaties with Russia, including the START and SORT treaties, as well as steps taken as a result of the 2010 NPR. Part of the total stockpile number includes the ongoing retirement of excess W76 warheads.[37] The US Navy is estimated to have downloaded each missile to an average of 4-5 warheads to meet a warhead ceiling mandated by SORT.

d. This number has decreased from 2,800 reported in the ICNND report of November 2009 due to continued implementation of strategic arms reduction agreements.

e. There is a lack of data available regarding Russian strategic warheads in reserve, as well as unresolved definitional issues concerning the difference between warheads in reserve and warheads awaiting dismantlement. The 2009 ICNND table gave the reserve number as 4,750 but qualified the figure as a rough approximation due to Russia's lack of transparency. The 2014 SIPRI number for the strategic reserve comprises 700 strategic warheads thought to be in reserve for SSBNs and bombers.[38] It appears that many of the strategic warheads classified by the ICNND table as being in reserve are actually awaiting dismantlement.

f. Pre-2012 calculations regarding the size of Russia's non-strategic nuclear forces were based on approximations that may have overestimated the real number owing to lack of a clear methodology. The difficulty in arriving at an accurate estimate is partly due to the fact that only the strategic forces of the United States and Russia have been subject to verification and transparency measures based in bilateral treaty obligations. The general trend has been a decrease in Russian operational non-strategic warheads since the end of the Cold War. For further information, see section 1.56 below.

g. China is thought to be expanding its nuclear arsenal as part of a modernization program, explaining the slight increase from 2009 ICNND numbers.

h. The 2010 UK Strategic Defence Review aims to decrease the size of the British nuclear arsenal from 225 warheads to "no more than 180 by the mid-2020s."[39] Deployed strategic warheads will be reduced to no more than 120.

i. Using a different definition of "deployed," SIPRI puts the warheads for India, Israel and Pakistan under a category it calls "Other." The issue is whether warheads that require further preparation – some further assembly, or loading on missiles before they are operational – should be described as deployed or not. CNND's view is that they should be, but that their low launch alert status should also be acknowledged given that transporting, assembling and loading the warheads could take anything from an hour to a couple of days. For further information, see sections 1.57 and 1.165 below.

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35. "US Nuclear Forces," *SIPRI Yearbook 2014*, pp. 289–90.

36. "World Nuclear Forces," *SIPRI Yearbook 2012: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 2012), p. 309. This estimate is based on SIPRI's 2012 *Yearbook* because the 2014 version does not include a detailed breakdown of warheads held in reserve.

37. "World Nuclear Forces," *SIPRI Yearbook 2012*, p. 309.

38. "World Nuclear Forces," *SIPRI Yearbook 2014*, p. 299.

39. UK Ministry of Defence, *Securing Britain in an Age of Uncertainty: The Strategic Defence Security Review*, Cm 7948 (HM Stationary Office: London, October 2010), p. 38, paragraph 3.11.

j. Israel's policy of "nuclear opacity" makes any estimate of nuclear weapons numbers, capabilities and deployment status essentially a matter of speculation.

k. Pakistan has roughly doubled its nuclear arsenal since the ICNND report. Pakistan is now the world's sixth largest nuclear power and it could double its nuclear stockpile within a decade based on increased military plutonium production capabilities.[40]

l. The 5 MWe reactor at Yongbyon is estimated to have produced enough weapon-grade plutonium for perhaps 6-8 nuclear warheads.[41]

1.56 The apparent reduction from the global stockpile of more than 23,000 nuclear warheads in Box 2.2 in the 2009 ICNND Report,[42] to approximately 16,400 in 2014, is less dramatic than these numbers seem to suggest. Much of the apparent overall downsizing can be explained by better information and research methodology, as explained in our 2012 State of Play report (with the Russian figures in particular likely to have been significantly overstated by the ICNND). While there has been a continuing reduction in US and Russian stockpiles under the older bilateral START and SORT treaties, and some additional unilateral reductions by both these powers, reductions by other nuclear-armed states have either been modest (in the case of France and the United Kingdom), non-existent, or negative (in that China's, India's, Pakistan's and North Korea's stocks have increased). Although it does not affect the size of the total stockpile of existing weapons, it is to be noted that New START should reduce the number of deployed warheads by 2018.

1.57 The definitions used in this table are not universally agreed among the NWS. They are currently working on a glossary of terms intended to resolve definitional discrepancies. While Russian–US disarmament practice establishes some useful benchmarks, New START does not in fact define the terms "deployed" or "reserve" warhead. It merely regulates the number of warheads on deployed delivery vehicles, and warhead numbers reported by each state under the treaty reflect this practice. The term "reserve" is most commonly used to refer to warheads that have been placed in long-term storage (that is, they are not located on an operational base). The term "strategic" is typically based on the range of the delivery vehicle. Again, the term is not explicitly defined in New START, but given that the treaty and its predecessors address the issue of "strategic offensive arms" reductions, any nuclear delivery vehicle not meeting the range requirements encompassed by New START is typically assumed to be non-strategic or tactical. However, outside of Russia–US agreements, other states with nuclear weapons generally consider all of their nuclear forces to be strategic, regardless of the ranges of their delivery vehicles.

1.58 Of the five NPT NWS, only *China's* nuclear arsenal is growing. China, however, does not publish or otherwise provide details of the size and composition of its nuclear arsenal, although it did claim in April 2004 to have the smallest arsenal among the

40. D. Albright and P. Brannan, "Pakistan appears to be building a fourth military reactor at the Kushan site," Institute for Science and International Security (ISIS) Report, 9 February 2011.

41. "Nuclear Weapons: Who Has What at a Glance," Arms Control Association, 2014, http://www.armscontrol.org/factsheets/Nuclearweaponswhohaswhat.

42. ICNND, *Eliminating Nuclear Threats*, p. 20.

NWS.[43] With the United Kingdom taking steps to reduce the size of its nuclear arsenal, this is no longer the case (Table 1.2). Taking into account estimates of China's fissile material production, the proportion of fissile material likely to have been used to make weapons, delivery vehicle numbers and other relevant factors, Philip Schell and Hans Kristensen estimate China's total stockpile to be approximately 250 warheads.[44] This figure appears to be the general consensus among non-government experts.[45] General C. Robert Kehler, then commander of the US Strategic Command, responding to studies suggesting that China could have between 1,600 and 3,000 warheads – for example, from the Russian Academy of Science's Institute of World Economy and International Relations (IMEMO RAN), arguing for a figure of 1,600-1,800[46] – has rejected claims that the Chinese arsenal is much larger than commonly believed.[47]

1.59 China is certainly modernizing and expanding its nuclear weapons systems, as the Second Artillery Force continues progressively to improve its missile force structure in both nuclear and conventional configurations, and the Navy to enhance its strategic deterrence and counter-attack capability.[48] In late 2014, China was close to establishing a "near-continuous at-sea strategic deterrent" with the deployment of JL-2 SLBMs (which have a 7,500 km range) on three JIN-class nuclear-powered ballistic missile submarines (SSBNs). China's road-mobile DF-31A missile has a range of over 10,000 km and includes Multiple Independently targeted Re-entry Vehicles (MIRVs), according to US Defense Department reports.[49] In September 2014, China conducted a first test of its DF-31B missile (an improved variant of the DF-31A, which is equipped for difficult road conditions to improve survivability).[50]

1.60 That said, China's nuclear arsenal has evolved and grown rather more slowly than was the case historically with the United States and the former Soviet Union. There is nothing to suggest that China is engaged in a "sprint to parity" with Russia or the United States and plenty of evidence to conclude that it is not. China is believed to have made some 300 warheads in total, of which about 50 were used for the 45 nuclear tests it conducted before the CTBT-related moratorium in 1996. It has about 150 land-based missiles capable of carrying nuclear payloads, of which 30-35 have a long enough range (7,000–12,000 km) to reach the continental United States.[51] Although it is widely speculated, including by the US Department of Defense, that some of these ICBMs are

43. Ministry of Foreign Affairs of the People's Republic of China, *Fact Sheet*, 27 April 2004, www.fmprc.gov.cn.
44. *SIPRI Yearbook 2014*, p. 315.
45. See, for example, "Status of World Nuclear Forces," Federation of American Scientists, http://www.fas.org/programs/ssp/nukes/nuclearweapons/nukestatus.html; "Nuclear Weapons: Who Has What at a Glance," Arms Control Association.
46. Victor Yesin, "China's Nuclear Capability" in Alexei Arbatov, Vladimir Dvorkin and Sergey Oznobishchev, eds., *Prospects of China's Participation in Nuclear Arms Limitations* (Moscow: Institute of World Economy and International Relations, Russian Academy of Sciences, 2012), pp. 26–33.
47. "STRATCOM Commander Rejects High Estimates for Chinese Nuclear Arsenal," *FAS Strategic Security Blog*, 22 August 2012, http://www.fas.org/blog/ssp/2012/08/china-nukes.php.
48. Of its planned triad of land, air and maritime nuclear forces, only the land-based ballistic missiles and nuclear-configured aircraft are currently considered operational. However, China is developing the DF-41, a next-generation ICBM capable of launching multiple nuclear warheads. US officials also expect China to have operational nuclear missile-equipped submarines by the end of 2014, http://www.nti.org/country-profiles/china/nuclear/; *SIPRI Yearbook 2014*, p. 315. *China Defence White Paper 2010*, http://www.china.org.cn/government/whitepaper/2011-03/31/content_22263885.htm.
49. http://www.stripes.com/news/on-land-and-sea-china-s-nuclear-capability-growing-1.299381.
50. "China Tests 10,000-km Range Nuclear Missile," *Hindu*, 4 October 2014.
51. *SIPRI Yearbook 2014*, p. 316.

MIRV-capable (able to carry up to 3 warheads), most analysts believe China is currently only deploying them with single warheads.[52] China's small stock of air-deliverable nuclear weapons are not believed to have any "primary mission."[53]

Table 1.3: China's Nuclear Forces (2014)

Type	NATO Designation	Year Deployed	Range (km)	Warhead x Yield (Kt)	No. of Warheads
Land-based missiles					
DF-3A	CSS-2	1971	3000	1 x 3300	-
DF-4	CSS-3	1980	5500	1 x 3300	~10-15
DF-5A	CSS-4 Mod 2	1981	13000	4000-5000	20
DF-21A	CSS-5 Mod ½	1991	2100	1 x 200-300	~80
DF-31	CSS-10 Mod 1	2006	>7200	(1 x 200-300)	~5-10
DF-31A	CSS-10 Mod 2	2007	11200	(1 x 200-300)	~20
Submarine-launched ballistic missiles					
JL-1	CSS-NX-3	1986	1700	1 x 200-300	(12)
JL-2	CSS-NX-14	-	>7000	(1 x 200-300)	(36)
Aircraft					
Hong-6	B-6	965	3100	1 x bomb	(20)
Others	-	-	-	1 x bomb	(20)
Total					**~250**

Source: *SIPRI Yearbook 2014: Armaments, Disarmament and International Security*, p. 316.

1.61 *France* no longer has a ground-based missile force. Its nuclear weapons are deployed on its four submarines and aircraft. Despite cuts in the airborne component of France's nuclear deterrent, its nuclear arsenal is being modernized and upgraded with the progressive introduction of longer-range missiles and new warheads.[54] This includes upgrading its SSBNs to the new M51 SLBM and replacing the ageing M45 missile.[55] On 20 November 2014, Defence Minister Jean-Yves Le Drian announced that France has launched studies for an airborne nuclear-tipped missile to replace the current weapon, with the focus on stealth and hypersonic technology in the next-generation atomic arms.[56]

52. Zachary Keck, "Is China Preparing MIRVed Ballistic Missiles?" *The Diplomat*, 8 August 2014.
53. Gregory Kulacki, "China's Nuclear Arsenal: Status and Evolution," Union of Concerned Scientists (October 2011), pp. 1–2.
54. Fihn, ed., *The 2010 NPT Action Plan Monitoring Report*, p. 28.
55. *SIPRI Yearbook 2014*, p. 312.
56. Pierre Tran, "France studies nuclear missile replacement," Defense News, 29 November 2014, http://www.defensenews.com/article/20141129/DEFREG01/311290019/France-Studies-Nuclear-Missile-Replacement?mkt_tok=3RkMMJWWfF9wsRokvaTIZKXonjHpfsX67eQrWKKg38431UFwdcjKPmjr1YEGSsd0aPyQAgobGp5I5FEIQ7XYTLB2t60MWA%3D%3D.

Table 1.4: France's Nuclear Forces (2014)

Type	No. Deployed	Year Deployed	Range (km)	Warhead x Yield (Kt)	No. of Warheads
Land-based aircraft					
Mirage 2000N	CSS-2	1988	2750	1 x 300	~20
Rafale F3	CSS-3	2010-11	2000	1 x 300	~20
Carrier-based aircraft					
Rafale MK3	CSS-NX-3	1986	2000	1 x 300	~10
Submarine-launched ballistic missiles					
M45	CSS-5 Mod ½	1996	6000	4-6 x 100	80
M51.1	CSS-10 Mod 1	2010-11	6000	4-6 x 100	160
M51.2	CSS-10 Mod 2	2007	6000	4-6 x TNO	-
Total					**~290**

Source: *SIPRI Yearbook 2014: Armaments, Disarmament and International Security*, p. 313.

1.62 As noted above, while *Russia* declares the number of deployed strategic warheads and deployed and non-deployed launchers, it does not release data on the overall size of its arsenal or the number of non-strategic weapons.[57] It is currently thought to have some 8,000 nuclear warheads in total, including 3,700 retired strategic and non-strategic warheads awaiting dismantlement.[58]

1.63 Russia is committed to reducing the size of its deployed strategic weapons arsenal in accordance with the provisions of the New START agreement, but during the period 2012–14, the number of warheads deployed on Russian strategic nuclear weapons actually increased from 1,492 to 1,643.[59] As explained by Hans M. Kristensen, this does not reflect a build-up of the Russian nuclear arsenal, but is a result of the rate at which Russia's older missiles are being withdrawn, slowing from about 50 missiles per year before the New START treaty to about 22 missiles per year after New START while the rate of introduction of new land-based missiles has increased from approximately 9 missiles per year to about 18; also "fluctuations caused by existing launchers moving in and out of overhaul." [60]

57. Mukhatzhanova, *Implementation of the 2010 NPT Review Conference Disarmament Actions*, p. 18.
58. *SIPRI Yearbook 2014*, p. 300.
59. *Fact Sheet: New START Treaty Aggregate Numbers of Strategic Offensive Arms*, 1 October 2014.
60. Hans M. Kristensen, "New START: Russia and the United States Increase Deployed Nuclear Arsenals," Federation of American Scientists, 2 October 2014, http://fas.org/blogs/security/2014/10/newstart2014/.

1.64 Russia is also modernizing its strategic nuclear forces. The National Security Strategy of the Russian Federation to 2020, adopted in May 2009, states that "Russia will undertake all necessary efforts, with minimum expenditure, to maintain parity with the United States of America in the area of strategic offensive arms."[61] In an article published in a Russian magazine in 2010, Foreign Minister Sergei Lavrov wrote that "as long as nuclear weapons exist, Russia's national security must be strengthened by phasing in modern, more effective and reliable types of strategic offensive weapons in conditions of coordinated and planned reduction of their aggregate amount."[62] According to the Defence Committee of the Duma (the lower house of the Russian Parliament) Russia will spend $1.4 billion on nuclear weapon systems in 2016.[63]

1.65 Russia has also been modernizing its land-based missile arsenal.[64] ICBM warhead payloads could not be changed under the 1991 Treaty on the Reduction and Limitation of Strategic Offensive Arms (START), but when it expired in 2010 Russia began deployment of the RS-24 Yars (SS-27 Mod 2), a MIRVed variant of the Topol-M (SS-27 Mod 1). Deployment of the road-mobile version of the RS-24 began at Teykovo in 2010 and introduction is currently under way at Novosibirsk and Tagil, where the first RS-24s were deployed in December 2013. Deployment of the first silo-based RS-24s has also begun, and Russia has started development of a third modification of the Topol-M, known as the RS-26 and of a new 'heavy' MIRVed ICBM.

1.66 Similarly, Russia is modernizing its nuclear submarine fleet and SLBMs. The first of eight fourth-generation Borei class nuclear submarines entered active service at the beginning of 2013.[65] The second was delivered to the Northern Fleet in December 2013, while the third boat is undergoing sea trials.[66] The submarines will carry up to sixteen new Bulava missiles which "can transport 10 independently targeted nuclear warheads over distances approaching 5,000 miles."[67] On 28 November 2014, the Ministry of Defence announced that Russia had successfully tested the new submarine-launched 12 metre Bulava intercontinental missile from its nuclear submarine Alexander Nevsky.[68] Russia is reported to have plans to develop a fifth-generation nuclear submarine and to have started research and development work on a new strategic bomber.[69]

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61. *National Security Strategy of the Russian Federation to 2020*, Approved by Decree of the President of the Russian Federation 12 May 2009 No. 537, paragraph 96.
62. "Russia Demands Broader Participation in Future Nuclear Cuts," *Global Security Newswire*, 3 August 2010, http://www.nti.org/gsn/article/russia-demands-broader-participation-in-future-nuclear-cuts/.
63. *SIPRI Yearbook 2014*, p. 302.
64. *SIPRI Yearbook 2014*, pp. 304–305 .
65. "Russian Nuke Sub Goes on Duty," *Global Security Newswire*, 3 January 2013.
66. *SIPRI Yearbook 2014*, p. 306.
67. "Bulava Missile, Sub to Join Russian Active Force," *Global Security Newswire*, 29 June 2012.
68. Reuters, "Russian Submarine Test-Launches Bulava Intercontinental Missile," *Moscow Times*, 30 November 2014, http://www.themoscowtimes.com/business/article/russian-submarine-test-launches-bulava-intercontinental-missile/512053.html?mkt_tok=3RkMMJWWfF9wsRokvaTIZKXonjHpfsX67eQrWKKg38431UFwdcjKPmjr1YEGSsd0aPyQAgobGp5I5FEIQ7XYTLB2t60MWA%3D%3D.
69. Mukhatzhanova, *Implementation of the 2010 NPT Review Conference Disarmament Actions*, p. 9.

Table 1.5: Russia's Nuclear Forces (2014)

Type	NATO Designation	Year Deployed	Range (km)	Warhead x Yield (Kt)	No. of Warheads
Strategic offensive weapons					
Bombers					
TU-95MS6	Bear-H6	1981	6500-10500	6 x AS-15A ALCMs, bombs	174
TU-95MS16	Bear-H16	1981	6500-10500	6 x AS-15A ALCMs, bombs	480
TU-160	Blackjack	1987	10500-13200		156
ICBMs					
SS-18	Satan	1992	11000-15000	10 x 500-800	460
SS-19	Stiletto	1980	10000	6 x 400	180
SS-25	Sickle	1985	10500	1 x 800	18
SS-27	Topol-M	1997	10500	1 x 800	60
SS-N-18 M1	Stingray	1978	6500	3 x 50	144
SS-N-23	Sineval	1986	9000	4 x 100	384
SS-N-32	-	(2015)	>8050	4 x (100)	(192)
Subtotal					**ca. 2248**
Non-strategic and defensive forces					
ABMs					
SH-11/SH-08	Gorgon/Gazelle	1986	30	1 x 10	(68)
SA-10	Grumble	1980		1 x low	(~340)
SSC-1B	Reduct	1973	500	1 x 350	(~17)
Bombers and Attack aircraft					
Backfire/ Fencer/ Fullback				ASM, bombs	(~730)
Ground-based					
SS-21 Scarab			120	(1 x 10)	(~140)
SS-26 Stone			500	(1 x 10)	(~30)
Naval					
Subs/ships/air					(~700)
Subtotal					**ca. 2025**
Total					**ca. 4273**

Note: The numbers in Tables 1.5 and 1.7, based on data from *SIPRI Yearbook 2013*, do not align with those in Table 1.2, which is updated to 2014 data.

Source: *SIPRI Yearbook 2014: Armaments, Disarmament and International Security*, p. 300.

1.67 The *United Kingdom*'s relatively small nuclear arsenal consists of less than 160 operationally available nuclear warheads, most of which are deployed on sea-launched Trident missiles on three of four Vanguard-class submarines. Only one submarine is on patrol at any time, with up to 48 warheads.[70] The total UK stockpile (including retired warheads awaiting dismantlement) comprises 225 nuclear warheads.[71] The United Kingdom is in the process of modernizing its nuclear weapons complex. This includes a new facility at Aldermaston for manufacturing uranium components for weapons and a new warhead assembly/disassembly plant at Burghfield. Both plants are expected to enter into service between 2016 and 2020.[72]

1.68 The existing fleet of four Vanguard-class submarines is due for replacement in the 2020s. Following a 2007 vote by the British parliament to renew the nuclear deterrent, the 2010 Strategic Defence and Security Review concluded that the "main gate" decision on replacing the submarine fleet needed further consideration, and should be delayed until 2016 (main gate is a final decision following an assessment phase), and a decision on the precise timing of the transition to a new class of submarines would be taken in 2019. Since then, debate on the future shape of the UK nuclear deterrent has become more prominent, as discussed in section 1.6.1 on Weapons Deployment.

Table 1.6: UK Nuclear Forces (2014)

Type	NATO Designation	Year Deployed	Range (km)	Warhead x Yield (Kt)	No. of Warheads
SLBMs					
D-5	Trident II	1994	>7400	1-3 x 100	225
Total					**225**

Source: *SIPRI Yearbook 2014: Armaments, Disarmament and International Security*, p. 310.

1.69 As of 29 April 2014 (the most recent publicly available figures), the *United States'* aggregate nuclear weapons stockpile (deployed and non-deployed, strategic and non-strategic nuclear weapons) comprised 4,804 warheads (not including warheads retired and awaiting dismantlement).[73] Under New START Treaty provisions, the United States declares deployed strategic warhead and deployed and non-deployed launcher numbers biannually.

1.70 The April 2010 NPR Report confirmed that the United States would maintain its nuclear triad of ICBMs, SLBMs and heavy bombers. The US long-term nuclear modernization program currently includes twelve new nuclear-powered ballistic missile submarines (SSBNs), a new air-launched stand-off nuclear missile, and eventual

70. *SIPRI Yearbook 2014*, pp. 309–11.
71. *SIPRI Yearbook 2014*, p. 310.
72. IPFM, *Global Fissile Material Report 2011*, p. 6.
73. *Fact Sheet: Transparency in the U.S. Nuclear Weapons Stockpile*, 29 April 2014.

replacement of the Minuteman III ICBM and B-52H strategic bomber.[74] The F-35 Joint Strike Fighter will also be made nuclear-capable.[75]

1.71 As the BASIC Trident Commission reminds us, it is important to remember that "planned reductions in deployed and Treaty-counted U.S. forces are … taking place in the context of an extensive Obama administration commitment to maintain and modernize the U.S. nuclear force and its supporting infrastructure for the long-term."[76] In 2010, senior US officials told hearings of the US Senate Foreign Relations Committee on New START that "Over the next decade, the United States will invest well over $100 billion in nuclear delivery systems to sustain existing capabilities and modernize some strategic systems. U.S. nuclear weapons will also undergo extensive life extension programs in the coming years to ensure their safety, security and effectiveness."[77]

1.72 These cost estimates now, however, sound like a serious underestimate. For Fiscal Year (FY) 2014, nuclear weapon activities in the Department of Energy's National Nuclear Security Administration (NNSA), which oversees the US nuclear stockpile and production complex, were funded at $7.78 billion, an 11.6 per cent increase over FY 2013 at a time when other defence budget accounts are in decline.[78] Some estimates are as high as $1 trillion.[79] The life extension program for the air-delivered B61 nuclear bomb is now expected to cost some US $10.4 billion, more than two-and-a-half times the original estimate. Around 180 of these nuclear weapons in Europe are to be maintained and upgraded "despite the fact that no military commander can be found anywhere who would actually reach for them, in any scenario."[80] Critics have attributed the massive cost overrun to "an overly ambitious refurbishment project" which involves redesigning most of the bomb's major components and "for all practical purposes building new [bombs] from scratch."[81]

74. Ian Kearns, *Beyond the United Kingdom: Trends in the Other Nuclear Armed States*, Discussion Paper 1 of the British American Security Information Council (BASIC) Trident Commission (London: BASIC, November 2011), p. 4, available at: http://www.basicint.org/publications/dr-ian-kearns-trident-commission-consultant/2011/beyond-uk-trends-other-nuclear-armed-s.

75. US Department of Defense, *Nuclear Posture Review Report* (Washington: April 2010), p. 27, http://www.defense.gov/npr/docs/2010%20nuclear%20posture%20review%20report.pdf.

76. Kearns, *Beyond the United Kingdom*, p. 11.

77. Kearns, *Beyond the United Kingdom*, p. 11.

78. *FY2014 Omnibus Appropriations Bill*, cited in "US Modernization Programs," Arms Control Association Fact Sheets and Briefs, January 2014, http://www.armscontrol.org/factsheets/USNuclearModernization.

79. Jon B. Wolfsthal, Jeffrey Lewis and Marc Quint, "The Trillion Dollar Nuclear Triad," Center for Nonproliferation Studies, January 2014.

80. Des Browne and Ian Kearns, "NATO, Russia, and the Nuclear Disarmament Agenda: Reflections Post-Chicago," *ELN European Security Policy Brief* 4 (London: European Leadership Network, August 2012), p. 10.

81. John Fleck, "Billions more needed to refurbish B61 nuclear bombs," *Albuquerque Journal*, 4 November 2012. The life extension program, which the administration says is needed "to provide nuclear extended deterrence to NATO allies and to continue a gravity bomb capability on the B-2 stealth bomber" is expected to see the consolidation, in the B61-12, of four current versions of the weapon. Hans M. Kristensen, "B61 Nuclear Bomb Costs Escalating," http://www.fas.org/blog/ssp/2012/05/b61cost.php.

Table 1.7: US Nuclear Forces (2014)

Type	NATO Designation	Year Deployed	Range (km)	Warhead x Yield (KT)	No. of Warheads
Strategic Forces					
Bombers					
B-52H	Stratofortress	1961	16000	AKCM 5-150	200
B-2	Spirit	1994	11000	Bombs	100
ICBMs					
LGM-30g	Minuteman III				
	Mk-12A	1979	13000	1-3 x 335	220
	Mk-21/SERV	2006	13000	1x300	250
SSBNs/SLBMs					
UGM-133A	Trident II (D-5)				
SH-11/SH-08	Mk-4	1992	>7400	4 x 100	267
SA-10	Mk-4A			4 x 100	500
SSC-1B	Mk-5			4 x 475	384
Subtotal					**1921**
Non-Strategic Forces					
B61-3, -4, -10 bombs		1979		0.3-170	~184
Reserve					2685
Total					**ca. 4790**

Note: The numbers in Tables 1.5 and 1.7, based on data from SIPRI Yearbook 2013, do not align with those in Table 1.2, which is updated to 2014 data.

Source: *SIPRI Yearbook 2014: Armaments, Disarmament and International Security*, p. 290.

1.73 *India*'s nuclear arsenal is growing, although the lack of transparency surrounding its nuclear program makes it difficult to assess how fast this is happening. It is currently estimated to possess some 90-110 warheads for delivery by missiles and aircraft, based on calculations of India's inventory of weapon-grade plutonium and the number of operational nuclear-capable delivery systems.[82] This growth is likely to accelerate if India follows through on ambitious plans to build six fast-breeder reactors and to expand its uranium enrichment facilities, which will significantly increase its capacity to produce weapon-usable materials.

1.74 Aircraft provide the most mature component of India's nuclear strike capabilities. India also operates land-based tactical and longer-range nuclear ballistic missiles, and is in the final stages of introducing the Agni III ballistic missile, which is the first nuclear

82. *SIPRI Yearbook 2014*, p. 322.

capable Indian missile capable of reaching Beijing from Indian territory.[83] India has also begun developing a new subsonic ground-launched cruise missile which is widely rumoured to be nuclear capable (although there is no official confirmation of this), and continues to develop the naval component of its nuclear triad, the Arihant class submarine, which is expected to become operational in 2015.[84] It will be fitted with the B05 (K-15) SLBM, which was tested successfully in January 2013. Meanwhile, work has begun on another nuclear reactor for a second indigenously developed nuclear-powered submarine.[85]

Table 1.8: India's Nuclear Forces (2014)

Type	Range (km)	Payload (kg)	Status
Ballistic Missiles (Land-based)			
Prithvi I/II	350	500	Inducted into the Strategic Forces Command in 2003
Agni I	~700	1000	Entered service in 2004
Agni II	>2000	1000	Possibly operational; test launched on 7 Apr. 2013
Agni III	>3200	1500	Inducted into the armed forces but not fully operational; test launched on 23 Dec. 2013
Agni IV	>3500	1000	Under development
Agni V	>5000	(1000)	Under development; test launched on 15 Sep. 2013
Ballistic Missiles (Sea-based)			
Dhanush	400	500	Induction under way but probably not operational; test launched on 24 Nov. 2013
K-15	700	500-600	Under development; test launched on 27 Jan. 2013
K-4	~3000	-	Under development; reportedly test launched from a submerged platform on 24 Mar. 2014
Aircraft			
Mirage 2000H Vajra	1850	6300	Reportedly certified for delivery of nuclear gravity bombs

Source: *SIPRI Yearbook 2014: Armaments, Disarmament and International Security*, p. 324.

83. *SIPRI Yearbook 2014*, p. 325.
84. Ankit Panda, "India's Indigenous Nuclear Submarine, Agni-V ICBM Set To Launch In 2015," *The Diplomat*, 11 February 2014.
85. "Work on second nuclear sub reactor begins," *Deccan Herald*, 1 December 2014, http://www.deccanherald.com/content/445065/work-second-nshyuclear-sub-reactor.html?mkt_tok=3RkMMJWWfF9wsRokvaTIZKXonjHpfsX67eQrWKKg38431UFwdcjKPmjr1YEGSsd0aPyQAgobGp5I5FEIQ7XYTLB2t60MWA%3D%3D.

Table 1.9: Pakistan's Nuclear Forces (2014)

Type	Range (km)	Payload (kg)	Status
Ballistic Missiles (Land-based)			
Abdali (Hatf-2)	180	200-400	Under development
Ghaznavi (Hatf-3)	290	500	Entered service in 2004; fewer than 50 launchers deployed
Shaheen I	750	750-1000	Entered service in 2003; fewer than 50 launchers deployed
Shaheen II	2000	(~1000)	Under development
Ghauri I (Hatf-6)	1250	700-1000	Entered service in 2003; fewer than 50 launchers deployed
Nasr (Hstf-7)	60	-	
Cruise missiles			
Babur (Hatf-7)	350	400-500	Under development; test launched on 17 Sep. 2012; initially ground launched, but sea- and air-launched versions reportedly also under development
Ra'ad (Hatf-8)	350	-	Under development; air-launched
Aircraft			
F-16A/B	1600	4500	~30 aircraft
Mirage V	2100	4000	

Source: *SIPRI Yearbook 2014: Armaments, Disarmament and International Security*, p. 330.

1.75 *Pakistan* is believed to have the fastest expanding nuclear arsenal. It is currently estimated to have some 100-120 warheads for delivery by missiles and aircraft.[86] Estimates of the number of weapons in Pakistan's nuclear arsenal are based on fissile material stock estimates and evidence of nuclear weapons design. Current warhead designs are believed to primarily use highly enriched uranium (HEU), although SIPRI analysts believe that the expansion of Pakistan's plutonium production capabilities and the development of smaller nuclear-capable ballistic and cruise missiles could indicate a trend towards an arsenal that is partly based on plutonium.[87] The Khushab plutonium production complex, combined with Pakistan's continuing HEU production, could increase Pakistan's annual nuclear warhead production capacity "several-fold," although this will depend on an adequate supply of uranium and the capacity to reprocess spent fuel.[88]

86. *SIPRI Yearbook 2014*, p. 328.
87. *SIPRI Yearbook 2014*, p. 328.
88. *SIPRI Yearbook 2014*, p. 329.

1.76 Pakistan is expanding its nuclear-capable missile arsenal, including through the development of several nuclear-capable short-range ballistic missiles that appear to be intended for battlefield missions. Pakistan's military describes the 60 km-range, road-mobile Nasr missile as a "quick response system," which "add[s] deterrence value" to the posture "at shorter ranges" in order "to deter evolving threats."[89] Pakistan also possesses aircraft that have been assigned a nuclear-weapon delivery role, and has a long-standing ambition to develop a sea-based nuclear deterrent (although the latter faces serious economic constraints).[90]

1.77 *Israel*'s policy of "nuclear ambiguity" or "nuclear opacity" makes any estimate of nuclear weapons numbers and capabilities essentially a matter of speculation. It is, however, thought to have an arsenal of some 80 nuclear weapons (50 for delivery by ballistic missiles and 30 non-strategic nuclear weapons).[91]

Table 1.10: Israel's Nuclear Forces (2014)

Type	Range (km)	Payload (kg)	Comments
Ballistic Missiles			
Jericho II	1500-1800	750-1000	Approx. 50 missiles; introduced in 1990
Jericho III	>4000	1000-3000	Status unknown
Aircraft			
F-16 A/B/C/D/I	1600	5400	205 aircraft. It is believed that some have nuclear weapons delivery purposes

Source: *SIPRI Yearbook 2014: Armaments, Disarmament and International Security*, p. 334.

1.78 *North Korea* is estimated to have enough fissile material for up to eight rudimentary weapons assuming that each uses 5 kg of weapon-grade plutonium.[92] Following a third underground nuclear test on 12 February 2013, in August 2013 Pyongyang appears to have restarted a reactor that it has used in the past to produce plutonium for nuclear warheads. It will be about 18 months before the first new bomb-ready plutonium will be separated from the spent fuel.[93] North Korea is frequently cited as possessing a total of 800–1,000 ballistic missiles of all types, but these estimates are highly uncertain, as are the capabilities and reliability of the missiles.[94] It is not believed to have mastered the technology to miniaturize warheads and make them robust enough to withstand the rigours of a ballistic missile flight trajectory, such as high gravity forces, vibrations and

89. Pakistani Inter Services Public Relations, Press Release no. PR94/2011-ISPR, 19 April 2011. Cited in *SIPRI Yearbook 2014*, p. 331.
90. Tim Craig and Karen DeYoung, "Pakistan is eyeing sea-based and short-range nuclear weapons, analysts say," *Washington Post*, 21 September 2014; Andrew Detsch, "Pakistan's Oversized Submarine Ambitions," *The Diplomat*, 9 October 2013.
91. *SIPRI Yearbook 2014*, p. 333.
92. *SIPRI Yearbook 2014*, p. 335.
93. "Nuclear Weapons: Who Has What at a Glance," Arms Control Association, 23 June 2014.
94. *SIPRI Yearbook 2014*, p. 337.

temperature extremes. Consequently its delivery capability for hitting distant (US, Australia, Europe) or even proximate (Japan) targets is questionable. Although in August/September 2014, North Korea performed a series of test-firings of a new short-range missile believed to be designed to carry a nuclear payload, South Korean military intelligence experts have stated that they are not nuclear-capable.[95]

1.4.2 Unilateral Measures

1.79 As noted above, such reductions as have occurred in US and Russian nuclear weapon stockpiles have resulted from a combination of bilateral commitments and unilateral decisions. The only other reductions known to have occurred have been in France and the United Kingdom, in each case as a result of a unilateral decision rather than any treaty process. At the NPT PrepCom in Vienna in 2012, *France*'s Head of Delegation confirmed that his country had met the objective set by the French president in 2008 to reduce its deterrent's airborne component (that is, missiles and nuclear warheads) by one-third. "All in all, in the last 15 years, we have cut the number of nuclear warheads by half and … announced the ceiling of nuclear warheads in our possession, which now number less than 300."[96]

1.80 The *United Kingdom* has announced reductions in the size of its arsenal since the 2010 NPT Review Conference. The 2010 Strategic Defence and Security Review concluded that the UK's minimum credible deterrence needs could be met with fewer nuclear weapons. As a consequence, the United Kingdom announced that by the mid-2020s, it would:

- Reduce the number of warheads on each of its submarines from 48 to 40;
- Reduce the requirement for operationally available warheads to no more than 120;
- Reduce the number of launch tubes on each submarine, from 12 to 8; and
- Reduce its overall nuclear weapons stockpile to no more than 180.[97]

1.81 In 2012, the United Kingdom confirmed that the projected changes had already been implemented with respect to at least one submarine and announced that the reduction from 160 to 120 operational warheads would be completed in time for the 2015 NPT Review Conference.[98] However, at the 2014 PrepCom, UK officials reverted to the original timeframe of the mid-2020s for these reductions.[99]

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95. Rajaram Panda, "North Korea Accumulates More Missile Capabilities – Analysis," *Eurasia Review*, 26 September 2014, http://www.eurasiareview.com/26092014-north-korea-accumulates-missile-capabilities-analysis/.

96. General Debate Statement by the Head of the French Delegation at the First Meeting of the Preparatory Committee of the 2015 NPT Review Conference (Vienna, 30 April–11 May 2012).

97. UK Secretary of State for Defence, Written Ministerial Statement, 29 June 2011 (Hansard reference Column 51 WS).

98. Statement by UK Head of Delegation (under Cluster 1 – Disarmament) at the 2012 Preparatory Committee of the 2015 NPT Review Conference, Vienna, 3 May 2012.

99. http://www.reachingcriticalwill.org/images/documents/Disarmament-fora/npt/prepcom14/statements/2May_UK.pdf.

1.4.3 Bilateral Processes

1.82 The 2010 NPT Review Conference saw Russia and the United States "commit to seek the early entry into force and full implementation of New START." They were also encouraged "to continue discussions on follow-on measures in order to achieve deeper reductions in their nuclear arsenals" (Action 4).

1.83 New START entered into force on 6 February 2011, after ratification by the United States on 22 December 2010 and by Russia on 25 January 2011. The treaty commits the two countries to establish new limits on deployed strategic offensive nuclear weapons by 2018. For warheads, these are 74 per cent lower than the limit of the 1991 START Treaty and 30 per cent lower than the deployed strategic warhead limit of the 2002 Moscow Treaty. For deployed ICBMs, SLBMs and nuclear-capable heavy bombers, the limits are less than half the corresponding strategic nuclear delivery vehicle limit of the 1991 START Treaty. The aggregate limits established by the treaty are 1,550 deployed strategic warheads (with each deployed nuclear-capable heavy bomber counting as just one warhead towards the limit) and a combined (deployed and non-deployed) limit of 800 strategic nuclear delivery vehicles (ICBMs, SLBMs, bombers), of which no more than 700 may be deployed.[100] Annual reductions in strategic offensive arms are not required, and each party is permitted to determine its own strategic force structure within these limits.[101]

1.84 The treaty's verification regime provides for up to 18 on-site inspections per year, data exchanges (through a common database) and notifications (numbers, locations and technical specifications of weapons systems and facilities subject to the treaty), non-interference with national technical means of verification, and an annual exchange of telemetric information (missile performance measurements) for up to five ICBM and SLBM launches per year.

1.85 The treaty also establishes a compliance and implementation body, the Bilateral Consultative Commission, which meets at least twice a year. Information on reductions is made publicly available online, but details of discussions on compliance are not included. Between February 2011 and September 2013, Russia reduced its deployed warhead numbers from 1,537 to 1,512; the United States from 1,800 to 1,585. Over the same period, the number of Russian strategic nuclear delivery vehicles fell from 521 to 498; and that of the United States from 882 to 778.[102] However, Russia's deployments in both categories increased in relation to the 2012 figures (1499/491), reflecting Russia's commitment to achieve strategic parity with the United States. More recent aggregate figures show that between 1 September 2013 and 1 September 2014, deployments increased in both states, but these appear to be the product of temporary fluctuations rather than signalling non-compliance with New START, whose required aggregate reductions do not have to be achieved until 2018.[103]

100. http://www.whitehouse.gov/blog/2010/04/08/new-start-treaty-and-protocol.
101. http://www.state.gov/documents/organization/230113.pdf.
102. http://www.armscontrol.org/factsheets/Nuclearweaponswhohaswhat.
103. Kristensen, "New START: Russia and the United States Increase Deployed Nuclear Arsenals," Federation of American Scientists, 2 October 2014, http://fas.org/blogs/security/2014/10/newstart2014/.

1.86 Even if New START, addressing deployed strategic weapons, remains on track, it remains clear that the two nuclear superpowers are retaining excessively large nuclear arsenals, reflecting a serious unwillingness to uphold their NPT Article VI obligations and to implement the 2010 NPT Action Plan.

1.87 In February 2011, the US Senate, in its resolution consenting to ratification of New START, said that the United States should seek within a year to initiate new negotiations with Russia to address tactical nuclear weapon stockpile disparities "and to secure and reduce tactical nuclear weapons in a verifiable manner." President Obama told the Senate in March 2011 that he would try to do this, but no bilateral negotiations have taken place. The United States and Russia both say they have taken unilateral steps to reduce their stockpiles of tactical nuclear weapons from 1991 levels (by about 90 per cent in the case of the US and about 75 per cent in the case of Russia) but currently there is no momentum to continue these reductions via a formal bilateral process.

1.88 As outlined by President Obama in Berlin in June 2013, the United States remains open to negotiate further reductions with Russia in all categories of nuclear weapons, including non-strategic. In his speech to the UN First Committee on 9 October 2014, Mikhail Ulyanov, Director of the Department for Non-Proliferation and Arms Control, noted that Russia had "pulled back" its non-strategic nuclear weapons to its territory a long time ago, and called on other states possessing such weapons to follow Russia's example.[104] He did not repeat the comments made in 2012 by Russia's Deputy Foreign Minister Sergei Ryabkov, who said publicly that Russia is open to discussing further reductions in tactical nuclear weapon inventories.[105]

1.89 Tensions over Ukraine, differences over ballistic missile defence and advanced conventional weapons, and also the prospects of an arms race in outer space, are impediments to further progress on nuclear arms reductions. In a written address to a meeting of International Physicians for the Prevention of Nuclear War in Hiroshima in August 2012, President Vladimir Putin said that, while Russia is open to the idea of additional cuts in Russian and US nuclear arsenals, this will only be possible "if all factors affecting international security and strategic stability are taken into account." Inhibiting factors include "the unilateral and totally unlimited deployment of a global U.S. missile defense system," the possible weaponization of space and conventional arms imbalances in Europe.[106] Unfortunately, tensions related to these issues have escalated significantly since then. The issue of conventional arms imbalances, not just in Europe, and particularly of US global superiority in conventional weapons capability, will complicate and may significantly impede future bilateral, and multilateral, disarmament negotiations. (See section on parallel security issues, below.)

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104. According to Russia's national report to the 2014 NPT PrepCom, Russia's non-strategic nuclear weapons are "non-deployed" and are "located exclusively within national territorial boundaries" at "centralized storage bases." The United States similarly claims to have reduced the number of its non-strategic nuclear warheads by 90 per cent between 1967 and September 2009. See US Statement (under Cluster 1 – Disarmament) at the 2012 Preparatory Committee of the 2015 NPT Review Conference, Vienna, 3 May 2012 and http://www.un.org/ga/search/view_doc.asp?symbol=NPT/CONF.2015/PC.III/17.

105. http://www.mid.ru/brp_4.nsf/0/72A5D657EC7A908244257D6C0029CF8E.

106. Reuters, "Putin Links Nuclear Cuts to U.S. Shield," *Moscow Times*, 27 August 2012.

1.90 In the United States, concerns are mounting that New START's monitoring provisions might not be sufficient to detect treaty violations.[107] The verification system agreed upon is less robust than the one implemented under the old START regime. When New START was negotiated, this was considered appropriate due to improvements in bilateral US–Russian relations. But concerns seem to have increased since the publication in July 2014 of the Annual Report on Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments, which states that the US has determined that Russia has violated the 1987 Intermediate-Range Nuclear Forces (INF) Treaty.

Table 1.11: New START

Type	Russia	US
Maximum Number of Weapons after 7 years		
Deployed ICBM, SLBMs, and bombers	700	700
Warheads on deployed ICBMs, deployed SLBMs, deployed and heavy bombers	1550	1550
Deployed and non-deployed ICBM launchers, SLBM launchers and heavy bombers	800	800
Reductions as of 2014[a]		
Deployed warheads	1643	1642
Strategic delivery vehicles	528	794
Inspections and Notifications as of 2014		
Inspections[b]	68[c]	68[c]
Notifications exchanged	7505[c]	7505[c]

Notes:

a As of 1 September 2014, see US Department of State <http://www.state.gov/t/avc/rls/232359.htm>.

b The US and Russia are permitted 18 short-notice on-site inspections per year each under the treaty. Their purpose is to confirm information shared in notifications.

c As of 6 Nov 2014, see US Department of State <http://www.state.gov/t/avc/newstart/index.htm>.

Source: SIPRI and A. Woolf, *The New START Treaty: Central Limits and Key Provisions*, Library of Congress, Congressional Research Service, Washington, DC, 27 Aug. 2014, URL http://fas.org/sgp/crs/nuke/R41219.pdf.

1.4.4 Multilateral Processes

1.91 **Conference on Disarmament.** The world's only standing multilateral disarmament negotiating forum is the Conference on Disarmament (CD) based in Geneva. It has been unable to agree and implement any program of work since the conclusion of nuclear-test-ban treaty negotiations in 1996. There has been protracted disagreement over the priority to be given to core issues: nuclear disarmament, a fissile material production ban, preventing an arms race in outer space, and assurances of immunity from nuclear

107. Amy F. Woolf, "The New START Treaty: Central Limits and Key Provisions," *CRS Report to Congress*, 27 August 2014, pp. 28–34.

attack for non-NWS. With Pakistan having in recent years taken the lead in blocking the adoption of a program of work because of its unshakeable opposition to fissile material cut-off treaty (FMCT) negotiations, the CD remains essentially moribund and in no position to "establish a subsidiary body to deal with nuclear disarmament."[108] The impasse in the CD is eroding its credibility; efforts to get it back to work are discussed in the next chapter (§2.10).

1.92 **UN General Assembly.** In 2012 the General Assembly First Committee established an open ended working group to develop proposals to take forward multilateral nuclear disarmament. In 2013 the First Committee, by a vote of 158 in favour, 4 against (France, Russia, United Kingdom, United States) and 20 abstentions, welcomed the open ended working group's report and requested the secretary-general to seek the views of member states on how to take forward multilateral nuclear disarmament; he reported back on this in 2014 (A/69/154). A further resolution on "Taking forward multilateral nuclear disarmament negotiations" (A/C.1/69/L.21), continuing that process and resolving to take stock as to where it had got to at the General Assembly's 70th session in 2015, was adopted at the 2014 First Committee by a vote of 152 in favour, 4 against (France, Russia, United Kingdom, United States) and 22 abstentions. The United States, on behalf of itself, France and the United Kingdom, reaffirmed the view that there are already sufficient forums for discussion of multilateral nuclear disarmament negotiations and registered concern over the consistency between the General Assembly initiative and the NPT and its 2010 Action Plan.[109]

1.93 **The Five NWS.** While China advocates "the complete prohibition and thorough destruction of nuclear weapons,"[110] and has until now taken steps consistent with this position (for example, its unconditional no first use and negative security assurance declarations), it has taken no steps in support of any initiative in nuclear disarmament, believing this to be the particular responsibility of the two most heavily armed NWS. As such, China believes that Russia and the United States "should further drastically reduce their nuclear arsenals in a verifiable, irreversible and legally-binding manner, so as to create the necessary conditions for the complete elimination of nuclear weapons."[111]

1.94 In its national report to the 2014 NPT PrepCom, Russia declared that it stands ready to "further pursue verifiable and irreversible limitation of nuclear weapons in compliance with its obligations under Article VI of the NPT."[112] The report states that these measures should be taken in a step-by-step process that ultimately aims at universal and complete disarmament, which can only be achieved "if addressed comprehensively while maintaining strategic stability, and respecting the principle of equal and indivisible security for all." According to the report, multilateral nuclear disarmament is dependent upon a number of steps being implemented by nuclear-capable states, including a prohibition on placing weapons in outer space; agreement that the accumulation of non-nuclear strategic offensive arms is "inadmissible"; abandonment of the "one-sided

108. 2010 NPT Review Conference Action 6.
109. http://reachingcriticalwill.org/images/documents/Disarmament-fora/1com/1com14/eov/L21_P3.pdf.
110. *China Defence White Paper 2010*.
111. *China Defence White Paper 2010*.
112. http://www.reachingcriticalwill.org/disarmament-fora/npt/2014/national-reports.

development of strategic ABM [anti-ballistic missile] systems"; and efforts to eliminate quantitative and qualitative imbalances in conventional arms.

1.95 The *United Kingdom* sees nuclear disarmament as an incremental, benchmarked and multilateral process based on nuclear non-proliferation, growing trust and confidence among states (including confidence in the efficacy of safeguards and verification techniques), and other "tangible steps towards a safer and more stable world where countries with nuclear weapons feel able to relinquish them."[113] However, apart from its verification work with Norway (as discussed above) and the United States, and its participation in the P5 conferences (discussed below) – better described as "NWS conferences" in this context – the United Kingdom has not been visible in operationalizing this approach. France, while joining in relevant NWS discussions and statements, has shown no serious interest in any multilateral disarmament process.

1.96 In the case of the *United States*, the 2010 NPR report described as "very demanding" the conditions that would "ultimately permit the United States and others to give up their nuclear weapons without risking greater international instability and insecurity." Among them were "success in halting the proliferation of nuclear weapons, much greater transparency into the programs and capabilities of key countries of concern, verification methods and technologies capable of detecting violations of disarmament obligations, enforcement measures strong enough to deter such violations, and ultimately the resolution of regional disputes that can motivate rival states to acquire and maintain nuclear weapons."[114]

1.97 In a carefully worded statement delivered by the United States to the PrepCom on 3 May 2012, the NWS jointly reaffirmed their "enduring commitment" to the fulfilment of their obligations under Article VI of the NPT and to the Action Plan adopted at the eighth review conference in 2010. They attributed the success of the 2010 Review Conference to "the *international community's shared commitment* to seeking a safer world for all and *to creating the conditions for a world without nuclear weapons* … in a way that promotes international stability, peace and security; based on the principle of undiminished security for all; and *underlining the vital importance of non-proliferation for achieving this goal*" (emphases added). The statement noted, with a degree of satisfaction not shared even by some of the NWS's closest friends, "the unprecedented progress and efforts made by the nuclear-weapon states in nuclear arms reduction, disarmament, confidence-building and transparency."[115]

1.98 The statement described the NWS dialogue process begun in September 2009 at the London Conference on Confidence Building Measures towards Nuclear Disarmament. A second meeting was held in Paris in July 2011 to discuss implementation of the 2010 NPT Review Conference Action Plan. In Paris, the NWS agreed to establish a working

113. *Securing Britain in an Age of Uncertainty*, p. 37. This approach to multilateral disarmament was restated in the 2013 UNGA First Committee. See *UK Statement on Nuclear Weapons*, New York, 16 October 2013.

114. US, *Nuclear Posture Review*, Executive Summary, p. xv.

115. "P5 Statement to the 2012 Preparatory Committee of the 2015 NPT Review Conference, Vienna, 3 May 2012." The added emphasis draws attention to some persistent, and troubling, elements of P5 nuclear disarmament doctrine: getting rid of nuclear weapons is not just the responsibility of the nuclear weapons possessors; the world will have to change first; and any further increase in the number of nuclear-armed states will make an already distant objective recede even farther over the horizon.

group under the direction of China to compile a glossary of terms to facilitate future engagement on nuclear disarmament issues.

1.99 The P5/NWS continued their discussions in Washington (June 2012), Paris (April 2013), and Beijing (April 2014). The focus in these discussions has been on issues of transparency, mutual confidence and verification, including fulfilment of the requirement to report to the 2014 NPT PrepCom on implementation of the 2010 NPT Review Conference Action Plan. Under the leadership of France, the NWS agreed to a reporting framework and introduced their national reports to one another during their April 2014 conference in Beijing.[116] They also discussed the Glossary of Key Nuclear Terms, which is being developed in a working group under China's leadership. The first phase of the glossary is due to be completed in time for the 2015 NPT Review Conference. The UK has offered to host the sixth P5 conference in London in 2015. Forty-five years after the entry into force of the NPT, and some twenty years after the end of the Cold War, this would seem at best to be a modest achievement.

1.100 Beyond these discussions, the NWS have been wary of multilateral initiatives that occur outside the NPT process and formal UN disarmament machinery. Their reluctance to engage with the humanitarian consequences movement (discussed below in 1.8.4), which has drawn attention to the horrific impact of nuclear weapons use through a series of conferences in 2013-14, is a good example of this behaviour. The reasons they have not engaged can be found in a statement issued by the United Kingdom at the Conference on Disarmament on 5 March 2013, which cautioned that the humanitarian consequences movement might "divert attention and discussion away from what has been proven to be the most effective means of reducing nuclear dangers – a practical, step by step approach that includes all those who hold nuclear weapons."[117] Behind this is the long-standing NWS hostility to any initiative that might increase international support to begin negotiating a nuclear weapons convention that would ban the use and possession of nuclear weapons. The decision by the United States, followed by the UK, to break with NWS solidarity and attend the Vienna Conference in December 2014 indicates that their respective governments have concluded that it would be politically damaging to remain outside the initiative, and that there may be some prospects for constructive engagement with conference participants.

1.4.5 North Korea

1.101 The situation in North Korea requires separate discussion, because it has only very recently joined the ranks of the nuclear-armed states, possesses a much smaller nuclear arsenal than the other eight, and remains the subject of intense diplomatic efforts aimed at dismantling its nuclear weapons program. North Korea effectively confirmed its withdrawal from the NPT in January 2003[118] – the only country so far to

116. http://www.state.gov/r/pa/prs/ps/2014/04/224867.htm.

117. UK Statement on Nuclear Weapons, Geneva, 5 March 2013, www.unog.ch/80256EDD006B8954/(httpAssets)/.../$file/1281UK.pdf.

118. A state party has the right to withdraw from the NPT if it decides that "extraordinary events, related to the subject matter of [the] Treaty, have jeopardized the supreme interests of its country" (Article X). North Korea announced its withdrawal from the NPT on 12 March 1993 but then suspended it on 11 June 1993, the day before the decision would have taken effect. In January 2003, North Korea ended the suspension, which for all practical purposes meant withdrawal with immediate effect. Christer Ahlstrom, "Withdrawal from arms control treaties," *SIPRI Yearbook 2004: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 2004), pp. 763–77.

have done so – after being accused of operating a clandestine uranium enrichment program. North Korea cited the "grave" threat to its security and sovereignty posed by the US "tyrannical nuclear crushing policy toward the DPRK" (Democratic People's Republic of Korea).[119] This led also to the collapse of the 1994 US–DPRK Agreed Framework which had facilitated the suspension of an earlier notice of withdrawal and "froze Pyongyang's plutonium-based nuclear program for nearly a decade."[120]

1.102 In September 2005, at the fourth round of Six Party Talks (between North Korea, South Korea, Japan, China, Russia and the United States) begun in 2003 with the aim of denuclearizing the Korean Peninsula, North Korea, in return for security assurances and the promise of economic cooperation, "committed to abandoning all nuclear weapons and existing nuclear programs" and to returning to the NPT and International Atomic Energy Agency (IAEA) safeguards.[121] A year later, North Korea tested its first nuclear explosive device. This prompted UN Security Council Resolution 1718 demanding North Korea "abandon all nuclear weapons and existing nuclear programs" and "return immediately to the Six Party Talks without preconditions."[122] The resolution imposed sanctions, including a weapons import-export ban, on North Korea.

1.103 In 2007, the six parties reached agreement on a plan to implement the 2005 Joint Statement,[123] but the agreement did not hold. In 2009, North Korea tested a second nuclear explosive device and announced its permanent withdrawal from the Six Party Talks.[124] UN Security Council Resolution 1874 (12 June 2009) condemned the test "in the strongest terms" and demanded that "the DPRK not conduct any further nuclear test or any launch using ballistic missile technology." The resolution strengthened the mandatory international sanctions imposed three years earlier. The Panel of Experts established pursuant to Resolution 1874 reported in 2012 that North Korea continued to violate Security Council Resolutions 1718 and 1874. The Panel found that North Korea was using elaborate techniques to evade Security Council sanctions and the vigilance of UN member states.[125] The Panel's final report of 6 March 2014 stated that North Korea is "persisting with its arms trade and other prohibited activities in defiance of Security Council resolutions" and "makes increasing use of multiple and tiered circumvention techniques." The Panel recorded its strong belief that "overall implementation of existing sanctions should be significantly improved."[126]

119. Korean Central News Agency (KCNA), 22 January 2003.
120. George Bunn and John B. Rhinelander, "NPT Withdrawal: Time for the Security Council to Step In," http://www.armscontrol.org/act/2005_05/Bunn_Rhinelander.
121. Joint Statement of the Fourth Round of the Six-Party Talks, Beijing, 19 September 2005; http://www.fmprc.gov.cn/eng/zxxx/t212707.htm.
122. S/RES/1718 (14 October 2006).
123. Joint Statement of the Fourth Round of the Six-Party Talks, Beijing, 19 September 2005.
124. Korean Central News Agency (KCNA), "KCNA report on one more successful underground nuclear test," 25 May 2009, http://www.kcna.co.jp/item/2009/200905/news25/20090525-12ee.html.
125. http://www.un.org/ga/search/view_doc.asp?symbol=S/2012/422.
126. Report of the Panel of Experts established pursuant to resolution 1874 (2009), 6 March 2014, http://www.un.org/ga/search/view_doc.asp?symbol=S/2014/147.

1.104 North Korea revealed the presence of a uranium enrichment facility at Yongbyon in 2010.[127] It is also developing a progressively more extensive range of ballistic missile capabilities. North Korea has close links with Iran and Syria and is a major proliferator of ballistic missile and other weapons of mass destruction (WMD)-related systems and technology. A February 2012 deal that would have had North Korea suspend uranium enrichment and nuclear weapon and long-range missile tests, and the United States send nutrition aid, collapsed in April 2012 in the face of Pyongyang's determination to proceed with a long-range rocket launch. The April launch was a failure, but a further launch on 12 December 2012 was successful and drew condemnation from the UN Security Council president for constituting a clear violation of its resolutions.

1.105 North Korea's nuclear defiance continued in 2013–14. On 12 February 2013 a third nuclear test led the Security Council to impose a further round of sanctions, and in April 2013 a report by the US Defense Intelligence Agency concluded with "moderate confidence" that North Korea's military had developed the capability to launch nuclear-capable ballistic missiles.[128] This assessment proved controversial at the time, and North Korea's nuclear capabilities remain a subject of intense debate. In August/September 2014, following a series of test-firings of a new short-range missile believed to be designed to carry a nuclear payload, South Korean military intelligence experts stated that they do not believe the new missiles are nuclear-capable.[129]

1.106 A successful negotiated reversal of North Korea's nuclear program would reinforce the view that nuclear arms reductions can be made safely, "based on the principle of increased and undiminished security for all."[130] North Korea repeatedly violated its international non-proliferation obligations, undermining confidence in the NPT and associated safeguards arrangements and thus also in the integrity of the nuclear disarmament–non-proliferation bargain. This is extremely damaging; the international community must be confident that states cannot walk away from their non-proliferation commitments with impunity. In 2003, the Security Council failed to live up to its responsibilities in this regard when it took no action in response to North Korea's withdrawal from the NPT. Developments to that point and since have provided ample evidence that North Korea's withdrawal from the NPT posed a threat to international peace and security, as subsequently recognized in Security Council Resolutions 1718 (14 October 2006), 1874 (12 June 2009), 2087 (22 January 2013) and 2094 (7 March 2013).

1.107 Resumption of the Six-Party Talks – or at least some further process leading to a multilaterally negotiated set of agreements, involving the key players in and around the Korean peninsula – still offers the best hope of pursuing a comprehensive, negotiated

127. In November 2010, North Korea showed a visiting delegation of US scientists a new uranium enrichment facility, located in a former fuel-rod fabrication building at Yongbyon. The scientists were told that the facility contained 2,000 centrifuges in six cascades; that it was built between April 2009 and November 2010; and that it was producing uranium with an average enrichment level of 3.5 per cent for a civilian light-water reactor program. S.S. Hecker, "What I found in North Korea," *Foreign Affairs*, 9 December 2010, p. 4, http://www.foreignaffairs.com/articles/67023/siegfried-s-hecker/what-i-found-in-north-korea.

128. Steven Pifer, "North Korea and Nuclear-Armed Missiles: Calming the Hyperbole," 15 April 2013, http://www.brookings.edu/blogs/up-front/posts/2013/04/15-north-korea-nuclear-missiles-pifer.

129. Panda, "North Korea Accumulates More Missile Capabilities."

130. A much-used phrase in this context. See, for example, 2010 NPT Review Conference, *Conclusions and recommendations for follow-on actions* I (Nuclear Disarmament) A (Principles and Objectives) iv.

resolution of the North Korea nuclear issue. However reluctantly, key players may need again to consider an initiative to bring North Korea back to the negotiating table. North Korea must realize that its nuclear weapons program has detracted from, rather than enhanced, its international standing and national security; and that isolation and eventual economic collapse pose a far more real threat to the regime than external attack. Recognizing that the international community is dealing with a disarmament problem created by a former, but not current, NPT state party, the objective must be North Korea's return to the NPT as a non-NWS and resumption of, and full compliance with, its IAEA safeguards obligations. At the very least, North Korea should be signed up to NPT-equivalent export, transfer and assistance disciplines through parallel agreements.

§1.5 Nuclear Doctrine

1.108 Reducing the role and salience of nuclear weapons in the national security strategies of the nuclear-armed states is a crucial step on any road to nuclear disarmament. This has been recognized in the prominence given to this subject in NPT Review Conference discussions, every major commission and panel report, and indeed in President Obama's path-breaking 2009 Prague speech, when he said 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." Unhappily, however, this recognition has been matched by very few, if any, significant moves in this direction by the nuclear-armed states.

1.109 *China*'s stated nuclear doctrine goes further than the other nuclear-armed states in limiting the role of nuclear weapons. Its weapons, declared doctrine and force posture and deployment patterns are said to be designed neither to coerce others nor to fight a nuclear war with the expectation of winning, but to counter any attempt at nuclear blackmail. According to Li Bin, director of the Arms Control Program in Tsinghua University's Department of International Relations, China "chooses to keep a small, off-alert nuclear force" as a means of "countering nuclear coercion" but does not consider nuclear weapons to have any real military utility.[131] Its 2010 Defence White Paper says that China "has always exercised the utmost restraint in the development of nuclear weapons" and will continue to "limit its nuclear capabilities to the minimum level required for national security." China remains firmly committed to no-first-use of nuclear weapons "at any time and in any circumstances" and has made an "unequivocal commitment" not to use or threaten to use nuclear weapons against non-NWS and nuclear-weapon-free zones: that is, it would not use its nuclear weapons even in the extreme circumstances of its very survival being at stake under conventional attack. China wants the NWS to conclude treaties on mutual no-first-use of nuclear weapons and to provide unconditional treaty-based negative security assurances to non-NWS.[132] But might China's intense nuclear force modernization be indicative of a future hardening of its nuclear doctrine? China's lack of transparency will continue to make it difficult to

131. http://www.armscontrol.org/act/2011_03/LiBin.
132. *China Defence White Paper 2010*.

assess whether evolving force structures and postures do in fact accord with published statements of doctrine.[133]

1.110 President Nicolas Sarkozy gave a clear exposition of *France*'s nuclear doctrine in a speech in Cherbourg in March 2008. He emphasized France's strong attachment to its nuclear deterrent. While nuclear weapons would only be used "in extreme circumstances of legitimate defence," their role was not simply to protect France against nuclear attack but from "any aggression against [its] vital interests emanating from a State – wherever it may come from and whatever form it may take." France's nuclear deterrent was "quite simply the nation's life insurance policy."[134] The 2013 French White Paper on defence and national security similarly describes nuclear deterrence as "the ultimate guarantee of our sovereignty."[135]

1.111 *Russia* reserves the right to use nuclear weapons in response to a WMD attack on it or its allies or if the country was under conventional attack and its very existence was under threat. According to its 2010 military doctrine, Russia's nuclear weapons are intended to prevent military conflict and, as such, have a potential role to play in regional and large-scale conflicts involving not only nuclear or other WMD but also conventional weapons. Whereas, however, the previous (2000) version of the doctrine envisaged a possible first use of nuclear weapons "in situations critical for [the] national security" of Russia, the 2010 version foresees their use only in circumstances where "the very existence of Russia is under threat."[136] It was reported in December 2014 that a new draft of the Russian doctrine resisted military pressure to make explicit provision for pre-emptive nuclear strikes.[137]

1.112 In February 2012, then-Prime Minister Vladimir Putin described Russia's "robust nuclear deterrent" as a counterweight to US strength and a contribution to international stability. He ruled out any concessions on tactical nuclear weapons. Russia's armed forces were in fact "preparing additional stronger weapons." Final nuclear disarmament would only be possible when Russia had "exceptionally accurate non-nuclear systems of similar effectiveness"[138] (to those under development in the United States). In August 2014, amid the escalating crisis in Ukraine, Putin, Russia's president again since May 2012, spoke to a pro-Kremlin youth group about his belief that "no one is thinking of unleashing a large-scale conflict with Russia," because "Russia is one of the leading nuclear powers."[139]

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133. There were no references to no-first-use in China's most recent White Paper, released in April 2013, raising questions on whether China's position on nuclear weapons might be changing. However, China's national report to the 2014 NPT PrepCom emphasized that: "China always honors its commitment of not being the first to use nuclear weapons at any time or under any circumstances... China has never deviated from its commitment and will never do so in the future." See *Implementation of the Treaty on the Non-Proliferation of Nuclear Weapons, Report submitted by the People's Republic of China*, 2014 NPT PrepCom, http://www.reachingcriticalwill.org/disarmament-fora/npt/2014/national-reports.

134. Speech by President Nicolas Sarkozy, Cherbourg, 21 March 2008, http://www.acronym.org.uk/docs/0803/doc09.htm.

135. Government of France, Livre Blanc: Défense et Sécurité Nationale 2013 [White Paper: Defense and National Security 2013] (Paris, 2013), www.gouvernement.fr/sites/default/files/fichiersjoints/livre-blanc-sur-la-defense-et-la-securite-nationale_2013.pdf.

136. Nikolai Sokov, *The New 2010 Russian Military Doctrine: The Nuclear Angle*; http://npsglobal.org/eng/component/content/article/147-articles/847-the-new-2010-russian-military-doctrine-the-nuclear-angle-nikolai-sokov-.html.

137. "Preemptive nuclear strike omitted from Russia's new military doctrine – reports," *RT*, 10 December 2014, http://rt.com/politics/213111-russia-nuclear-preemptive-strike/.

138. "Strong Russian Nuclear Force Deters Conflict, Putin Says," *Global Security Newswire*, 27 February 2012. Putin's comments are broadly consistent with current Russian military doctrine which "assigns high-precision [apparently, conventional] weapons to the mission of strategic deterrence." Sokov, *The New 2010 Russian Military Doctrine*.

139. Colin Freeman, "Vladimir Putin: don't mess with nuclear-armed Russia," *Daily Telegraph*, 29 August 2014.

1.113 The *United Kingdom* states that it will only consider using nuclear weapons "in extreme circumstances of self-defence, including the defence of [its] NATO Allies" but remains "deliberately ambiguous about precisely when, how and at what scale [it] would contemplate their use."[140] It is committed to the long-term goal of a world without nuclear weapons, but not while large arsenals of nuclear weapons remain and there is any risk of nuclear proliferation. Until then, "only a credible nuclear capability can provide the necessary ultimate guarantee [of] national security. The British government is therefore committed to maintaining a minimum national nuclear deterrent, and to proceeding with the renewal of Trident and the submarine replacement program."[141]

1.114 In the *United States*, the Obama administration has shown in multiple ways that it is acutely conscious of the significance of nuclear doctrine in setting the scene for serious movement towards disarmament, but so far its achievements in this respect have been more rhetorical than real. The April 2010 NPR Report recognized that, with "the growth of unrivalled U.S. conventional military capabilities, major improvements in missile defenses, and the easing of Cold War rivalries," there was an opportunity and the need to better align US nuclear doctrine with contemporary national security priorities: preventing nuclear terrorism and nuclear proliferation.[142] Furthermore, by "reducing the role and numbers of U.S. nuclear weapons – and thereby demonstrating that we are meeting our NPT Article VI obligation to make progress toward nuclear disarmament – we can put ourselves in a much stronger position to persuade our NPT partners to join with us in adopting the measures needed to reinvigorate the non-proliferation regime and secure nuclear materials worldwide against theft or seizure by terrorist groups."[143]

1.115 The NPR affirmed that the primary function of US nuclear weapons was to deter nuclear attack on the United States, its allies and partners. Although nuclear weapons would continue to have a role in deterring non-nuclear attacks (conventional, biological and chemical), this role had diminished and would continue to do so. While the United States was "not prepared at the present time to adopt a universal policy that deterring nuclear attack is the sole purpose of nuclear weapons … [it] will work to establish conditions under which such a policy could be safely adopted."[144] The United States would consider the use of nuclear weapons only "in extreme circumstances to defend the vital interests of the United States or its allies and partners."[145] Henceforth, non-nuclear systems could be expected to make an increasingly significant contribution to US deterrence and reassurance goals.

1.116 In June 2013, following a Pentagon-led interagency review that had the support of the US military and strategic command, the US published "new guidance" on its nuclear strategy that did not alter the nuclear doctrine set out in the 2010 NPR. Its only break with the past was a decision that the United States can secure itself, its allies and partners with

140. *Securing Britain in an Age of Uncertainty*, p. 37.

141. General Statement by UK Head of Delegation at the 2012 Preparatory Committee of the 2015 NPT Review Conference, Vienna, 30 April 2012. A final decision on the shape of Britain's future nuclear deterrent will not, however, be taken until after the next general election, which will be held on 7 May 2015.

142. *Nuclear Posture Review*, April 2010, p. 6.

143. *Nuclear Posture Review*, April 2010, p. 7.

144. *Nuclear Posture Review*, April 2010, p. viii.

145. *Nuclear Posture Review*, April 2010, p. 16.

up to one-third fewer deployed strategic warheads than permitted by New START. Despite this, a White House summary of the new guidance states that it "narrowed" the US nuclear strategy "to focus on only those objectives and missions that are necessary for deterrence in the 21st century" – a claim that lacks substance.[146] The concerns of US allies in both Europe and East Asia are a significant factor in the US reluctance to adopt a sole purpose doctrine,[147] and progress is unlikely until they show a willingness to reduce their reliance on the nuclear component of US extended deterrence (as discussed further below).[148]

1.117 *India* first conducted what it called a "peaceful nuclear explosion" on 18 May 1974. It confirmed its nuclear-armed status almost twenty-five years later with five tests over the period 11–13 May 1998. India's declared aim is to "pursue a doctrine of credible minimum nuclear deterrence." It will not be the first to use nuclear weapons but would "respond with punitive retaliation should deterrence fail." India has pledged not to use nuclear weapons against non-aligned non-NWS.[149] It has, however, reserved the right to use nuclear weapons in response to biological or chemical weapons attack,[150] and to that extent its commitment to "no first use" is qualified.

1.118 India's National Security Advisory Board published its draft report on nuclear doctrine in 1999, and it was officially adopted by the cabinet on 4 January 2003. Kanti Bajpai divides India's analysts into three camps: rejectionists; maximalists; and pragmatists, who accept that nuclear weapons have both a security (deterrence and prevention of nuclear coercion) and political (global prestige) role to play in India's defence and foreign policy.[151] The stated doctrine of credible minimum deterrence reflects the triumph of the pragmatists. While "credibility" is defined by retaliatory capability, command-control-communications survivability, and political will on the part of the Nuclear Command Authority, "minimum" defines size, cost, posture, doctrine and use.[152] The doctrine remains in place despite calls for change among some Indian nuclear strategists, who argue that it is not credible because they believe no Indian government would follow through on the threat of massive retaliation in response to a sub-strategic WMD attack.[153] In August 2014 Prime Minister Narendra Modi put an end to speculation that his BJP government would amend it when he stated in public that he does not plan to initiate a doctrinal review.[154] However, this fails to address the doubts

146. The White House, "Fact Sheet: Nuclear Weapons Employment Strategy of the United States," 19 June 2013, http://www.whitehouse.gov/the-press-office/2013/06/19/fact-sheet-nuclear-weapons-employment-strategy-united-states.

147. Some of these concerns were expressed during the 8th Japan–Australia Track 1.5 Dialogue, which took place in Tokyo on 20-21 June 2013, shortly after the new guidance was released. See the report on the meeting: http://www2.jiia.or.jp/en/pdf/conference/130620eng_The_8th_Japan–Austraria_Track1_5_Dialogue.pdf.

148. Gareth Evans, "The Road to Abolition: Beyond the Nuclear Umbrella," Keynote Address to the Asahi Shimbun International Peace Symposium, The Road to Abolition of Nuclear Weapons, Nagasaki, Japan, 2 August 2014, http://www.gevans.org/speeches/speech548.html.

149. Draft *Report of the National Security Advisory Board on Indian Nuclear Doctrine*, 17 August 1999; http://www.fas.org/nuke/guide/india/doctrine/990817-indnucld.htm.

150. http://www.armscontrol.org/factsheets/indiaprofile.

151. Kanti Bajpai, "India's Nuclear Posture after Pokhran II," *International Studies* 37:4 (October 2000), pp. 267–301.

152. Tanvi Kulkarni and Alankrita Sinha, "India's Credible Minimum Deterrence: A Decade Later," Institute of Peace and Conflict Studies (New Delhi), *IPCS Issue Brief* 179 (December 2011), www.ipcs.org/pdf_file/issue/IB179-NSP-AlankritaTanvi.pdf.

153. Lt.-Gen. B.S. Nagal (ret'd), "Checks and Balances," *Force* (June 2014), http://www.forceindia.net/Checks_and_Balances.aspx; Abhijit Iyer-Mitra, "India's Nuclear Imposture," *New York Times*, 11 May 2014; Jaideep A Prabhu, "India's Nuclear Indecision," *South Asian Idea*, 5 May 2014.

154. "No Review of Nuclear Doctrine, Says Modi," *Hindu*, 29 August 2014.

regarding the asymmetrical requirements of "minimum" vis-à-vis China and Pakistan: "what is credible toward China will likely not be minimum toward Pakistan; and what is minimum toward Pakistan cannot be credible toward China."[155]

1.119 The role of nuclear weapons in India's strategic doctrine is best summarized by former National Security Adviser Shivshankar Menon, who believes that India's possession of nuclear weapons has, "empirically speaking, deterred others from attempting nuclear coercion or blackmail against India."[156] India's nuclear weapons are not meant, however, to counter the superior armed strength of others or for use in theatre-level conflict. India's primary objective is to strengthen its strategic deterrent against China. With respect to Pakistan, the Indian establishment believes, as said openly by Defence Minister George Fernandes in 2002, that India can survive a nuclear attack but Pakistan cannot.[157] India explicitly rejects the distinction between nuclear and non-nuclear-weapon states established by the NPT and has made it very clear that it will not join the NPT as a non-NWS.

1.120 *Pakistan*, which has had a nuclear weapons program since the early 1970s, followed India's nuclear weapons tests with six of its own on 28 and 30 May 1998. Pakistan is the only one of the nine nuclear-armed states where nuclear weapons were developed by the military, are essentially under military control, and any decision to use them would likely be made by the military rather than civilian leadership. Pakistan's nuclear doctrine is based on the principle of "credible minimum deterrence," but without any "no first use" component: resort to nuclear weapons is envisaged in response to an existential threat which need not be the result of an attack by any category of WMD (biological, chemical or nuclear weapons).[158]

1.121 Pakistan's nuclear doctrine is India-specific.[159] The introduction of tactical nuclear weapons as a counter to India's superiority in conventional arms, and to compensate for its lack of strategic depth, would seem to leave open the possibility of first use of nuclear weapons against India, particularly in the case of invasion. While battlefield nuclear weapons may be thought to give Pakistan the chance of denying "victory" to India in a nuclear war by inflicting particularly severe damage, they would also expose Pakistan to a very high risk of nuclear retaliation and, if used against Indian forces inside Pakistan, to the certainty of partial irradiation of the homeland. Deployment of battlefield nuclear weapons requires the delegation of command and control to military units in the field. This increases the risks of miscalculation, accident, theft and infiltration by militant groups.[160]

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155. Vipin Narang, "Five Myths about India's Nuclear Posture," *The Washington Quarterly* 36:3 (Summer 2013), p. 144. See also Ramesh Thakur, "The Inconsequential Gains and Lasting Insecurities of India's Nuclear Weaponization," *International Affairs* 90:5 (September 2014), pp. 1114–17.

156. "Nukes protect India from blackmail by other powers: National security advisor," *Indo-Asian News Service*, 21 August 2012, http://www.ndtv.com/article/india/nukes-protect-india-from-blackmail-by-other-powers-national-security-advisor-257583.

157. "Indian defence minister dismisses nuclear war fears," *Sydney Morning Herald*, 3 June 2002, http://www.smh.com.au/articles/2002/06/03/1022982668341.html.

158. http://www.globalsecurity.org/wmd/world/Pakistan/nuke-battlefield.htm.

159. See Pervez Hoodbhoy and Zia Mian, "Changing Nuclear Thinking in Pakistan," APLN/CNND *Policy Brief* No. 9 (Canberra: Centre for Nuclear Non-Proliferation and Disarmament, February 2014)

160. http://www.globalsecurity.org/wmd/world/Pakistan/nuke-battlefield.htm.

1.122 *Israel* does not admit to the possession of nuclear weapons. It has maintained a policy of "nuclear ambiguity" or "nuclear opacity" since the 1960s when Prime Minister Levi Eshkol declared that Israel would "not be the first to introduce nuclear weapons to the Middle East."[161] The policy is argued to have provided Israel with "the benefits of existential deterrence at a very low political cost" without directly opposing US non-proliferation objectives.[162] In the absence of a declared nuclear-weapons capability, the circumstances in which Israel might be prepared to use such weapons have not been publicly documented, although prior to the first Gulf War, in response to Iraqi missile threats, Prime Minister Yitzhak Shamir warned of Israel's "very strong deterrent capability" and Defence Minister Moshe Dayan referred, none too subtly, to Israeli weapons "which the world does not yet know about."[163] It would thus seem reasonable to assume that Israel sees an undeclared but barely disguised nuclear-weapons capability as compensating for its small size and population, lack of strategic depth, and as an appropriate response to the multiplicity of existential threats seen as confronting it in its region.

1.5.1 No First Use

1.123 The ICNND Report recommended that, pending the elimination of nuclear weapons, every nuclear-armed state "make an unequivocal 'no first use' declaration, committing itself to not using nuclear weapons either preventively or pre-emptively against any possible nuclear adversary" (Recommendation 49); and that, until this is done, they should "at least accept the principle that the sole purpose of possessing nuclear weapons … is to deter others from using such weapons" against them or their allies (Recommendation 50). In 2014, both China and India called for negotiations on a no first use (NFU) convention to begin.[164]

1.124 Of the five NWS, only China is publicly committed to no first use of nuclear weapons. The commitment dates back to the 1960s. China holds that all NWS should abandon any nuclear deterrence policy based on first use of nuclear weapons and conclude a treaty on no first use of nuclear weapons against each other, pending the prohibition and elimination of nuclear weapons.[165]

1.125 The 2010 NPR was the first comprehensive reassessment of US nuclear weapons policy in a decade (the previous NPR was in 2001). It made no reference to no first use but did take a very small step in the direction of "sole purpose" when it said that while the United States is "not prepared at the present time to adopt a universal policy that deterring nuclear attack is the sole purpose of nuclear weapons … [it] will work to establish conditions under which such a policy could be safely adopted."[166] The NPR failed to reassess existing nuclear weapons deployment and targeting policies, and

161. Noam Sheizaf, "Clear and Present Danger," *Haaretz*, 21 March 2012.
162. http://www.nti.org/country-profilesd/Israel/nuclear/.
163. http://www.nti.org/country-profilesd/Israel/nuclear/.
164. *Implementation of the Treaty on the Non-Proliferation of Nuclear Weapons, Report submitted by the People's Republic of China*, 2014 NPT PrepCom, http://www.reachingcriticalwill.org/disarmament-fora/npt/2014/national-reports; "Manmohan Singh proposes no-first use of nuke weapons," *Economic Times*, 2 April 2014, http://articles.economictimes.indiatimes.com/2014-04-02/news/48801227_1_nuclear-weapons-no-first-use-nuclear-arsenal.
165. *Report submitted by the People's Republic of China*, 2014 NPT PrepCom, p. 3.
166. *Nuclear Posture Review*, April 2010, p. viii.

President Obama subsequently asked the Pentagon to lead an interagency review to develop alternative constructs of deterrence and stability with accompanying force sizes and postures. However, the review reaffirmed the existing core principles and characteristics of US nuclear-strike planning.[167]

1.126 India's no first use commitment of 1999 was diluted significantly in 2003 to the effect that nuclear weapons could be used in response to attacks on India or its soldiers with chemical or biological weapons. On 2 April 2014, outgoing Indian Prime Minister Manmohan Singh called for the establishment of a global convention on a no-first-use policy for nuclear weapons, based on the argument that if all states recognize that nuclear weapons are for deterrence only, and "are prepared to declare it," the world "can quickly move to the establishment of global no-first use norm."[168]

1.127 A global NFU convention would reflect the strong tradition of non-use of nuclear weapons that in practice has made any first use of nuclear weapons politically and morally unacceptable, and to that extent would not involve any substantive change to the security benefits nuclear-armed states claim to derive from nuclear weapons. Increased confidence following a NFU convention would reduce tensions between nuclear-armed states and contribute to a climate conducive to further progress on nuclear disarmament.[169] Regrettably, however, beyond China and India, there is no indication of any nuclear-armed state interest in the negotiation of a global NFU convention, and the outlook is not helped by the current geopolitical environment including heightened US–Russia tensions over Ukraine, North Korea's nuclear weapons and missile programs, continued uncertainty over Iran's nuclear intentions, and nervousness on the part of allies who see benefit in being under an NWS nuclear umbrella.

1.5.2 Extended Nuclear Deterrence

1.128 "Extended nuclear deterrence" refers to the role of nuclear weapons of the NWS in protecting allies from external attack.[170] While it applies to the Russian nuclear umbrella extended to allies in the Commonwealth of Independent States (former Soviet republics), the concept has particular force with respect to the network of US alliances in Europe, the Middle East and the Asia Pacific. In this context, Russia appears in practice to envisage a possible resort to nuclear weapons only in response to a WMD attack on its allies.[171] For the United States, while the primary function of US nuclear weapons is seen as deterring nuclear attack,[172] as already indicated it has not yet excluded the possibility of a nuclear response to non-nuclear threat contingencies.

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167. http://www.whitehouse.gov/the-press-office/2013/06/19/fact-sheet-nuclear-weapons-employment-strategy-united-states.
168. http://www.indiastrategic.in/topstories3290_India_suggests_No_First_use_Nuclear_Weapons.htm.
169. See Ramesh Thakur, "Australia Should Lead on a Global No-First-Use Convention," *Australian Outlook*, 13 August 2014, http://www.internationalaffairs.org.au/australian_outlook/australia-should-lead-on-a-global-no-first-use-convention/.
170. This is a subset of the wider concept of "extended deterrence," which refers to the commitment by a state to defend its allies from external attack by any means, nuclear or non-nuclear.
171. Sokov, *The New 2010 Russian Military Doctrine*.
172. *Nuclear Posture Review*, p. 16.

1.129 **NATO**. Many believe that NATO has a responsibility to provide leadership on the alliance's nuclear policy and on the NATO–Russia relationship. Instead, NATO is "pursuing an enhanced nuclear capability in Europe that can neither be afforded nor makes strategic sense in current or likely future circumstances."[173] Under current NATO nuclear-sharing arrangements, there are understood to be a total of some 180 American B-61 tactical nuclear weapons on bases in five European countries (Belgium, Germany, Italy, Netherlands and Turkey), all of them non-NWS signatories to the NPT.[174]

1.130 NATO's Strategic Concept, adopted at the Lisbon Summit in November 2010, commits NATO to "the goal of creating the conditions for a world without nuclear weapons – but reconfirms that, as long as there are nuclear weapons in the world, NATO will remain a nuclear Alliance." However, unlike its predecessors, which called for the indefinite preservation of nuclear deployments in Europe, the 2010 Strategic Concept does not exclude a possible end to nuclear-sharing arrangements. The new formulation – "Deterrence, based on an appropriate mix of nuclear and conventional capabilities, remains a core element of our overall strategy" – does not call for nuclear weapons to be in Europe indefinitely or indeed at all. It does, however, clearly identify "the strategic nuclear forces of the Alliance, particularly those of the United States," as "the supreme guarantee" of NATO's security.[175]

1.131 The Lisbon Summit mandated a review of NATO's "overall posture in deterring and defending against the full range of threats to the Alliance" which, in the shape of the Deterrence and Defence Posture Review (DDPR), was adopted by the NATO Summit in Chicago on 20 May 2012. The DDPR described, in standard terms, the alliance's resolve "to seek a safer world for all and to create the conditions for a world without nuclear weapons in accordance with the goals of the NPT." Rather more significantly, though, it also described nuclear weapons as "a core component of NATO's overall capabilities for deterrence and defence" and affirmed that the review has demonstrated "the Alliance's nuclear force posture currently meets the criteria for an effective deterrence and defence posture." The DDPR simply repeated the Lisbon Strategic Concept document when it said that "the supreme guarantee of the security of the Allies is provided by the strategic nuclear forces of the Alliance, particularly those of the United States" and went on to observe that "the independent strategic nuclear forces of the United Kingdom and France, which have a deterrent role of their own, contribute to the overall deterrence and security of the Allies."[176]

1.132 Because it includes three of the world's five NWS (France, the United Kingdom and the United States) and eight of the fourteen states that have nuclear weapons on their territory (Belgium, France, Germany, Italy, Netherlands, Turkey, the United Kingdom and the United States), NATO "has a responsibility to be the change it wants to see in the

173. Browne and Kearns, "NATO, Russia, and the Nuclear Disarmament Agenda," p. 2.

174. The most recent estimates are that there are 70 tactical nuclear warheads in Italy (at two bases), 50 in Turkey, and 20 each in Belgium, Germany and the Netherlands. Hans M. Kristensen, "B61-12: The New Guided Standoff Nuclear Bomb," Side event presentation, Third Preparatory Committee Meeting for the Nuclear Non-Proliferation Treaty, United Nations, New York, 2 May 2014.

175. *Active Engagement, Modern Defence: Strategic Concept for the Defence and Security of the Members of the North Atlantic Treaty Organization*, adopted by Heads of State and Government at the NATO Summit in Lisbon, 19–20 November 2010.

176. "Deterrence and Defence Posture Review," *NATO Press Release*, 20 May 2012.

world, not just to advocate for that change on the part of others."[177] Instead, having committed to President Obama's goal in Prague in April 2009 of creating the conditions for a world without nuclear weapons, at the Lisbon summit in 2010, NATO ignored the commitment in making its own nuclear policy. For example, it has chosen to modernize and enhance its tactical nuclear weapons in Europe, not just to maintain the current capability.[178] The DDPR disappointed those who had hoped that it might provide an opportunity to soften NATO's nuclear deterrence posture, for example by declaring "that the central purpose of nuclear weapons was to discourage a similar attack" or by responding positively to calls "for the immediate reduction, withdrawal, or consolidation" of US tactical nuclear weapons in Europe.[179] Instead, allies simply acknowledged "the importance of the independent and unilateral negative security assurances offered by the United States, the United Kingdom and France" and, "while seeking to create the conditions and considering options for further reductions of non-strategic nuclear weapons assigned to NATO," promised to "ensure that all components of NATO's nuclear deterrent remain safe, secure, and effective for as long as NATO remains a nuclear alliance."[180]

1.133 The DDPR emphasized that, since the end of the Cold War, NATO had "dramatically reduced the number, types, and readiness of nuclear weapons stationed in Europe and its reliance on nuclear weapons in NATO strategy." Against this background, it was ready to consider "further reducing its requirement for non-strategic nuclear weapons assigned to the Alliance in the context of reciprocal steps by Russia, taking into account the greater Russian stockpiles of non-strategic nuclear weapons stationed in the Euro-Atlantic area."[181] To many, the DDPR was an opportunity missed "to make a comprehensive, coherent and balanced assessment of the mix of capabilities required by the Alliance in the years ahead" and "to spell out the potential contribution that arms control and disarmament could make to reducing nuclear risks in Europe" and more widely.[182]

1.134 The Wales Summit Declaration, issued by NATO leaders on 5 September 2014, upholds the basic tenets of the DDPR. It also states that "Russia's aggressive actions against Ukraine have fundamentally challenged our vision of a Europe whole, free, and at peace," with "long-term consequences for peace and security in the Euro–Atlantic region and stability across the globe."[183] The summit leaders affirmed their commitment to extended nuclear deterrence by declaring that the strategic nuclear forces of the Alliance, particularly those of the United States, are the "supreme guarantee" of its security. They did not take up the practical recommendations of an important NATO-focused Track II dialogue, which was co-chaired by Des Browne, Wolfgang Ischinger, Igor Ivanov, and Sam Nunn, and included distinguished former senior political leaders, senior military officers, defence officials, and security experts from Europe,

177. Browne and Kearns, "NATO, Russia, and the Nuclear Disarmament Agenda," p. 5.
178. Edmond Seay, "Escalation by Default: The Future of NATO Nuclear Weapons in Europe," (London: ELN, 10 May 2012), http://www.europeanleadershipnetwork.org/escalation-by-default-the-future-of-nato-nuclear-weapons-in-europe_380.html.
179. Rachel Oswald, "NATO Maintains Nuclear Weapons' Role in Deterrence," *Global Security Newswire*, 21 May 2012.
180. "Deterrence and Defence Posture Review," 20 May 2012.
181. "Deterrence and Defence Posture Review," 20 May 2012.
182. European Leadership Network, "Former Military, Diplomatic and Ministerial Leaders call for Change in NATO Policy," 17 May 2012, http://www.europeanleadershipnetwork.org/group-statement-on-outcomes-required-from-chicago_387.html.
183. http://www.nato.int/cps/en/natohq/official_texts_112964.htm.

Russia, and the United States. The group's 2013 report called for the adoption of a new strategy for building mutual security, involving a phased approach for reducing the role of nuclear weapons in security policies over the next fifteen years.[184]

1.135 **Asia Pacific**. In the Asia Pacific, extended nuclear deterrence is understood in the context of the reliance by a number of US allies (especially Japan and South Korea) on US nuclear capability, not only to deter possible nuclear attack, but also to deter or respond to threats from biological and chemical weapons, and indeed overwhelming conventional forces, deployed against them. The particular significance of the US commitment here is seen as lying in its very strong incentive for Japan and South Korea not to acquire a deterrent nuclear capability of their own, although the strong anti-nuclear sentiment in Japan in particular acts as a very powerful disincentive for any government to go down that path.

1.136 Within Japan and South Korea there is a range of views on the value of extended nuclear deterrence. Amid rising nationalism in the region, territorial disputes in the East and South China Seas, continued North Korean nuclear defiance, and concerns about the Obama administration's disarmament agenda, doubts about the reliability of US deterrence have been catalysts for pro-nuclear arguments in Japan and, especially, South Korea.[185] However, these represent minority views. In practice, extended nuclear deterrence appears to have operated more as an expression of closeness between the United States and its allies rather than as a concrete security measure. To the extent that there is a diminished role for nuclear weapons, and emphasis on conventional military capabilities, envisaged in current US strategic guidance, this should have little impact on the substance of US security relationships with Japan and South Korea. As ever, these relationships will rest upon non-nuclear defence and security cooperation.

1.137 The limitations of extended nuclear deterrence are those of nuclear deterrence generally.[186] Washington is acutely conscious that the use of nuclear weapons to defend an ally against a nuclear-armed adversary would risk nuclear retaliation against the United States. It is thus hardly surprising that, while the United States has firm security commitments to countries in North East Asia, these do not include specific commitments to use nuclear weapons in their defence.[187]

1.5.3 Negative Security Assurances (NSAs)

1.138 A negative security assurance in this context is one given by a nuclear-armed state that it will not use or threaten to use nuclear weapons against non-nuclear-armed states. The ICNND Report called on all nuclear-armed states to provide "new and unequivocal

184. See Des Browne, Wolfgang Ischinger, Igor Ivanov, and Sam Nunn, *Building Mutual Security in the Euro-Atlantic Region: Report Prepared for Presidents, Prime Ministers, Parliamentarians, and Publics*, The Nuclear Threat Initiative, 2013, http://www.buildingmutualsecurity.org/.

185. See Peter Hayes and Chung-in Moon, "Should South Korea Go Nuclear?" EAF Policy Debates No. 7, 28 July 2014; "Nuclear Arms Card for Japan," an English translation of an article that first appeared in the April 2013 issue of *Sentaku* (a monthly magazine covering political debates in Japan), and was re-published in *The Japan Times*, 29 April 2013.

186. See Gareth Evans, "Nuclear Deterrence in Asia and the Pacific," *Asia and the Pacific Policy Studies* 1:1 (2014), pp. 91–111.

187. Jeffrey Lewis, *Extended Nuclear Deterrence in Northeast Asia*, 1 August 2012, http://nautilus.org/napsnet/napsnet-special-reports/extended-nuclear-deterrence-in-northeast-asia.

negative security assurances … supported by binding Security Council resolution" to all non-NWS (Recommendation 53). At the 2010 NPT Review Conference, all states agreed that the CD should "immediately begin discussion of effective international arrangements to assure non-nuclear-weapon States against the use or threat of use of nuclear weapons" (Action 7).

1.139 Understandably, and particularly since the NPT's entry into force in March 1970, states which have pledged not to acquire nuclear weapons have been keen to secure from the treaty's five recognized NWS firm assurances that nuclear weapons will not be used against them. Assurances were provided, individually by each of the five NWS, at the first special session of the UN General Assembly devoted to disarmament (May–June 1978) and reaffirmed in the lead-up to the NPT Review and Extension Conference in 1995 as part of efforts to win support for the treaty's indefinite extension.[188]

1.140 Of the NWS, only China has given an unconditional undertaking not to use or threaten to use nuclear weapons against non-nuclear-armed states. Of the non-NPT nuclear-armed states, only Pakistan has given a like undertaking. China and Pakistan are the only two nuclear-armed states to support the idea of transforming this undertaking into a legally binding international instrument. There has been no substantive discussion of this, or any other disarmament issue, in the CD since 2009 (ICNND report) and 2010 (NPT Review Conference).

1.141 Four of the five NWS (France, Russia, the United Kingdom and the United States) have undertaken not to use nuclear weapons against NPT non-NWS except in the case of an invasion or any other attack on the state concerned, its territory, its armed forces or other troops, its allies or on a state towards which it has a security commitment, carried out or sustained by such a non-NWS in association or alliance with a NWS.[189]

1.142 Two NWS, the United Kingdom and the United States, have qualified their assurances by specifying that beneficiaries must be in compliance with their obligations under the NPT. In its April 2010 NPR, the United States said that it would not "use or threaten to use nuclear weapons against non-nuclear-weapon States that are party to the NPT and in compliance with their nuclear non-proliferation obligations." The United States nonetheless reserved "the right to make any adjustment in the assurance that may be warranted by the evolution and proliferation of the biological weapons threat and U.S. capacities to counter that threat."[190]

1.143 For countries not covered by this assurance (other nuclear-armed states, and states deemed by Washington not to be in compliance with their nuclear non-proliferation obligations), there remains "a narrow range of contingencies in which US nuclear weapons may still play a role in deterring a conventional or CBW attack against the United States or its allies and partners." The United States is thus not ready to make a "sole purpose" affirmation (that "deterring nuclear attack is the sole purpose of nuclear

188. See Jayantha Dhanapala (President of the 1995 NPT conference), "The Permanent Extension of the NPT, 1995," in Andrew F. Cooper, Jorge Heine and Ramesh Thakur, eds., *The Oxford Handbook of Modern Diplomacy* (Oxford: Oxford University Press, 2013), pp. 810–25.

189. UN Security Council documents S/1995/261, 262, 263 and 264 of 6 April 1995.

190. *Nuclear Posture Review Report*, p. viii.

weapons"), but "will work to establish conditions under which such a policy could be safely adopted."[191] As explained above, the new guidance, published in June 2013, did not change this position despite the White House claim that it narrowed the role of nuclear weapons in US security strategy.

1.144 The United Kingdom's 2010 Strategic Defence and Security Review similarly provides an assurance that "the UK will not use or threaten to use nuclear weapons against non-nuclear-weapon States parties to the NPT," noting that the assurance "would not apply to any State in material breach of [its] non-proliferation obligations." It also reserves the right to review this assurance if "the future threat, development and proliferation of [other weapons of mass destruction, for example chemical and biological] make it necessary."[192]

1.145 China has adopted a different approach. Its April 1995 declaration opened with an undertaking "not to be the first to use nuclear weapons at any time or under any circumstances" and went on to promise that China would not "use or threaten to use nuclear weapons against non-nuclear-weapon States or nuclear-weapon-free zones *at any time or under any circumstances*" (emphasis added). China urged all NWS to follow its lead by providing both NFU declarations and unqualified NSAs, incorporating nuclear-weapon-free zones (NWFZs); and concluded by calling for "the early conclusion of an international convention on no first use of nuclear weapons as well as an international legal instrument assuring the non-nuclear-weapon States and nuclear-weapon-free zones against the use or threat of use of nuclear weapons."[193] China's unequivocal NSA was reaffirmed in its 2010 National Defence White Paper.

1.146 Of the five NWS, all but China oppose the idea of a legally binding international instrument on NSAs and routinely abstain on a UN General Assembly resolution promoting the "Conclusion of effective international arrangements to assure non-nuclear-weapon States against the use or threat of use of nuclear weapons."[194]

1.147 Pakistan has given an "unconditional pledge not to use or threaten to use nuclear weapons against states not possessing nuclear weapons" and is "ready to transform this pledge into a legally binding international instrument."[195] India's position is less clear. The Indian National Security Advisory Board's 1999 Draft Report on Nuclear Doctrine says that India "will not resort to the use or threat of use of nuclear weapons against states which do not possess nuclear weapons, or are not aligned with nuclear weapon powers."[196]

191. *Nuclear Posture Review Report*, p. viii.
192. *Securing Britain in an Age of Uncertainty*, pp. 37–38.
193. UN Security Council document S/1995/265 of 6 April 1995.
194. In 2014, A/C.1/69/L.27 was adopted 122-0-56.
195. http://www.reachingcriticalwill.org/images/documents/Disarmament-fora/cd/2012/statements/part2/12June_Pakistan.pdf.
196. Draft Report of National Security Advisory Board on Nuclear Doctrine, http://www.fas.org/nuke/guide/india/doctrine/990817-indnucld.htm#disarm.

§1.6 Nuclear Force Posture

1.148 "Trust, but verify," US President Ronald Reagan famously said about arms control agreements with the Cold War enemy the Soviet Union. Whatever the declared policy, statements on nuclear doctrine reducing the role of nuclear weapons have credibility only if backed by appropriate nuclear force postures, that is, arrangements for the deployment of nuclear arsenals, and the launch alert status of those weapons, which are consistent with the stated doctrine.

1.6.1 Weapons Deployment

1.149 Only *Russia* and the *United States* currently maintain a credible nuclear triad of land, air and sea-based nuclear weapons (although China and India are coming close). Their deployed strategic offensive weapons – to be significantly reduced in number under present New START obligations, as discussed above, but still constituting formidable arsenals – include ICBMs, SLBMs and gravity bombs. Russia appears to be making changes to the deployment patterns of land-based strategic forces to increase their survivability. The road-mobile single warhead Topol-M and a new road-mobile multiple warhead missile, the Yars, will be the backbone of the Russian strategic rocket forces in the coming decades. US and Russian nuclear missiles are de-targeted. Re-targeting can be accomplished quickly, but a missile launched accidentally will land in an area of open ocean and an additional decision from the command authority is required prior to an authorized launch.

1.150 Both Russia and the United States also have inventories of "tactical" or "non-strategic" weapons. The United States currently deploys 184 B-61 bombs at bases in five NATO countries. The size and readiness of these arsenals have been reduced significantly since the end of the Cold War, with launch readiness reduced to weeks rather than hours and minutes in 1995, and further reduced to months in 2002.[197] This might suggest that some of the equipment needed to arm and deliver the nuclear bombs may have been removed and placed in storage.[198] "Russia's non-strategic nuclear warheads are normally kept in central storage."[199]

1.151 *China* provides no details of its nuclear arsenal. It is believed to have a small stock of air-deliverable nuclear weapons but depends heavily on land-based missiles. It is actively modernizing its land-based ballistic missiles by replacing ageing liquid-fuelled, silo-based missiles with newer solid-fuelled, road-mobile models to increase the survivability and strengthen the retaliatory capabilities of its nuclear forces.[200] Beijing is also reportedly close to achieving a "credible sea-based nuclear capability." According to Jess Karotkin of the US Office of Naval Intelligence, China has five nuclear attack submarines (SSNs), four nuclear ballistic missile submarines (SSBNs), and 53 diesel

197. Nick Ritchie, "Beyond the Trident Alternatives Review," *BASIC Blog*, 4 April 2013, p. 7.
198. Hans M. Kristensen, *U.S. Nuclear Forces in Europe* (Washington, DC: Natural Resources Defense Council, 2005), p. 68.
199. Mukhatzhanova, *Implementation of the 2010 NPT Review Conference Disarmament Actions*, p. 29.
200. Li Bin, "Tracking Chinese Strategic Mobile Missiles," *Science & Global Security* 15:1 (2007), pp. 4–5.

attack submarines.[201] In March 2014, the head of US Pacific Command, Admiral Samuel Locklear, stated that China will likely have submarines equipped with long-range nuclear missiles within the year.[202] While the sea-based component of China's nuclear arsenal will significantly increase the survivability of its nuclear forces, it remains unclear how many Jin-class SSBNs China plans to build and what strategy it envisions for its future sea-based nuclear forces.[203] China's nuclear doctrine stipulates that "in peacetime the nuclear missile weapons of the Second Artillery Force are not aimed at any country."[204] Its stockpile is not thought to be fully deployed.

1.152 *France*'s nuclear weapons are deployed on its four ballistic missile submarines and a mix of land- and carrier-based aircraft. At any given time, at least one submarine is at sea, providing continuous deterrence. In December 2012, France denied that it was contemplating a change to its nuclear force posture such that it would no longer have a sea-borne deterrent 365 days a year, as would happen if its fleet of submarines was reduced from four to three as a cost-cutting measure. The 2013 Defence White Paper confirmed that France intends to maintain its four ballistic missile carrying submarines and squadron of fighter bombers carrying cruise missiles.[205]

1.153 The *United Kingdom* has only sea-launched Trident missiles deployed on four Vanguard-class submarines, one of which is always at sea. Over the next several years, the number of warheads on each submarine is to be reduced from 48 to 40. Missiles are de-targeted. The Vanguard-class submarines are due for replacement in the 2020s. While both the ruling Conservative and opposition Labour parties support the maintenance of a nuclear deterrent, a final decision on the configuration of the UK's future nuclear forces will not be taken until after the next general election, which will take place on 7 May 2015. The ruling Conservative Party favours a "like-for-like" nuclear modernization plan, but in 2011, its Liberal Democratic coalition partner demanded a fresh assessment of policy alternatives, which could include fewer or no new submarines, and a switch from Trident ballistic missiles to nuclear-capable cruise missiles. The subsequent *Trident Alternatives Review*,[206] published on 16 July 2013, provided an assessment of the costs, risks and technical challenges associated with different policy options, and fed into a wider national debate on the subject. In July 2014, the Trident Commission (an independent panel led by former defence and foreign-affairs leaders from the United Kingdom's three major political parties) published a new report, which recommended that the country should keep its arsenal of nuclear-armed submarines, but should "study the steps down the nuclear ladder more thoroughly," possibly to

201. "Top US Official: 'China Will Soon Place Long-Range Nuclear Missiles On Submarines'," *AFP*, 26 March 2014, http://www.businessinsider.com.au/nuclear-missiles-on-chinese-submarines-2014-3.

202. Ridzwan Rahmat, "PACOM Chief Says China Will Deploy Long-Range Nuclear Missiles on Subs this Year," *IHS Jane's Navy International*, 25 March 2014.

203. Wu Riqiang, "Survivability of China's sea-based nuclear forces," *Science and Global Security* 19:2 (2011), pp. 94–96. For a discussion of the potential risks associated with the deployment of future sea-based nuclear forces, see Tanya Ogilvie-White, "The Urgent Need for Nuclear Risk Reduction in Asia," APLN/CNND *Policy Brief* No. 14 (Canberra: Centre for Nuclear Non-Proliferation and Disarmament, August 2014), https://cnnd.crawford.anu.edu.au/publication/cnnd/4631/policy-brief-no-14-urgent-need-nuclear-risk-reduction-asia.

204. Mukhatzhanova, *Implementation of the 2010 NPT Review Conference Disarmament Actions*, p. 28.

205. Government of France, *Livre Blanc: Défense et Sécurité Nationale 2013* [White Paper: Defense and National Security 2013] (Paris, 2013), www.gouvernement.fr/sites/default/files/fichiersjoints/livre-blanc-sur-la-defense-et-la-securite-nationale_2013.pdf.

206. https://www.gov.uk/government/publications/trident-alternatives-review.

include "further reductions in warheads or changes in posture and declaratory policy."[207] The commission also recommended that the main gate decision should be delayed so that these possibilities can be explored in more detail, but a decision is still expected in 2016.

1.154 Neither *India* nor *Pakistan* provides details of its nuclear arsenal. They are both working to create survivable nuclear forces based on a mix of different launch platforms. Indian plans to deploy nuclear weapons at sea are based on the development of a ballistic missile launched from a nuclear-powered submarine. Both elements are in the development testing phase and – according to India's Defence Research and Development Organization (DRDO) – will be operational in 2015.[208] Pakistan's plans are not thought to be as far advanced. Both India and Pakistan have developed road-mobile nuclear-capable ballistic missiles. Their stockpiles are not thought to be fully deployed, as discussed below.

1.6.2 Launch Alert Status

1.155 In the middle of a nuclear crisis, if strategic doctrine and operational plans require a very quick decision on strategic force employment, the possibility grows of miscalculation or a decision based on the wrong information by the national command authority. This is why the issue of launch alert status has been of great interest to successive NPT review conferences and international commissions alike. Both the 2010 NPT Review Conference (Action 5) and the ICNND Report emphasized the need for reducing the operational status of nuclear weapons systems as a confidence-building measure. ICNND urged changes to the deployment of nuclear weapons which, while allowing them to survive a potentially disarming first strike, nonetheless ensures that they are not "instantly useable" (Recommendation 55). Weapons should be taken off "launch-on-warning alert" as soon as possible (Recommendation 56).

1.156 Terms like "hair trigger" and "launch-on-warning" may be criticized as technically inaccurate in that they imply automaticity. There are rigorous technical and procedural safeguards that require human agency: the *decision* has to be made to launch the nuclear weapons. But this does not negate the fact that huge numbers of Russian and US nuclear weapons are maintained on a "ready alert" or "day-to-day alert" status. The problem and the solution thus concern issues of nuclear doctrine and deployment. Regrettably, there have been only modest changes in operational status since 2009–10. The most significant of these was an announcement, in June 2014, confirming that the United States has finished removing the last MIRV from its Minuteman 3 ICBMs, so that these missiles now only carry a single warhead.

1.157 Historically, alert levels of nuclear weapons systems have varied with changes in the overall security environment, the deployment patterns of the adversary, fiscal elasticity, and political pressures. Nuclear-armed states do not release information on

207. Elaine M. Grossman, "U.K. Independent Panel: Retain Trident Subs, But Explore Delay Options," *Global Security Newswire*, 2 July 2014, http://www.europeanleadershipnetwork.org/uk-independent-panel-retain-trident-subs-but-explore-delay-options_1585.html.

208. "Agni-5, INS Arihant to be Ready for Induction Next Year," *Live Mint & The Wall Street Journal*, 7 February 2014, http://www.livemint.com/Politics/7k215HpGXMgLSWbBNviaDI/Agni5-INS-Arihant-to-be-ready-for-induction-next-year.html.

exactly which systems are on alert, or where they are, for obvious reasons. However, analysts at the Federation of American Scientists estimate that taken together, the US and Russia have very many strategic nuclear warheads on high alert on land- and sea-based ballistic missiles, ready to launch between 5 and 15 minutes after receiving a launch order.[209] The United States is thought to have 920 alert warheads, split more or less evenly between ICBMs and SLBMs. Russia is believed to have 890, mainly on ICBMs.[210] France and Britain also deploy 80 and 48 fully operational nuclear weapons, respectively, on their submarines, at a lower level of readiness than US forces. The other nuclear-armed states do not keep nuclear forces on alert, despite their much smaller arsenals.

1.158 According to the Cartwright study for Global Zero, US early warning teams will have up to three minutes to determine that indications of an incoming nuclear attack are real and report to the president; the president would have a maximum of twelve minutes to decide whether to retaliate in kind or risk decapitation of nuclear command-and-control capacity and decimation of US nuclear forces; missile launch crews in underground command posts and submarines would have two and twelve minutes respectively to take the missiles out of their silos and tubes and launch them on their 30 minutes (or less) flight path to enemy targets.[211]

1.159 Some steps have been taken by the United States and Russia to address the potential risks arising in circumstances where there is only a short time available to reach a decision to launch nuclear weapons. The two countries operate Nuclear Risk Reduction Centres, initially designed and launched as a single government-to-government communications link, intended to provide a reliable channel of communication in times of crisis. This includes the direct communication line established in 1963 between Washington and Moscow to help reduce the risk of nuclear exchange precipitated by accident or mistake. (Similar lines exist between India and Pakistan and the United States and China.) But for all this, and despite the many calls that have been made by numerous commissions, experts and campaign groups for change, there has been no movement on increasing launch decision times. As the ICNND report put it, "So long as the logic of mutual deterrence prevails in the minds and behaviour of U.S. and Russian decision-makers … 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 would appear at first sight."[212]

1.160 *Russia*'s deployed ICBMs are at launch-on-warning ("ready to launch if it appears that another state has initiated a nuclear strike against Russia"). Sea- and air-based nuclear weapons are at lower levels of readiness. "Gravity bombs are not continuously deployed on heavy bombers and Russian SSBNs are not on continuous at-sea patrol."[213] Increasing the mobility of ICBMs, and increasing the number of prepared and

209. Hans M. Kristensen and Matthew McKinzie, "De-alerting Nuclear Forces," *Bulletin of the Atomic Scientists*, 19 June 2013, http://thebulletin.org/de-alerting-nuclear-forces.

210. Kristensen and McKinzie, "De-alerting Nuclear Forces."

211. Cartwright, et al., *Modernizing U.S. Nuclear Strategy, Force Structure and Posture*, p. 5. See also ICNND Report, pp. 178–79.

212. ICNND, *Eliminating Nuclear Threats*, pp. 178–79, paragraph 17.42.

213. Mukhatzhanova, *Implementation of the 2010 NPT Review Conference Disarmament Actions*, p. 29.

pre-surveyed places from which they can be launched, could help increase the time available for reaching a decision to launch. Russia is also said to be implementing measures to reduce the risk posed by advanced conventional weapons to missiles prior to launch, including electronic counter-measures and decoys. But it remains extremely nervous about its overall vulnerability to superior US conventional capability. Whatever the unlikelihood may now be of war between them, Moscow sees mutual de-alerting of ICBMS, the principal launch-on-warning force, as making US missiles essentially invulnerable.[214]

1.161 The *United States* has combined a launch posture that safeguards against unauthorized launch of ICBMs with procedures that allow for rapid re-targeting and launch of strategic forces after a valid order is received from the national command authority. Little is known about the launch status of US submarine forces at sea, but it obviously would be impractical in the extreme for these to be without the ability to launch warheads without having to return to shore. Strategic submarines on combat patrol maintain a radio silence to help avoid detection, but could receive and carry out a launch order before enemy anti-submarine warfare assets could engage. In case of loss of communication with the national command authority, it is believed that the commanding officer performs a list of checks to indicate whether the command authority has been destroyed. If the indicators are positive, the commanding officer has sealed orders that explain the specific course of action to follow.

1.162 The April 2010 NPR included a statement that the United States would continue to seek ways to maximize the time available to the president to consider whether to authorize the use of nuclear weapons. But the NPR did not change the alert status of US nuclear forces, summarized as "heavy bombers off full-time alert, nearly all ICBMs on alert, and a significant number of SSBNs at sea at any given time."[215] Most US deployed ICBMs are at launch-on-warning. Eight or nine SSBNs are at sea at any given time, with up to five SSBNs on "hard alert."[216] In 2010 the United States revealed that all of its ICBMs are in so-called "open ocean target" mode, so that if there was an inadvertent launch the missile would land in the middle of one of the large oceans.[217]

1.163 US officials contest the view that current launch status is "dangerously high," arguing that a prudent balance has been struck between the survivability of nuclear forces and the capacity to implement a legal order from the proper command authority. Modifying launch status to prolong the time taken to implement a lawful order would, according to officials, carry the risk of creating a "window" of time that an adversary might exploit to try and neutralize US strategic forces. US military representatives have also argued that re-alerting weapons in a crisis could trigger escalation by causing an adversary to conclude that a first strike was imminent – although it should be noted that US nuclear strategy already includes scenarios for increasing alert levels in a crisis.

214. ICNND, *Eliminating Nuclear Threats*, p. 179, paragraph 17.42.

215. Testimony of James Miller to the *Hearing on Implementation of the New Strategic Arms Reduction Treaty (START) and Plans for Future Reductions in Nuclear Warheads and Delivery Vehicles*, before the Subcommittee on Strategic Forces of the House of Representatives Armed Services Committee, 4 May 2011.

216. S.H. Kile, P. Schell and H.M. Kristensen, "US Nuclear Forces," in *SIPRI Yearbook 2012*, p. 313.

217. Andrew Quinn, "U.S. reveals nuclear target: oceans," *Reuters*, 6 April 2010.

In June 2013, the Pentagon released a nine-page summary report for Congress on a revised nuclear weapons employment strategy that reaffirmed the existing core principles and characteristics of US nuclear-strike planning.[218]

1.164 In *France*, one SSBN is always at sea on deterrent patrol. In the *United Kingdom*, at any given time, one SSBN is at sea on deterrent patrol and at several days' "notice to fire." In 1998, the British government rejected calls to take its submarines off deterrent patrol and remove warheads from their missiles, to be stored separately ashore. The official argument against these measures was that they would undermine deterrence credibility, and could even lead to a destabilizing race to "re-alert."[219] Since then, the UK's approach has been to maintain a policy of opacity about the detailed technical attributes of its nuclear weapons, the circumstances under which they might be used and the specifics of their operational readiness. The Ministry of Defence sees this opacity as a strategic necessity, critical to deterrence being sustained under conditions of de-alerting in which missiles are held at a number of days' notice to fire. Thus, no additional information about operational readiness has been disclosed to the public.[220] *China*'s nuclear force posture would appear to be consistent with its stated view of the limited utility of nuclear weapons and the declared doctrine of using nuclear weapons solely to deter a nuclear attack and prevent any nuclear blackmail. China is believed to keep its nuclear weapons on low alert, with warheads separated from missiles and fuel. It is worth noting that under New START counting rules, this would reduce China's deployed nuclear weapons stockpile to zero.[221]

1.165 *India* and *Pakistan* are believed to keep warheads separate from delivery systems. Independent analysts agree that India has decided against a strategy that requires launch-on-warning and has structured its nuclear forces accordingly. India's nuclear arsenal is said to be dispersed in different locations, with warheads separated from delivery systems. Different organizations have custody of weapons and delivery systems in peacetime.[222] Pakistan's nuclear weapons are believed to be kept on low alert. Missiles may not be mated with warheads under normal conditions and the two may be stored at different locations, though this is unclear. The suggestion that warheads were kept in disassembled form was denied by a former official from the weapons establishment.[223] The National Command Authority has operational control over Pakistan's nuclear assets, including authority to launch a nuclear attack. While the Prime Minister officially chairs the National Command Authority, in practice the military is in charge.[224] A "two-man rule" governs access to nuclear release codes, known as permissive action links (PALS).

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218. US Department of Defense, *Report on the Nuclear Employment Strategy of the United States*, 12 June 2013, http://www.defense.gov/pubs/Reportto CongressonUSNuclearEmploymentStrategy_Section491.pdf.

219. Hans M. Kristensen and Matthew McKinzie, *Reducing Alert Rates of Nuclear Weapons* (New York and Geneva: UNIDIR, 2012), p. 21.

220. John Simpson, "Deterrence, Disarmament, Non-Proliferation and UK Trident," Discussion Paper 4, BASIC Trident Commission, March 2013, p. 15.

221. Kulacki, "China's Nuclear Arsenal," p. 2.

222. Manpreeth Sethi, *Nuclear Deterrence in Second Tier Nuclear Weapon States: A Case Study of India*, Centre de Science Humaine, CSH Occasional Paper no. 25, December 2009, p. 54.

223. Bruno Tertrais, *Pakistan's Nuclear and WMD Programmes: Status, evolution and risks*, EU Non-proliferation Consortium paper no. 19, July 2012, p. 5.

224. Mark Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers* (London: IISS/Routledge, 2014), p. 122.

The latter are designed to prevent accidental launch, but Pakistan's safety systems could be weak enough to be bypassed in a crisis.[225] Information on Israeli practices is not available.

1.166 The differences between Russia, the United States, France and the United Kingdom on the one hand, and the remaining nuclear-armed states on the other, may be ascribed to differences in doctrine (China), absence of early warning systems (India, Pakistan) or considerations of control and safety (India, Pakistan). Keeping nuclear weapons on high alert is not required for any political roles – of coercion and bargaining – seen for them by some weapons possessors.

1.167 **The Case for De-alerting.** A nuclear-armed state acquires credible first-strike capability against a nuclear rival when it can launch a nuclear attack without fear of reprisal. Taking nuclear warheads and weapons systems off high alert can deepen the stability of nuclear deterrence so that nuclear-armed rivals will not attack each other regardless of any rise in tension between them. The security environment of the 21st century is starkly different from the Cold War period, but the nuclear force posture is still trapped in the old paradigm with nuclear warheads kept at high readiness to be launched en masse before the apprehended arrival of incoming enemy missiles.

1.168 Like nuclear terrorism, the launch of nuclear weapons on high alert by mistake, miscalculation or through a malfunction is low probability but high impact. In the tense environment of nuclear decision-making, high alert weapons carry a fourfold risk of unnecessary nuclear war:

- Accidental launch (technical failure caused by malfunction);
- Authority to launch being usurped by a subordinate official or by terrorists (custody failure leading to rogue launch). Unauthorized use is judged to be the least likely of these contingencies, although the risk increases in the middle of a crisis dispersion of nuclear weapons and in the case of countries like Pakistan whose organizational and technical safeguards may be brittle rather than robust;[226]
- Misinterpretation of incoming warning data (information failure leading to miscalculation);
- Premature and ill-judged response to an actual attack (miscalculation caused by decision-making failure in a crisis).

1.169 Conversely, anything that lengthens the decision-making fuse – such that there is a significant extension of the timeline from the first report of an incoming threat to a decision to use a nuclear weapon and then the actual launch of the weapon – can only add to the existing tight margins of security from nuclear weapons. In practice, de-alerting measures would include shutting systems off or removing warheads (in the case of land-based nuclear forces), or moving nuclear forces out of range of their targets and/

225. Pervez Hoodbyoy and Vipin Narang both argue that Pakistan's PALS are weak and could be bypassed in a crisis. Pervez Hoodbhoy, ed., *Confronting the Bomb: Pakistani and Indian Scientists Speak Out* (Karachi: Oxford University Press, 2013), pp. 192–94; Vipin Narang, "Posturing for Peace? Pakistan's Nuclear Postures and South Asian Stability," *International Security* 34:3 (Winter 2009/2010), p. 69. Both cited in Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers*, p. 137.

226. Cartwright, et al., *Modernizing U.S. Nuclear Strategy, Force Structure and Posture*, p. 5.

or removing electronic missile components (in the case of ballistic missile submarines).[227] In addition to de-alerting, other steps that could increase the security margins of sea-based nuclear forces include reducing missile lethality: replacing powerful nuclear-armed Trident missiles – which are capable of destroying hardened targets with accuracy and speed – with less powerful nuclear-armed missiles, which would take longer to reach their target, thus increasing decision times and reducing first strike incentives.[228]

1.170 Non-NWS have forcefully argued that lowering the operational status of nuclear weapons would both reduce the risk of accidental or unintended nuclear war and provide a much-needed practical boost for disarmament and non-proliferation. A resolution on decreasing the operational readiness of nuclear weapon systems, first submitted in 2007 by Chile, New Zealand, Nigeria, Sweden and Switzerland (later joined by Malaysia), and adopted annually by the UN General Assembly by over two-thirds majority, typically has only France, Russia, the United Kingdom and the United States voting against it.

1.171 The urgent need for de-alerting has been highlighted in a series of papers,[229] including a study by Andrew Brown and Jeffrey Lewis for NTI on maximizing presidential decision time;[230] a co-authored study (also for NTI) by Des Browne, Wolfgang Ischinger, Igor Ivanov, and Sam Nunn titled *Building Mutual Security in the Euro-Atlantic Region*;[231] and a study by Hans Kristensen and Matthew McKinzie for UNIDIR.[232] More recently, in October 2014, Global Zero launched a new initiative at the UN First Committee to build support for de-alerting at a meeting hosted by a group of states and NGOs that have been strong advocates of de-alerting over the past several years (the Swiss Federal Department of Foreign Affairs, the New Zealand Ministry of Foreign Affairs and Trade, the European Leadership Network (ELN), and the Nuclear Threat Initiative).[233] Speakers drew attention to some disturbing trends, including that additional countries – besides the United States and Russia – are raising their launch readiness; the nuclear superpowers are failing to come to grips with their own risky practices; and cyber attack is emerging as a new threat to launch-ready nuclear forces.[234]

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227. Every time a US submarine returns to port after being out on patrol, sailors remove an electronic component in each D5 and C4 missile so that they cannot be accidentally launched while the submarine is in port. The electronic component is replaced after the submarine leaves port and before it reaches its patrol area. Sailors need about 90 minutes to reinstall this electronic component in each missile, and submarine crews typically work on two missiles at a time. One practical de-alerting measure would be to change this practice so that the components are no longer systematically reinstalled when the submarine leaves port. David E. Mosher, Lowell H. Schwartz, David R. Howell, and Lynn E. Davis, *Beyond the Nuclear Shadow: A Phased Approach for Improving Nuclear Safety and US-Russian Relations* (Santa Monica, CA: RAND, 2003), p. 101; Bruce G. Blair, *Global Zero Alert for Nuclear Forces* (Washington DC: Brookings Institution, 1995): pp. 88–89.

228. Mosher et al., *Beyond the Nuclear Shadow*, pp. 82–87.

229. See generally Gareth Evans, "Nuclear Arms Control: A Realistic Global Agenda," APLN/CNND *Policy Brief* No. 8 (Canberra: CNND, January 2014) and http://www.gevans.org/speeches/speech511.html.

230. Andrew Brown and Jeffrey Lewis, "Reframing the Nuclear De-alerting Debate: Towards Maximizing Presidential Decision Time," NTI, 11 December 2013, http://www.nti.org/analysis/articles/reframing-nuclear-de-alerting-debate-towards-maximizing-presidential-decision-time/.

231. Browne et al., *Building Mutual Security in the Euro-Atlantic Region*.

232. Hans M. Kristensen and Matthew McKinzie, *Reducing Alert Rates of Nuclear Weapons* (New York and Geneva: UNIDIR, 2012).

233. Speakers included NTI Vice Chairman Des Browne, Ambassador Benno Laggner of Switzerland, Global Zero's Bruce Blair and Ambassador Dell Higgie of the New Zealand Ministry of Foreign Affairs and Trade. Details of the event are available at http://www.nti.org/about/projects/nuclear-security-project/event/2000-nuclear-weapons-de-alert-reducing-operational-readiness-way-global-zero.

234. For a recent discussion of cyber threats to nuclear assets, see Vincent Boulanin and Tanya Ogilvie-White, "Cyber Threats and Nuclear Dangers," APLN/CNND *Policy Brief* No. 17 (Canberra: Centre for Nuclear Non-Proliferation and Disarmament, November 2014), https://cnnd.crawford.anu.edu.au/publication/cnnd/4911/policy-brief-no-17-cyber-threats-and-nuclear-dangers.

1.172 Opponents of de-alerting (France, Russia, the United Kingdom and the United States) argue that the risks of accidental launch and unintended nuclear war are minimized by physical locks, technical safeguards and procedures that require political leaders to transmit authorization codes to crews who must confirm their authenticity and then override a series of safety systems before nuclear weapons can be targeted and fired.[235] They also argue that high alert levels have not been a bar to Russia and the United States building a good strategic relationship. Conversely, nuclear risk reduction narrowly conceived could potentially undermine the overarching objective of strategic stability. Crisis stability is reduced when a potential enemy, who has cheated by either failing to de-alert fully or by secretly re-alerting, has an incentive to launch an attack during a tense standoff before "re-alerting" has been completed. Therefore irreversible deep cuts are better than reducing the operational readiness of existing nuclear forces. Both crisis stability and deterrence are enhanced when nuclear rivals know that primary targets will not escape retaliatory strikes even if a surprise attack is launched first.

1.173 These are highly questionable claims.[236] The reality is that it does not matter whether the alarm about an incoming nuclear attack turns out to be genuine or false; in the real world, the sole purpose of nuclear weapons can only be deterrence, not defence or retaliation. There is no conceivable circumstance in which either Russia or the United States could launch massive nuclear strikes against the other without committing nuclear suicide itself. Even if all fixed site weapons and missiles could be destroyed in a surprise attack – regardless of how many nuclear weapons the enemy has on high alert – Russia would have more than enough mobile ICBMs and the United States would have more than enough sea and air-launched weapons to destroy the other. To this extent the debate over alert status is esoteric and surreal rather than grounded in reality.

1.174 In any case, de-alerting has to be seen as a strategic step in deemphasizing the military role of nuclear weapons.[237] It is a necessary step in transforming relations between nuclear adversaries from one of strategic confrontation to strategic collaboration and in confirming the now generally assumed status of nuclear weapons as weapons of last resort. It is also politically important because unless they de-alert, the United States and Russia cannot convince non-NWS that national security goals can be fully met without nuclear weapons – there is thus a non-proliferation as well as a disarmament and crisis stability argument for de-alerting.

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235. Numerous encrypted codes are required by US military commanders before a nuclear weapon can be launched: SAS codes (used to validate launch orders); unlock codes (used to activate and target a nuclear weapon); and PALS (needed to override safety systems to enable the nuclear weapon to be fired).

236. A group of American and Russian experts conducted simulations to show that strategic stability is enhanced by taking nuclear weapons off high alert. See Bruce Blair, Victor Esin, Matthew Mckinzie, Valery Yarynich, and Pavel Zolotarev, "Smaller and Safer," *Foreign Affairs* 89:5 (September/October 2010), pp. 9–16 and "One Hundred Nuclear Wars: Stable Deterrence between the United States and Russia at Reduced Nuclear Force Levels Off Alert in the Presence of Limited Missile Defenses," *Science & Global Security Archive* 19:3 (2011), pp. 167–94. The technical details of the analysis is available at www.globalzero.org/files/FA_appendix.pdf. See also John Hallam, "Straight from the Planning Department of Hell: Maximising Decision-making Time, Lowering Operational Readiness," unpublished ms., May 2012.

237. Department of Foreign Affairs, Switzerland, East–West Institute, and Ministry of Foreign Affairs, New Zealand, *Re-framing Nuclear De-Alert: Decreasing the Operational Readiness of U.S. and Russian Arsenals* (New York: East–West Institute, 2009), p. 15.

§1.7 Parallel Security Issues

1.7.1 Ballistic Missile Defence (BMD)

Box 1.1: Ballistic Missile Defence Primer

In trying to understand the complex subject of ballistic missile defence (BMD), it helps first to understand what a ballistic missile is. In brief, this is a missile that is powered through only a brief period of its flight. That phase, called the 'boost' phase, lifts the rocket and its payload into a ballistic trajectory. Once the boost phase ceases, the rocket and its warhead(s) fall back – perhaps with some steering adjustments – towards the earth. Some missiles are unitary, which means the warhead does not separate from the body of the missile when the boost phase is complete. Other missiles feature separating warheads, which typically makes the target a smaller one for BMD systems. Sophisticated multiple-warhead missiles have a separate postboost-phase 'bus', which manoeuvres to deploy the warheads along different trajectories. Once the boost phase ceases, the missile/warhead enters the mid-course phase of its journey. This typically occurs in space, and is also the time when the missile deploys decoys or other counter-measures to help conceal the true warhead from the defender. The terminal phase of flight commences when the missile/warhead re-enters the atmosphere. Re-entry helps the defence by stripping away many of the lightweight decoys, but now only a short time remains before the warhead hits its target.

Ballistic missile defences vary enormously. In terms of current capabilities, the US Ground-Based Interceptor (deployed in Alaska and California) is intended to intercept long-range ballistic missiles in the mid-course phase. The Aegis sea-based system includes an SM-3 interceptor, designed to intercept missiles in the mid-course phase, and an SM-2 interceptor, designed to intercept in the terminal phase. Among the ground-based theatre and tactical systems, the Terminal High Altitude Area Defence (THAAD) system and the Patriot PAC-3 system are meant to be complementary terminal systems, THAAD providing interception in the higher altitudes and Patriot at lower altitudes.

Source: Andrew Davies and Rod Lyon, *Ballistic missile defence: How soon, how significant, and what should Australia's policy be?* (Canberra: Australian Strategic Policy Institute, 2014).

1.175 The shadow of US withdrawal in 2002 from the 1972 Anti-Ballistic Missile (ABM) Treaty hovers over nuclear disarmament efforts. The ABM Treaty had helped to contain the nuclear weapons competition between the United States and Russia by limiting the deployment of systems capable of destroying incoming ballistic missiles, thereby preserving the perceived deterrent value of each side's strategic nuclear forces that rely on guaranteed second-strike retaliatory capability. US abrogation of the ABM Treaty, subsequent BMD deployments in Europe and geographical mission creep to the Middle

East and Asia Pacific have eroded Russian and Chinese perceptions of strategic balance, driving both countries to pursue more advanced nuclear and missile capabilities. The resulting distrust is not only inhibiting US–Russia and NATO–Russia cooperation on nuclear issues, it is also feeding wider strategic tensions, including between the United States (plus its allies in the Asia Pacific) and China. Concerns over these dynamics, which have been apparent for some time now, led ICNND to urge that "severe limits" should be set on strategic ballistic missile defences which "now constitute a serious impediment to both bilateral and multilateral nuclear disarmament negotiations" (Recommendation 61).

1.176 ICNND's advice is not being heeded. In fact, evolving US strategic doctrine has been assigning a progressively larger role to non-nuclear systems, including ballistic missile defence. Russia, on the other hand, has not prioritized indigenous BMD development,[238] but has taken a decision to sustain nuclear forces sufficient to defeat any potential future BMD systems. Resulting Russian missile development might, under certain conditions, lead to the termination of the INF Treaty[239] – something that would have major implications for future nuclear arms control and disarmament. Recently the treaty has come under severe strain. In 2014, the United States alleged actual and potential violations of the treaty by Russia, which it accused of field-testing missiles with a range exceeding treaty parameters. Russia in turn alleged that the United States is violating INF by deploying on land surface-to-air missile launchers that could also launch cruise missiles with range parameters in excess of INF limits.

1.177 US missile defence plans are widely criticized for promising a false sense of security to the United States and its allies while provoking a false sense of insecurity among Russia and China – false in both cases according to the conclusions of scientific studies that have explored the technical challenges that stand in the way of effective BMD.[240] In answering concerns that BMD is destabilizing, its proponents argue that it is designed to defend against limited attacks from regional states such as Iran or North Korea, not to weaken the deterrent value of the nuclear arsenals of countries such as Russia and China. But just as with "theatre" as distinct from "strategic" missile defence systems, it is very difficult in practice to develop systems which would serve only the former objective, with no implications for the latter.

1.178 **Questions over BMD Effectiveness.** Assessing BMD effectiveness is a complicated task, not least because of counter-measures that the adversary can take. Ballistic missiles follow a trajectory that can be calculated if the requisite information is available. A ballistic missile could, in theory, be destroyed at any point along its flight path – in the boost phase (immediately after launch), the mid-course phase, or the terminal phase

238. Russia has had an active BMD program since the 1960s and does possess a technical platform on which a more ambitious program could be built.

239. The INF Treaty was signed at a summit meeting between US President Ronald Reagan and Soviet General Secretary Mikhail Gorbachev in Washington on 8 December 1987. It eliminated an entire category of nuclear weapons and introduced, for the first time, extensive arms control verification mechanisms, including on-site inspections. The weapons it eliminated included intermediate-range missiles with a range between 1,000 km to 5,500 km, and shorter-range missiles with a range between 500 km and 1,000 km. The treaty played a significant role in bringing Cold War nuclear arms racing to an end. Its termination would have major strategic implications, particularly for Europe.

240. US scientific assessments by the Defense Science Board Task Force on *Science and Technology Issues of Early Intercept Missile Defense Feasibility*, and by the National Research Council of the National Academy of Sciences on *Making Sense of Missile Defense* suggest that these programs may be technological dead-ends. Philip Coyle, "The Failures of Missile Defence," *The National Interest*, 26 July 2012, http://nationalinterest.org/commentary/the-failures-missile-defense-7248.

(as it approaches its target). However, the barriers to successful destruction in the boost and terminal phases are formidable, and even intercepting long-range missiles in mid-course flight is extremely difficult, requiring a very fast interceptor that can engage at high altitudes. Short and medium-range ballistic missiles may literally fly "under the radar," never rising to an altitude at which detection systems designed to monitor intermediate and long-range missiles can identify them. Conversely, missile defence systems developed in response to short and medium-range missiles may not be able to intercept objects at high altitude.

1.179 The probability of destroying ballistic missiles will also depend on the correct identification of real warheads, as opposed to decoys or debris from previously destroyed warheads. Defending forces must recognize, and be able to solve, problems created by changes to the ballistic trajectory of attacking missiles (such as missiles that follow a depressed trajectory, or warheads that manoeuvre in the terminal phase). The numbers of interceptors in relation to the size of the attacking force is also an important factor.

1.180 Given these different requirements, a comprehensive BMD system may need to be "layered." That is, different elements of an integrated system may be designed to engage with ballistic missiles at different altitudes and at different points along their flight path. Missile defence systems such as Aegis and Patriot, designed for area defence, in a comprehensive BMD system also provide terminal-phase interception for longer range ballistic missiles. In the case of NATO, leaders at their 2010 Summit decided that NATO's Active Layered Theatre Ballistic Missile Defence program's "command, control and communication capabilities will be expanded beyond the capability to protect forces to also include NATO European populations and territory." NATO indicates that this program "is being fielded in several phases and eventually will merge with the capabilities for territorial BMD that are being developed in parallel."[241]

1.181 Hence, a distinction between short range theatre missile defence systems and those for national missile defence may be artificial. In any case, no country has yet come close to developing a fully comprehensive BMD system able to defend national territory and the main population centres against an attack involving more than a small number of unsophisticated ballistic missiles. A threat scenario based on an overwhelming number of long-range missiles is one in which no defence is feasible.

1.182 Based on the unresolved technical difficulties alone, a compelling case can be made for the abandonment of US BMD plans. There are other good reasons to abandon them, too. Cancelling the plan could save the US $8 billion per year,[242] and reduce tensions with Russia and China, making them more open to cooperation on other international issues in Europe, the Middle East and Asia. Despite these incentives to reverse course, US BMD ambitions are expansive, driven by a combination of incremental improvements in the range and accuracy of missiles close to Europe and Asia, and by alliance dynamics.

241. http://www.nato.int/cps/en/natolive/topics_49635.htm.

242. Yousaf Butt (a nuclear physicist), "Obama, Congress should push NATO missile defense program off 'fiscal cliff'," *Christian Science Monitor*, 15 November 2012, http://www.csmonitor.com/Commentary/Opinion/2012/1115/Obama-Congress-should-push-NATO-missile-defense-program-off-fiscal-cliff.

1.183 **US BMD Cooperation with Allies.** Despite technical hurdles and political fallout, the US is pushing ahead with its BMD plans, with growing cooperation and support from its allies. The nature of this cooperation has changed in important ways since the end of the Cold War. Before the 1990s, the objective of BMD was limited to defending specific facilities. The objective has subsequently expanded to include defending the whole of the national territory of the United States and NATO members, through an integrated collective effort. US legislation has also called for the study of BMD systems for the Asia Pacific that would have the capability to protect key allies of the United States in the region. Since September 2009, US BMD plans have been shaped by what is called a Phased Adaptive Approach (PAA), in which the deployment of BMD is tailored to evolving missile threat assessments.[243] The US also places greater emphasis on the regional dimensions of BMD and on providing indivisible security among Allies.

1.184 NATO members contribute to the US-led layered missile defence capability as part of their NATO burden-sharing commitments, for example through radar systems, joint training exercises and force protection of BMD assets. In February 2014, the first of four US Navy destroyers arrived in the Spanish Naval Base of Rota, which will become its permanent home port – the first time a US Navy ship equipped with the Aegis BMD system has been permanently based in Europe. At present, it is not clear when the system will reach full operational capability, although estimates suggest that the target date is 2018.

1.185 **Russian Opposition to US BMD Plans.** The issue of strategic missile defence has been addressed in the bilateral US–Russia context in many forums, unofficial as well as official. However, the positions of the two sides cannot currently be reconciled. Russian concerns were summarized by Putin during the Munich Security Conference in 2007, when he stated that: "the United States is actively developing and already strengthening an anti-missile defence system. Today this system is ineffective, but we do not know exactly whether it will one day be effective … We recognize that when this moment arrives, the possible threat from our nuclear forces will be completely neutralized."[244]

1.186 US regional missile defence cooperation in Asia and Europe is viewed by Russian experts and officials as part of a broader US plan to prepare the ground for any potential future confrontation with Russia, China or both.[245] They do not believe the US strategic rationale for BMD, which focuses on defending against the ballistic missile capabilities of North Korea and Iran, in part because they are not convinced Iran will be able to solve the technical problems associated with the production of long-range ballistic missiles. They argue that countries that are developing long-range missiles today (India and Israel) or have the technical knowledge to do so at relatively short notice (Japan) are US friends and allies, not adversaries and potential enemies. In his first State of the Nation address to the Russian parliament in 2008, President Dmitry Medvedev pointed to elements of a perceived relentless encirclement of Russia, including "the construction of

243. White House, *Fact Sheet on US Missile Defense Policy: A 'Phased, Adaptive Approach' for Missile Defense in Europe*, 17 September 2009.

244. Vladimir Putin, Speech and Following Discussion at the Munich Conference on Security Policy, 10 February 2007.

245. Alexander Kalyadin, "The Antimissile Debate: Two Trends Within the Expert Community," *World Economy and International Relations Journal*, 6:30 (June 2012), pp. 3–13.

a global missile defence system, the installation of military bases around Russia, [and] the unbridled expansion of NATO."[246] Three years later, he again stressed that the BMD program being designed by the United States and its allies "in a short while, in six to eight years, could weaken our nuclear deterrence posture."[247] Russia seeks "clear legal guarantees … verifiable under mutually approved technical criteria" that US missile defence systems will not be directed against Russia's nuclear forces, and has threatened military retaliation if differences remain unresolved.[248]

1.187 **NATO–Russia BMD Discussions.** The United States has made it clear that it will not accept any obligations that limit its capability to defend against ballistic missile attacks, regardless of Russian concerns. This applies both to the technical characteristics of BMD systems and to where they are deployed.[249] Washington's NATO partners have been more attuned to Russia's concerns, partly due to historic reservations among some allies about the concept of BMD and its potential to undermine nuclear deterrence.[250] To address mutual concerns, talks took place in the NATO–Russia Council's Missile Defence Working Group, covering numerous aspects of missile defence, including proposals for NATO-Russia cooperation. However, the Working Group was unable to make any progress.

1.188 Before 2014, the lack of progress in NATO–Russia BMD discussions reflected the incompatibility of approaches being taken to missile defence cooperation: while Russia sought an integrated approach, NATO preferred to discuss how independent missile defence systems could work together.[251] These incompatible positions became entrenched in 2012–13, until in the autumn of 2013, the Russian government suggested that there should be a pause in the dialogue. In April 2014, in response to the Ukraine crisis, NATO suspended all cooperation with Russia, including talks on missile defence cooperation. No date has been set for the resumption of discussions.

1.189 **China's Response to US BMD.** The arguments against BMD made by Russia also apply to the Chinese assessment of missile defence, its relationship to strategic stability and implications for arms reduction. China has long opposed the general concept of strategic missile defence systems and views US cooperation with Japan on Aegis-based ballistic missile defence in the Asia Pacific with growing concern. In its 2010 Defence White Paper, Beijing stated that:

> China maintains that the global missile defense program will be detrimental to international strategic balance and stability, will undermine international and regional security, and will have a negative impact on the process of nuclear disarmament. China holds that no state should deploy overseas missile defense systems that have strategic missile defense capabilities or potential, or engage in any such international collaboration.[252]

246. Dmitry Medvedev, Address to the Federal Assembly of the Russian Federation, 5 November, 2008.
247. *Statement in connection with the situation concerning the NATO countries' missile defence system in Europe*, 23 November 2011, http://eng.kremlin.ru/news/3115.
248. Mansur Mirovalev, "Russia pessimistic about US missile defense talks," AP, 3 May 2012; "Russia Warns West on Antimissile Effort," *Global Security Newswire*, 21 August 2012.
249. Josh Rogin, "Tauscher: We will get a missile defense agreement with Russia," *The Cable*, 12 January 2012.
250. Tanya Ogilvie-White, *On Nuclear Deterrence: The Correspondence of Sir Michael Quinlan* (London: IISS/Routledge, 2011).
251. Russia favours an interdependent system in which Moscow would provide missile defence coverage for northern Europe if missiles were fired from the Middle East. NATO favours complete coverage through separate systems, which its members argue would increase the chances of successful interception.
252. *China Defence White Paper 2010*.

1.190 China has much smaller and less modern nuclear forces than Russia. Whereas Russia has nuclear forces that would survive under any scenario, China is still in the process of creating a reliable second-strike capability. The continued development and modernization of its sea- and land-based nuclear forces could in time reduce China's concerns about the implications of missile defences for the effectiveness of deterrence.

1.191 China responded firmly to March 2012 comments by US Assistant Secretary of Defense for Global Strategic Affairs Madelyn R. Creedon that the United States was discussing cooperative missile defence with Australia, Japan and South Korea. A senior foreign ministry official said that a missile defence system in the Asia Pacific region would have "negative effects on global and regional strategic stability, and go against the security needs of the countries in the Asia Pacific region."[253] A senior Chinese military official subsequently warned that US missile defence activities could force China to "modernize its nuclear arsenal … Beijing will have to improve its capabilities of survival, penetration … otherwise it is very difficult for us to maintain the credibility of nuclear deterrence."[254]

1.192 There is no clear evidence that China has decided to develop its own national missile defence system. Public information suggests that Chinese projects to develop missile interceptors are intended to help understand the technical issues surrounding missile defence, mainly with a view to understanding how to defeat defences, rather than a serious effort to develop a BMD system.[255] Chinese analysts have highlighted the potential vulnerabilities of current and future US ballistic missile defences – they point out that disabling or destroying the space-based sensors on which the system depends for early warning would reduce the effectiveness of the system. Similarly, developing the capability to attack sea-based elements of the BMD system could be an effective way of degrading its capability.

1.193 China has made diplomatic and political approaches to countries in North East Asia, outlining its objections to ballistic missile defence, and explaining that participation in the US-led regional missile defence architecture will be interpreted by China as a potentially hostile act. China is already highly critical of bilateral missile defence cooperation between the United States and Japan and South Korea respectively, and would be even more critical if bilateral projects evolved into trilateral or wider regional programs. In September 2014, the Shanghai Cooperation Organization (which includes China, Russia and four Central Asian states) declared that "The unilateral and unlimited capacity of individual states' or groups of states' missile defence systems will be detrimental to international security and strategic stability."[256]

1.194 Japan has invested heavily in the development of a layered ballistic missile defence system. The Aegis system plays a central role in Japanese plans, and the United States and Japan cooperate extensively in the development of equipment. The two countries also conduct regular joint training and exercises, and in April 2014 Japan modified its

253. "China Lashes Talk of Asian Missile Shield," *Global Security Newswire*, 12 April 2012.
254. "China Warns of Response to U.S. Missile Defense," *Global Security Newswire*, 19 July 2012.
255. Timothy Farnsworth, "China Conducts Missile Defence Test," *Arms Control Today*, March 2013.
256. "Bloc Led by Russia and China Criticizes U.S. Over Missile Defense," *Reuters*, 12 September 2014.

arms exports policy to permit exports that enhance security and defence cooperation with partners. South Korea also has a national program, which would be closely coordinated with US forces in a conflict, and the three countries discuss missile defence in their trilateral dialogue. In March 2014, Japan's Prime Minister Shinzo Abe and South Korea's President Park Geun-hye agreed to reconsider trilateral missile defence cooperation.[257] Australia has also been cooperating with the US on ballistic missile defence. Its Jindalee Operational Radar Network can detect missile launches in Asia and it is thought that its new air-warfare destroyers, which are being built in Adelaide and Melbourne, will ultimately be equipped with BMD systems.[258]

1.195 If these various efforts at bilateral BMD cooperation develop into a US-led Asia Pacific missile defence shield, as widely expected, China is likely to accelerate the expansion of its own nuclear and ballistic missile programs and possibly adopt a somewhat more robust nuclear deterrence doctrine. A 2014 US proposal calling for the Pentagon's Missile Defense Agency to explore the costs and benefits of merging Taiwan's early-warning radar and new national BMD system into the wider US BMD network would, if adopted, make this even more likely.[259]

1.7.2 Weapons in Space

1.196 There are a number of dimensions to the issue of space weapons: ground-based weapons that attack targets in space; space-based weapons that attack targets in space; and space-based weapons that attack targets on the ground. Many of the issues involved are caught up in the missile defence debate. In addition, space-based assets have become an increasingly important component of military missions such as surveillance, early warning, target acquisition, guidance and communications. The ability to degrade or destroy such assets can have a significant impact on military capability; equally, the capacity to hold such assets at risk can have a significant deterrent effect.

1.197 The list of those with a satellite launch capability (China, India, Israel, Japan, the European Union (EU), North Korea, Russia, Ukraine, and the United States) includes most of the countries that own nuclear weapons. Argentina, Brazil, Iran and Pakistan also have important capabilities. South Africa had a substantial program to develop long-range rockets that was terminated at the time that the South African nuclear weapon program was abandoned at the end of the Cold War. Other countries with a significant technology base are actively exploring joining the list of launch providers, with South Korea perhaps the most likely to succeed in the coming decade.

1.198 Since the 1960s, the military have used reconnaissance satellites to monitor the Earth, using increasingly sophisticated instruments (cameras and radars). The military use of satellites as platforms for telecommunications, and to assist with accurate global

257. Cheryl Pellerin, "Hagel: U.S. to Send 2 More Aegis Ships to Japan," American Forces Press Service, Department of Defense, 6 April 2014.

258. "Joint Missile Defence on the Cards for Australia and US," *The Australian*, 7 August 2014, http://www.theaustralian.com.au/national-affairs/defence/joint-missile-defence-on-the-cards-for-australia-and-us/story-e6frg8yo-1227015914212.

259. Maggie Ybarra and Guy Taylor, "U.S. Missile Defense Plans in Taiwan Face Rising Opposition," *Washington Times*, 5 June 2014; "Taiwan to spend HK $19 billion on home-made missile defence against Beijing," *South China Morning Post*, 30 August 2014.

positioning, has made them a critical element of modern military capability in an increasing number of countries. In addition to dedicated military satellites, the miniaturization of instruments and the widespread use of digital technology enabled the construction of satellites with mixed civilian/military payloads on one platform. The military is also able to take advantage of the increasingly sophisticated services offered by the operators of civilian satellites on a commercial basis.

1.199 While the "demilitarization" of space is no longer a realistic objective, prohibiting the placing of actual weapons in space is the main focus of proposals to prevent a space arms race. The ICNND Report called for strong support to be given to attempts to prevent the weaponization of space at the CD in Geneva (Recommendation 63). However, the enduring stalemate in the CD over the adoption of a work program has prevented concrete progress on the development of an international legally-binding instrument for the prevention of an arms race in outer space (PAROS).[260] Behind these disagreements are contested issues in the strategic relationship between the major powers – in particular China, Russia and the United States. China and Russia see the military use of space by the United States as part of an overall military posture that undermines their own deterrence capabilities, increasing arms racing dynamics and diminishing strategic stability.

1.200 *China* and *Russia* have played the leading role in developing proposals for a legal instrument to ban weapons in space since 2002, when they were the main sponsors of a working paper to examine the possible elements for a future international legal agreement. In 2008 China and Russia continued to elaborate further on the idea until they tabled a draft treaty text on the Prevention of the Placement of Weapons in Outer Space, and the Threat or Use of Force against Outer Space Objects (PPWT) in 2008.[261] Russia proposed a moratorium on the placement of weapons in outer space, to last until a legally binding agreement could be reached on the issue.

1.201 The discussions around the Sino–Russian proposal for a draft PPWT revealed that a number of countries, but principally the United States, found the text unacceptable. There were two main objections. First, the text was not considered to have defined a "weapon in outer space" adequately.[262] Second, while the preamble of the text noted that an agreement should be effective and verifiable, the text did not give guidance on how such a mechanism could work. As a result of these objections, the United States and several of its allies (also spacefaring nations) were not willing to hold discussions on the basis of the Sino–Russian draft and did not see any reason to develop an alternative.

260. The history of PAROS dates back to the mid-1980s, when a Committee on PAROS was created in the CD. The Committee agreed to several recommendations for space-related confidence-building measures. In 1995, extending the mandate of the PAROS committee was linked to an unrelated issue – an agreed mandate to negotiate an FMCT – and discussion has been suspended ever since. Ambassador Paul Meyer, *The CD and PAROS: A Short History*, UNIDIR Resources, April 2011, http://www.unidir.org/files/publications/pdfs/the-conference-on-disarmament-and-the-prevention-of-an-arms-race-in-outer-space-370.pdf.

261. Draft Treaty on the Prevention of the Placement of Weapons in Outer Space, and the Threat or Use of Force against Outer Space Objects (PPWT), http://www.reachingcriticalwill.org/images/documents/Disarmament-fora/cd/2008/documents/Draft%20PPWT.pdf.

262. The definition proposed included "any device placed in outer space, based on any physical principle, which has been specially produced or converted to destroy, damage or disrupt the normal functioning of objects in outer space, on the Earth or in the Earth's atmosphere, or to eliminate a population or components of the biosphere which are important to human existence or inflict damage on them."

1.202 In June 2014 China and Russia tabled a new draft PPWT that provides some elaborated ideas on how allegations of non-compliance would be addressed.[263] The immediate US reaction was lukewarm, mainly due to the draft's lack of attention to the use of ground-based systems to destroy satellites. US officials appear to favour the contribution that non-binding diplomatic initiatives can make to space security.[264]

1.203 The problem of how to define space weapons is complex and remains very problematic. The 2014 text maintains the same basic approach as the 2008 draft by focusing on objects placed in outer space (meaning a device that has orbited the Earth at least once) and limiting the scope to objects specially produced or converted for destructive purposes. Missiles fired from the Earth into space are therefore excluded under the text's definition of a space weapon, as are ground-based anti-satellite weapons (equipment that either jams or blinds a satellite, rendering it useless without physically destroying it). A more comprehensive definition of space weapons would take account of a much wider spectrum of capabilities,[265] but this would inevitably entangle the discussion of space weapons with the issue of the feasibility and desirability of missile defence.

1.204 The prospects for progress on negotiating a PPWT depend on whether or not the impasse in the CD can be overcome – about which there is limited optimism. Moreover, countries that have expressed a view on priorities for the CD once it resumes its work have often emphasized the need for discussions on nuclear disarmament and the negotiation of a treaty banning the production of fissile material for nuclear weapons, rather than prioritizing space issues. If (as seems likely) the CD is not able to make progress, the incentive for groups of states to promote processes outside the UN framework will grow.[266]

1.205 The *European Union* began developing a draft Code of Conduct for Outer Space Activities in 2008.[267] The EU has released three subsequent drafts of the code, containing amendments based on the outcome of bilateral consultations with other states and based on the results of several workshops. The objective of the code is to promote the adoption of space rules that are grounded in best practices and that strengthen existing norms of behaviour. However, it has not been promoted as a legally binding agreement and the EU has framed the code as compatible with (not a substitute for) other initiatives.

263. (Updated) Draft Treaty on the Prevention of the Placement of Weapons in Outer Space, and the Threat or Use of Force against Outer Space Objects (PPWT), CD/1985, 12 June 2014, http://daccess-dds-ny.un.org/doc/UNDOC/GEN/G14/050/66/PDF/G1405066.pdf?OpenElement.

264. Frank Rose (Deputy Assistant Secretary, Bureau of Arms Control, Verification and Compliance), *Ensuring the Long-Term Sustainability and Security of the Space Environment*, Remarks to the American Institute of Aeronautics and Astronautics, 25 September 2014.

265. Ground-based weapons that attack targets in space would include missiles with explosive or kinetic warheads, lasers that blind or disable satellites and missiles that destroy long-range ballistic missiles during their mid-course flight path outside the Earth's atmosphere. Space-based weapons that attack targets in space would include satellites that kill satellites and satellites that use lasers or launch rockets to kill ballistic missiles during their mid-course flight path outside the Earth's atmosphere. Space based weapons that attack targets on the ground would include lasers, weapons with conventional explosive warheads, and kinetic weapons.

266. See John Page, "Bringing the UN Disarmament Machinery Back to Life," APLN/CNND *Policy Brief* No. 6 (Canberra: Centre for Nuclear Non-Proliferation and Disarmament, October 2013).

267. Council conclusions and draft Code of Conduct for outer space activities, Council Document 17175/08, Brussels, 17 December 2008.

1.206 The most recent EU draft[268] could provide a framework in which the discussion of military issues could be further developed and expanded in the future, at a pace at which participating states feel comfortable. It proposes consensus procedures that would reduce the risk of states feeling they are being pushed to adopt measures about which they feel uncomfortable. In the course of consultations with EU officials in 2013–14, representatives of key spacefaring nations have made it clear that there is very little (if anything) in the current draft that they find objectionable.[269] However, there is uncertainty about the procedure by which the draft was developed and about its impact on other processes. The Code of Conduct has never fully overcome the stigma of being developed in a closed group of EU Member States, with only the United States given privileged access to internal EU discussions. Some key countries – including China, India and Russia – have been reluctant to engage in serious talks about a code developed without their input.

1.207 In spite of EU assurances that the code is intended to complement rather than replace other processes, it is unclear whether it can gain the backing of China and Russia. The United States seems to prefer the non-binding format and general language of the code, rather than a treaty that might restrict current or future deployment options. US support for the Code of Conduct approach might strengthen suspicions that a successful code could deflect attention and remove momentum from discussions of PAROS.

1.208 The *UN Group of Governmental Experts (GGE)* has been running a third initiative, on Transparency and Confidence-building Measures in Outer Space Activities. The group's objectives, which were set out in General Assembly Resolution 63/68 (2011) are "to improve international cooperation and reduce the risks of misunderstanding and miscommunication in outer space activities," and to reach agreement on "conclusions and recommendations on transparency and confidence-building measures that can help ensure strategic stability in the space domain." Russia and China were strong supporters of Resolution 63/68. The United States abstained on the resolution, objecting to its mention of the draft PPWT, but subsequently declared support for the process.[270] In 2013 the GGE produced a consensus report recommending a number of technical confidence building measures based on voluntary information exchange on national space policy and activities, notifications above those required in existing law and a willingness to convene expert meetings at national space facilities.[271] The General Assembly endorsed the report at its 68th session and encouraged UN Member States to review and implement the proposed measures through relevant national mechanisms on a voluntary basis. A major focus in the foreseeable future will be how to implement the GGE's recommendations and any complementary activities within the other space sustainability and security initiatives.

268. Draft International Code of Conduct for Outer Space Activities, version of 31 March 2014.

269. The EU held open-ended consultations, in Kiev (May 2013), Bangkok (November 2013), and Luxembourg (May 2014). Overall, 95 states participated, and 61 were present at each round. http://eeas.europa.eu/non-proliferation-and-disarmament/outer-space-activities/index_en.htm.

270. Tiffany Chow, "Group of Governmental Experts on TCBMs in Outer Space Activities: Fact Sheet," Secure World Foundation, 21 June 2012, http://swfound.org/media/84703/SWF%20-%20GGE%20Fact%20Sheet%20-%20June%20 2012.pdf.

271. Report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities, UN General Assembly document A/68/189, 29 July 2013.

1.209 Cooperative measures to strengthen space security have a value per se, but might also help build a more permissive political atmosphere for nuclear talks. Russia holds that nuclear arms reductions cannot be discussed in isolation from wider developments in international security. If it were possible to resolve the issues surrounding the military use of space, or if it were possible to agree that the military issues should not be the subject of an agreement at this time, then one obstacle to a new round of strategic nuclear arms reductions would have been removed.

1.7.3 Biological and Chemical Weapons

1.210 The ICNND Report, although focused on nuclear weapons, recognized that concerns about other weapons of mass destruction impacted on the nuclear debate, and called for strong efforts to be made to promote universalization of the Biological (BWC) and Chemical (CWC) Weapons Conventions; and for the development of "more effective ways of defending against potential biological attacks, including – for all its difficulties – building a workable [Biological Weapons] Convention verification regime" (Recommendation 64). Progress on the biological weapons front, in particular, has been slow. Parties to the BWC continue to lament the absence of a verification mechanism. Agreement on such a mechanism is no closer, however, with the United States remaining firmly of the view that effective BWC verification is impossible.

1.211 Little concrete information is available about worldwide biological weapons (BW) activities. There is some public knowledge of past programs in Libya, Russia, South Africa, the UK and the US.[272] There are also allegations of active BW programs, including in states that have forcefully denounced biological weapons and deny they have ever engaged in offensive BW research. Uncertainty surrounding the current status of offensive BW programs has led some states, including the United Kingdom and United States, to operate bio-defence programs. It also has an impact on nuclear weapon doctrines, including, though not exclusively, in the case of the United States which has reserved "the right to make any adjustment [to its NSA] that may be warranted by the evolution and proliferation of the biological weapons threat and U.S. capacities to counter that threat."[273]

1.212 Chemical weapons do not pose a threat of the magnitude of other categories of WMD (nuclear and biological), but still arouse strong international concern owing to their indiscriminate nature and the horrific injuries they cause. While Russian and US failure to meet the 29 April 2012 deadline for destruction of their chemical weapons stocks was unhelpful (though expected and accommodated by other states parties), the focus of activity for the CWC's implementing agency, the Organization for the Prohibition of Chemical Weapons (OPCW), is nonetheless moving progressively from monitoring and verification of chemical weapon (CW) destruction schedules to non-proliferation. Vigorous implementation, particularly of the CWC's inspection provisions, will be essential for the treaty's future effectiveness, given the globalization of industrial chemical production, the emergence of new technologies and chemical compounds

272. http://www.armscontrol.org/factsheets/cbwprolif.
273. *Nuclear Posture Review*, April 2010, p. viii.

suitable for CW applications, and the relative ease with which some existing facilities could be converted or returned to the production of CW or CW precursors.[274]

1.213 The most significant recent developments concerning chemical weapons have revolved around the civil war in Syria. After the Syrian government's admission in 2012 that it possessed chemical weapons, a series of increasingly serious allegations led to an international inspection team, working under the auspices of the UN Secretary-General, entering Syria.[275] Its report confirmed chemical weapons had been used in the civil war but did not specify which side had used them. Syria subsequently became a party to the CWC, made a formal declaration of its chemical weapons stockpiles and reached agreement on their removal and destruction. What happened here was the result of huge international pressure and Security Council resolutions which were very effectively followed up with clear benchmarks, explicit timelines, active monitoring mechanisms, regular reporting processes, and well articulated consequences for non-compliance. The process showed the international security system working at its best, and is a useful reminder of what might ultimately be possible with nuclear weapons should similar political will be mobilized.

1.214 The CWC has achieved near universality with 190 states parties. As at 31 August 2014 (the most recent information available on 31 December 2014):[276]

- Only four states had yet to sign the convention (Angola, Egypt, North Korea and South Sudan), while Israel and Myanmar signed in 1993 but are yet to ratify;
- Iraq, Libya, Syria,[277] Russia and the United States had yet to complete destruction of their chemical weapon stockpiles;
- 61,608 tonnes (85 per cent) of category 1 chemical weapons had been destroyed;
- 14 states had declared 97 former chemical production facilities;
- 56 of these facilities had been destroyed and 23 converted to peaceful purposes;
- Russia had destroyed over 30,400 tonnes of chemical agents (as of August 2013: it plans to complete destruction between 2015-2016); and
- The United States had destroyed about 25,000 tonnes of chemical agents (as of August 2013: the US Army believes destruction will be completed by 2023).

1.7.4 Conventional Weapons

1.215 Like ballistic missile defence and space-based systems, long-range conventional strike systems have emerged as major complicating factors in achieving or maintaining stable deterrence relationships, and these are likely to intensify as relevant military capabilities improve over time. While it is obviously wrong to overlook or to undervalue the strength and persistence of these concerns, it is equally wrong to make nuclear disarmament contingent on their resolution, not least because to do so, while

274. See Ramesh Thakur and Ere Haru, eds., *The Chemical Weapons Convention: Implementation, Challenges and Opportunities* (Tokyo: United Nations University Press, 2006).

275. http://www.sipri.org/yearbook/2014/08.

276. See http://www.armscontrol.org/factsheets/cbwprolif; http://www.sipri.org/yearbook/2014/08; and http://www.opcw.org/news-publications/publications/facts-and-figures/.

277. Syria completed the destruction of its chemical weapon stockpile in June 2014.

simultaneously maintaining the exclusive right of the NPT's recognized NWS to possess such weapons, is to ignore present realities and to invite further proliferation. It is important to see conventional and nuclear disarmament as overlapping, rather than interdependent, security issues. To hold them hostage to each other is likely to render progress on both impossible.

1.216 The ICNND Report argued that "the issue of conventional arms imbalances … 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." It recommended revisiting matters covered in the Treaty on Conventional Armed Forces in Europe (CFE) "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,"[278] and believed that "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" (Recommendation 65).

1.217 At the time of the report's release and in the period immediately afterwards (late 2009–10), there were grounds for optimism about the prospects for renewed attention to conventional arms control in Europe. The Organization for Security Cooperation in Europe (OSCE)-led dialogue on the European security framework (the "Corfu Process") emphasized the need for renewed attention to the issue. Russia appeared to be willing to return to discussions about the future of the CFE Treaty, albeit without reversing its 2007 decision to suspend participation in the treaty. The Obama administration emphasized its willingness to revisit the future of conventional arms control and, in their bilateral summit in 2010, Presidents Obama and Medvedev committed to strengthen and modernize conventional arms control in Europe.

1.218 In 2011 and 2012 hopes for any progress in this area faded, to the point where it is highly unlikely that the adapted CFE Treaty will ever enter into force and prospects for any meaningful negotiations on an alternative look remote. In 2011 the United States suspended its cooperation with Russia within the framework of the CFE Treaty (while continuing to meet its obligations to the other parties to the treaty). NATO allies party to the CFE Treaty, as well as Georgia and Moldova, followed the US lead. The US focal point and negotiator on conventional arms control was withdrawn. Perhaps most significantly, the United States and Russia repeatedly stated that the basic problem that CFE was intended to address had been resolved and was no longer relevant to European security.

1.219 Russia, the United States and other countries have said that they are willing to look at alternative approaches to conventional arms control, beyond CFE. It is, however, not clear how such a process could be organized. Confining the talks to NATO–Russia or to Europe would be difficult as many capabilities (and in particular those of most concern to Russia) are to be employed globally. There cannot be any Europe-wide agreement based on equal balance because the forces of the potential parties are extremely asymmetrical and uneven. Russia's aim is to incorporate into the discussion weapon

278. ICNND, *Eliminating Nuclear Threats*, p. 197, paragraph 18.35.

types that the United States has always insisted on keeping outside arms control agreements (naval forces, missiles, unmanned aerial vehicles, space-based military assets). Behind this is a fundamental disagreement on the problem that arms control should seek to address. While Russia's objective is to contain the global power of the United States, NATO's principal aim is to stabilize military security in specific "grey zones" around the periphery of the enlarged alliance.

1.220 The state of play on conventional arms control has important implications for nuclear arms control. The United States has evaluated a series of different options to develop advanced conventional systems that could serve conventional prompt global strike (CPGS) missions, none of which has been pursued beyond the research and development phase. Russia has argued that current US plans to develop a faster global conventional strike capability could have an impact on strategic nuclear arms control. Senior Russian officials generally refer to such weapons as "strategic offensive weapons with conventional warheads." President Putin has said that Russia will only contemplate additional nuclear weapons reductions "if all factors affecting international security and strategic stability are taken into account,"[279] and has linked final nuclear disarmament to Russia's acquisition of "exceptionally accurate non-nuclear systems of similar effectiveness" to those now under development in the United States.[280] The United States, meanwhile, can be expected to seek to preserve its global advantage in conventional military capability as a guarantee of continuing strategic pre-eminence and as a hedge against future nuclear arms reductions.

1.221 The purpose of developing a CPGS capability is to attack difficult-to-reach but very high value targets making use of real-time intelligence. The US impetus to develop this capability can be traced back to the 1990s, when new knowledge about the weapon development programs of Iraq suggested that in future there would be a need for time-urgent military strikes that could destroy targets buried deep underground. The demand for effective weapons of this kind would likely increase as the US overseas military footprint shrank and forward basing options were reduced. After 2001, this impetus grew in response to the operational requirements of the so-called global war on terror. By 2010, the mission for advanced conventional weapons evolved further to emphasize specific regional scenarios.

1.222 Conventional strike weapons are increasingly seen as a component of extended deterrence, in conditions where adversaries might seek nuclear capabilities to dissuade the United States from coming to the aid of allies in Asia, Europe or the Middle East. While the United States appears to be alone in investigating these systems for CPGS missions, both Russia and China are actively developing very fast cruise missiles and armed unmanned aerial vehicles (UAVs or drones). It seems unlikely that either country would be ahead of the United States in solving the engineering problems with hypersonic cruise missiles, but the fastest cruise missiles that currently exist are Russian.[281] China and Russia both see very fast cruise missiles as a means of putting at risk the most

279. Reuters, "Putin Links Nuclear Cuts to U.S. Shield," *Moscow Times*, 27 August 2012.
280. "Strong Russian Nuclear Force Deters Conflict, Putin Says," *Global Security Newswire*, 27 February 2012.
281. Mark Gubrud, 'The argument for a hypersonic missile testing ban," *Bulletin of the Atomic Scientists*, 2 September 2014.

valuable, and the most heavily defended, US Navy ships that provide the United States with a significant instrument for power projection – not least in the Asia Pacific region. Moreover, the technologies needed for advanced, armed UAVs[282] are all areas where China and Russia are making significant investments.

1.223 Two issues are especially contentious about advanced conventional weapon systems. The first is the potential destabilizing effect that could be caused by the use of conventional arms that have technical profiles similar to nuclear weapons – a problem known as "warhead ambiguity."[283] Warhead ambiguity is greatest where modified long-range ballistic missiles that were developed as nuclear weapon delivery systems are armed with conventional warheads. This problem would be reduced if ballistic missiles were not the chosen long-range strike systems because of the different technical characteristics of alternative systems. However, the ambiguity issue might still remain,[284] and Russia, in particular, has expressed concern over this risk.

1.224 The second area of contention involves the risk that advanced conventional arms could be used to degrade the nuclear forces of an adversary without crossing the threshold of nuclear use, opening the way for blackmail or a subsequent nuclear attack against residual, but much weaker, nuclear forces. However, the numbers of such systems that would be required to achieve this effect far exceed anything contemplated in current US thinking. Despite this, Russia remains concerned that advanced conventional arms could be used in a disarming first strike and fears its own nuclear deterrent will lose credibility as nuclear weapons holdings are reduced further. Russia has also raised the issue of whether advanced conventional weapons could confuse implementation of New START. Existing ballistic missiles converted for this mission count against New START ceilings, but a hypersonic weapon with a conventional warhead (or a kinetic kill vehicle with no warhead at all) has no nuclear mission and would clearly fall outside New START.

1.225 The United States has supported the idea of dialogue to provide sufficient predictability and transparency in the development of armed forces to avoid any risk of a "strategic surprise." However, it has not expressed any interest in negotiating formal rules governing conventional arms of the kind that concern Russia. On the contrary, the United States has made it clear to Russia at the highest levels that it will not accept constraints that limit the research, development, testing, and evaluation of strategic concepts that incorporate advanced conventional arms, or constraints on research into the systems themselves.

1.226 The increasingly complex and ambiguous relationship between conventional and strategic nuclear forces has implications for other strategic dyad relationships. China, which has relatively small nuclear forces is also concerned that its nuclear deterrent is vulnerable to US CPGS plans. Chinese analysts argue that CPGS is part of a broader US strategy to achieve absolute security, "with BMD as the shield and CPGS as the sword,

282. These include a very efficient propulsion system, aerodynamic design, intelligent fire control mechanism, advanced flight controls; and security against an attack on the information and communications package on which the UAV depends.

283. James Acton, *Silver Bullet: Asking the Right Questions About Conventional Prompt Global Strike* (Washington DC: Carnegie Endowment for International Peace, 2013).

284. See Amy Woolf, *Conventional Prompt Global Strike and Long-Range Ballistic Missiles: Background and Issues*, Congressional Research Service, 26 August 2014.

such that Washington is able to act pre-emptively."[285] They see this as a threat to Beijing's conventional and nuclear weapons systems, as well as its command-and-control centres. In response, China is seeking similar systems. Chinese scientific journals reveal that technical and military institutes in China are conducting research into countering and developing hypersonic, precision-guidance, and boost-glide technologies. The nature and extent of much of this work is unclear, but in August 2014, Pentagon officials claimed that a second test of a new hypersonic glide vehicle, known as Wu-14, had taken place at a missile facility in western China (the first apparently took place at the same site in January 2014).[286] Both tests failed, as have US tests of boost-glide technology, which is as yet unproven.[287]

1.227 The discussion of how to define strategic conventional arms, as well as whether and how they might need to be regulated, has become a live issue. As Russian Deputy Prime Minister Dmitry Rogozin declared in June 2013, "we are experiencing, in fact, a revolution in military affairs," which is adding layers of complexity to international security, putting pressure on nuclear doctrines and arms control regimes, and creating new risks and dangers.[288] Science journals and research institutes around the world are already debating this subject in earnest, including the question of whether it could be possible to negotiate a ban on hypersonic weapons.[289] But as yet (perhaps because so much of the technology is still under development) there is little discussion in the multilateral diplomatic arena. If the issue is not addressed at the highest levels, it will be difficult to halt the decline of trust and confidence between the major powers, and prevent further erosion of nuclear disarmament and non-proliferation momentum.

§1.8 Mobilizing Political Will

1.8.1 Disarmament Education

1.228 The ICNND Report drew attention to the need for "sustained campaigning … to better inform policy-makers and those who influence them about nuclear disarmament and non-proliferation issues" (Recommendation 71) and called for a "major renewed emphasis on formal education and training about nuclear disarmament and related issues in schools and universities" (Recommendation 72).

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285. Lora Saalman, "Prompt Global Strike: China and the Spear," Asia-Pacific Center for Security Studies, 16 April 2014. Saalman cites the following key Chinese texts that use this language (and many others dealing with US CPGS): Zhou Feng, "Xianfa zhiren de yanjin yu juedui anquan de pianzhi" (The Evolution of Preemption and the Paranoia of Absolute Security), *Jiefangjun bao (People's Liberation Army Daily)*, 15 August 2007, p. 5; Wang Zhijun, "Lun meiguo 'juedui anquan' shenxue zhengzhi yu aobama 'wuhe shijie sixiang,'" (On U.S. 'Absolute Security' Political Theology and Obama's 'Nuclear Free World' Thought) *Guoji luntan (International Forum)*, Issue 1, 1 January 2010, pp. 17–18.

286. Bill Gertz, "China secretly conducts second test of new hypersonic missile," *Washington Times*, 20 August 2014; "Missile defense buster: China tests new hypersonic glide vehicle," *RT*, 14 January 2014, http://rt.com/news/supersonic-china-delivery-vehicle-554/.

287. Douglas Barrie, "China's Hypersonic Test – Behind the Headlines," *Military Balance Blog* (IISS), 30 January 2014, http://www.iiss.org/en/militarybalanceblog/blogsections/2014-3bea/january-1138/barrie-china-d0a8.

288. http://www.russiadefence.net/t2669-interview-with-deputy-prime-minister-dmitry-rogozin.

289. See, for example, Gubrud, "The Argument for a Hypersonic Missile Testing Ban"; James Acton, "Why Do We Need 'Hypersonic' Strike Weapons, Exactly?" *DefenceOne*, 17 September 2014, http://www.defenseone.com/ideas/2014/09/why-do-we-need-hypersonic-strike-weapons-exactly/94379/; Benjamin Schreer, "The Strategic Implications of China's Hypersonic Missile Test," *The Strategist*, 28 January 2014, http://www.aspistrategist.org.au/the-strategic-implications-of-chinas-hypersonic-missile-test/.

1.229 The UN General Assembly, by Resolution 57/60 of 30 December 2002, which affirmed a pressing need for disarmament and non-proliferation education and recognized the important role of civil society in promoting such education, welcomed the presentation of a UN study on disarmament and non-proliferation education and conveyed its 34 short and long-term recommendations "for implementation … by Member States, the United Nations and other international organizations, civil society, non-governmental organizations and the media." The Secretary-General was asked to prepare biennial reports on implementation of the recommendations. Six such reports have been published to date, the latest in June 2014.

1.230 The reporting record has been poor. Since the resolution's adoption in 2002, a total of just 47 reports have been submitted to the United Nations. Six reports were submitted in 2010 (A/65/160), the lowest number to date. Ten were submitted in 2012 (A/67/138), and nine in 2014 (A/69/113). Russia is the only NWS to have reported on its implementation of the UN study. Several states and groups addressed the issue of disarmament and non-proliferation education in working papers and reports to the Preparatory Committee for the 2015 NPT Review Conference.[290]

1.231 A robust, urgent, credible and sustained global commitment to public education with a view to building broad popular support for nuclear disarmament is badly needed and, in this context, Global Zero's efforts to build an international movement for nuclear disarmament among students in multiple countries is particularly to be welcomed.

1.8.2 Civil Society Action

1.232 While only governments and intergovernmental organizations can set authoritative standards, establish duly recognized international norms and negotiate treaties, civil society organizations have a crucial role to play in promoting global norms, monitoring state compliance with agreed commitments, and in reflecting community values and concerns that may not always find appropriate expression in governmental processes. Their critiques and policy prescriptions can have demonstrable consequences in the governmental and intergovernmental allocation of resources and in the exercise of political, military and economic power.

1.233 In the nuclear field, International Physicians for the Prevention of Nuclear War (IPPNW) and the Pugwash Conferences on Science and World Affairs have been awarded the Nobel Peace Prize. Several regional nuclear-weapon-free zones have their origins in NGO advocacy and grassroots campaigns; and NGOs have formed coalitions to draft a universal nuclear weapons convention that would prohibit nuclear weapons and to promote a range of nuclear arms control and disarmament measures, including the de-alerting of "launch on warning" ICBMs. Global Zero is currently seeking support for its own step-by-step plan to completely eliminate nuclear weapons by 2030; highly regarded think tanks and study centres such as the Carnegie Endowment for International Peace, the Monterey Institute's James Martin Center for Nonproliferation Studies and

290. *2014 Monitoring Report*, pp. 85-86; "Disarmament and non-proliferation education," Report of the UN Secretary-General, 30 June 2014, http://www.un.org/ga/search/view_doc.asp?symbol=A/69/113.

the Nautilus Institute contribute significantly to our understanding of the challenges facing us in the nuclear non-proliferation and disarmament field; while the *Bulletin of the Atomic Scientists*, and the famous Doomsday Clock (whose hands remain set – on 31 December 2014 – at five minutes to midnight), provide timely information and analysis of threats to our survival and development from nuclear weapons, climate change and emerging technologies in the life sciences.

1.234 In addition, coalitions such as Parliamentarians for Nuclear Non-Proliferation and Disarmament (PNND), the International Campaign to Abolish Nuclear Weapons (ICAN), the Middle Powers Initiative (MPI) and the Women's International League for Peace and Freedom (WILPF) use their extensive networks to support the elimination of nuclear weapons. Likewise, the Washington-based Nuclear Threat Initiative (NTI) works to reduce the global threat from WMD, including by supporting leadership networks of former senior political, diplomatic and military figures, in Europe (ELN), the Asia Pacific (APLN) and Latin America. The Moscow-based International Luxembourg Forum on Preventing Nuclear Catastrophe is another organization focusing on senior decision-makers. All these groups are engaged in efforts to energize public opinion, and especially high-level policy makers, to take seriously the very real threat posed by nuclear weapons and to do everything possible to achieve a world in which they are contained, diminished and ultimately eliminated.

1.235 Sadly, though, it still has to be said that most of the very good work done to promote nuclear disarmament, by a wide range of highly credible and committed civil society actors, currently has little impact outside specialist disarmament and non-proliferation circles. Nuclear weapons will need to become a mainstream public issue if a nuclear-weapon-free world is to be achieved or even if the ICNND's initial "minimization" target is to be met – without mass public engagement the indefinite retention of nuclear arsenals is likely.[291] In most countries, when asked whether they would prefer to live in a world without nuclear weapons, most people will say yes. But the very real possibility of nuclear weapons use, whether by accident, miscalculation or design, the opportunity costs of nuclear arms, and consideration of how peace and security can be maintained without nuclear weapons are not presently issues which bring large numbers of people together on a regular basis. Consequently, governments are under no real pressure to respond to expressions of popular concern because truly popular concern barely exists. Shaping and delivering nuclear disarmament messages able to convince and mobilize the general public in the nuclear armed states must be a priority, with greater use being made of expertise on how beliefs form and can be changed and on developing effective means to foster civic engagement.

1.236 World Public Opinion.org conducted a survey of public attitudes to nuclear weapons on 9 December 2008.[292] The poll involved more than 19,000 respondents in 21 countries, including all nuclear-armed states except North Korea. Respondents were asked whether they supported the idea of an internationally negotiated ban on nuclear

291. See John Page and Tanya Ogilvie-White, "Living with the Bomb: The Public and Nuclear Weapons" APLN/CNND *Policy Brief* No.13 (Canberra: Centre for Nuclear Non-Proliferation and Disarmament, June 2014).

292. World Public Opinion.org, http://www.worldpublicopinion.org/pipa/articles/international_security_bt/577.php?lb=btis&pnt=577&nid=&id=.

weapons under the terms of which countries with nuclear weapons would be required to dispose of them within a fixed timeframe and no other countries would be permitted to acquire them. The agreement would be subject to verification. According to the survey, the majority of populations favour the complete elimination of nuclear weapons. The elimination of nuclear arsenals was strongly supported in France (86 per cent), China (83 per cent), Great Britain (81 per cent) and the United States (77 per cent). Sixty-nine per cent of Russians, 67 per cent of Israelis, and 62 per cent of Indians also supported such an agreement. Only in Pakistan did less than half the respondents (46 per cent) favour the elimination of nuclear weapons.

1.237 However, responses to specific questions reveal a more complex reality. A 2013 British survey asked whether the United Kingdom should give up nuclear weapons altogether, replace its current sea-based nuclear weapons system with four new submarines, or develop a cheaper system for keeping nuclear weapons. Only 20 per cent considered the United Kingdom should give up nuclear weapons altogether, while 32 per cent supported replacing the current submarines and 34 per cent believed a cheaper system should be sought.[293] Another 2013 poll illustrated the scope of the public attitudes challenge in India, finding that an overwhelming majority of Indians (79 per cent) believe that nuclear weapons are important for achieving their nation's goals.[294] Nevertheless, the 2008 global poll indicates that the potential for strong community support for nuclear disarmament is there: the problem continues to lie in effectively harnessing and mobilizing it.[295]

1.238 This point is reinforced by the results of the Global Attitudes survey, conducted by the Pew Research Center from 17 March to 5 June 2014 and published in October 2014. A total of 48,643 respondents in 44 countries were asked which one of the following five poses the gravest threat to the world: nuclear weapons, inequality, religious-ethnic hatred, environmental pollution, or AIDS and other diseases? Nuclear weapons was chosen as the top threat in 10 of the 44 countries surveyed (including two nuclear-armed states Russia and Pakistan), and as the second gravest threat in another 16 countries (including China). Of the nine Latin American countries surveyed, five (Brazil, Chile, El Salvador, Mexico, Venezuela) reported nuclear weapons as the gravest and another three (Colombia, Nicaragua, Peru) as the second gravest global threat. The regional breakdown of the median responses shows that nuclear weapons were considered to be the top threat to the world by 20 percent of the people in the Middle East, 19 per cent in Europe, 21 per cent in Asia, 26 per cent in Latin America, 22 per cent in Africa, and 23 per cent in the United States.[296] Puzzlingly, this breadth of evident public concern finds little expression in journalistic commentary or government policies.

293. http://yougov.co.uk/news/2013/07/15/trident-keep-scrap-or-downgrade/.

294. http://www.lowyinstitute.org/publications/india-poll-2013.

295. See "Publics Around the World Favor International Agreement to Eliminate All Nuclear Weapons," 9 December 2008, http://www.worldpublicopinion.org/pipa/articles/international_security_bt/577.php.

296. Pew Research Global Attitudes Project, "Middle Easterners See Religious and Ethnic Hatred as Top Global Threat," 16 October 2014, http://www.pewglobal.org/2014/10/16/middle-easterners-see-religious-and-ethnic-hatred-as-top-global-threat/.

1.8.3 Nuclear Weapons Convention

1.239 A model Nuclear Weapons Convention (NWC) was prepared in 1997 in response to the ICJ Advisory Opinion on the legality of nuclear weapons and updated in 2007. It brought together an impressive international consortium of lawyers, doctors and scientists and attracted the interest, involvement and support of many civil society arms control groups. It continues to enjoy the support of many NGOs, non-NWS and the United Nations General Assembly. In this model, a fifteen-year timetable for the elimination of nuclear weapons by NWS ("nuclear-capable states" outside the NPT would be given only five years to reach the same objective) includes de-alerting, removal from deployment, dismantlement, and placement of all fissile material under international control. The model NWC's UN sponsors have described the draft convention as "a useful tool in the exploration, development, negotiation and achievement of such an instrument or instruments."[297]

1.240 Some such convention will undoubtedly be necessary in the long run to embed the complete elimination of nuclear weapons in a universal treaty. The ICNND Report, while sceptical that the model convention at its present stage of evolution could, in an area as complex as this, be an effective "campaign treaty" on the model of the Ottawa and Oslo Conventions discussed below, recommended further work on "refining and developing the concepts in the model Nuclear Weapons Convention now in circulation … with the objective of having a fully-worked through draft available to inform and guide multilateral disarmament negotiations as they gain momentum" (Recommendation 73). There are many technical, legal and political hurdles to be overcome and details to be clarified before any NWC can be finalized. But the very act of beginning a deliberate and sustained conversation on the topic would compel states to take the prospect of an NWC seriously and to begin to address particularly the "hard basket" issues of verification, compliance and enforcement.

1.241 While the ICNND report saw formal negotiations now as premature, and the NPT Review Conference simply noted the UN Secretary-General's Five-Point Proposal for Nuclear Disarmament, an annual resolution calling for the negotiation of a convention prohibiting the use of nuclear weapons "as an important step in a phased programme towards the complete elimination of those weapons within a specified timeframe" is supported by some two-thirds of the UN membership.[298]

1.242 UN Secretary-General Ban Ki-moon, in a landmark speech in October 2008 that still serves as a rallying call for nuclear arms control and disarmament advocates, urged all NPT parties, in particular the NWS, to fulfil their treaty obligations through negotiations leading to nuclear disarmament. In the first step of his five point-plan, he suggested that they could do this either by negotiating a "nuclear-weapons convention, backed by a strong system of verification" or, only marginally less ambitiously, "by agreement on a framework of separate, mutually reinforcing instruments."[299]

297. ICNND, *Eliminating Nuclear Threats*, p. 225, paragraph 20.40.

298. "General Assembly, in Wake of High-Stakes Debate in First Committee that Championed Common Positions but Fell Short of Bridging Divides, Adopts 58 Texts," http://www.un.org/press/en/2012/ga11321.doc.htm.

299. UN Secretary-General Ban Ki-moon's Five-Point Proposal for Nuclear Disarmament is contained in the text of an address ("The United Nations and Security in a Nuclear-Weapon-Free World") to the East–West Institute in New York on 24 October 2008, www.un.org/News/Press/docs/2008/sgsm11881.doc.htm. The other four points in the plan focused on P5 initiatives; renewed efforts at treaty ratification; greater transparency and accountability; and new measures against WMD terrorism.

The elements of such a framework are clearly visible today. They include a CTBT in force; an FMCT negotiated, adopted and in force; legally binding NSAs; reciprocal no-first-use declarations; ratification by all nuclear-armed states of the NWFZ treaty protocols; and the commencement of transparent, progressive and irreversible multilateral nuclear disarmament negotiations.

1.243 The aspiration for a comprehensive NWC, embodying a workable verification and enforcement system, must not be abandoned: it is the indispensable international legal framework for achieving ultimate abolition. The question, however, remains whether it would be productive to seek the commencement of negotiations on it now, with those fundamental verification and enforcement issues unresolved and multiple geopolitical issues inhibiting any likely agreement to the process by the present nuclear-armed states.

1.244 The international community has so far banned two entire classes of weapons of mass destruction – biological and chemical weapons. It has also negotiated treaties prohibiting some categories of particularly indiscriminate and inhumane conventional weapons – mines and cluster munitions. By no means every country has signed these conventions: the biggest users and producers of cluster munitions, and those with the largest anti-personnel-mine stockpiles, are not parties to the Cluster Munitions (Oslo) or Mine Ban (Ottawa) Conventions. But the conventions nonetheless exercise strong normative force and quite directly influence the behaviour of non-states parties. The CTBT provides a very clear example of this for, although its peculiar requirement for universal ratification by Annex 2 states prior to entry-into-force could leave the treaty in a perpetual limbo, the current voluntary moratorium on nuclear testing (with the sole exception of North Korea) which stands as a place-holder for the treaty has enormous practical effect and makes any return to nuclear testing by states not party to the treaty a fraught and challenging calculation indeed.

1.245 An NWC negotiated in the absence of all the nuclear-armed states would, however, be in a class of its own. These states are firmly of the view that it is far too early to be thinking seriously about an NWC and that, without them, such a convention would be meaningless. This may not in fact be completely the case. Four answers suggest themselves as to the purposes such an instrument could serve:

- It would compel consideration of the full range of technical, legal and political obstacles to the negotiation and signing of the convention, including the physical infrastructure and the multilateral agreements and protocols required for verification and enforcement;
- It would demonstrate that a continuing determination on the part of the NWS to interpret Article VI as no more than aspirational and tied to at best remote general disarmament objectives was not without serious reputational cost;
- It would have a non-proliferation benefit by supporting that increasingly beleaguered leg of the NPT, although non-NWS with nuclear weapons ambitions would almost certainly not ratify it; and, perhaps most importantly
- The negotiations themselves could provoke some new thinking among all the nuclear-armed states, and possibly help stimulate serious multilateral disarmament talks among them as a step up from the first tentative confidence-building exchanges

of recent years. They should also help strengthen public engagement and support for nuclear disarmament.

1.246 To achieve even these modest goals, however, an NWC negotiation would have to attract a significant and broadly representative level of participation by non-nuclear-armed states. Negotiation outcomes would, likewise, have to express a very broad non-nuclear-armed states consensus. The road to nuclear disarmament will always be long and obstacle-strewn, but the survival of this planet demands that we keep on trying to find ways to travel it.

1.247 Legal instruments addressing particular aspects of nuclear disarmament could help prepare the ground for an eventual comprehensive nuclear weapons convention negotiation or form part of a package of treaty commitments for the elimination of nuclear weapons. Possible variations on the NWC theme include the following:

> A comprehensive **Nuclear Weapons Convention (NWC).** A comprehensive NWC, presumably superseding the NPT, would include general prohibitions on development, testing, production, stockpiling, transfer, use and threat of use of nuclear weapons; a time-specific requirement for the elimination of existing weapons; provisions for bringing fissile material in nuclear-armed states under irreversible international control; and verification and enforcement provisions. Even though the NWS currently have no appetite for negotiation of such a convention, work should proceed on elaborating and refining its possible provisions, supported by interested governments. The model NWC referred to above (1.239) could be a point of departure for such work.

> A **No First Use (NFU) Convention.** While not of itself a nuclear disarmament measure, such a convention would build confidence and thereby be a step towards nuclear disarmament. The main provision would be a commitment by nuclear-armed states that they would never be the first to use nuclear weapons. A practical difficulty would be to identify an effective enforcement mechanism. As noted above, only China and India have voiced support for such a convention and the current geopolitical environment is an obstacle. However, with improved international circumstances and doctrinal evolution by at least some of the NWS, an NFU convention may become achievable.

> A **Use-Ban Convention.** A convention that banned the use of nuclear weapons without addressing their possession would codify the existing norm against the use of nuclear weapons. Its central provision would prohibit the use or threat of use of nuclear weapons by any state against any other state. As with an NFU convention, a use-ban convention would not of itself be a nuclear disarmament measure but would contribute to an environment conducive to achieving that goal. Proponents argue that a use-ban convention could gain the support of some nuclear-armed states and also allies that shelter under nuclear umbrellas, as they would be more willing to accept an arrangement that does not eliminate nuclear weapons altogether.[300] However, to date, this proposal has not gained traction among any such states,

300. Alyn Ware, "From nuclear taboo to a prohibition (ban) on use: The next step to a nuclear-weapon-free world?" Basel Peace Office, http://www.baselpeaceoffice.org.

because they are not willing to agree that nuclear weapons should not be used *under any circumstances* – they still regard the threat of nuclear retaliation as a way to deter a nuclear first strike. This explains their lack of support for the statement delivered by New Zealand to the 2013 First Committee of the UN General Assembly, noted below, and their early reservations over the humanitarian consequences initiative, which initially emphasized the need for negotiations to begin on an NWC.

> A **Possession-Ban Treaty.** This would create a prohibition on the possession of nuclear weapons, but not include all the legal and technical arrangements needed for the establishment and maintenance of a nuclear-weapon-free world, of the kind inherent in a comprehensive NWC. Proponents argue that this arrangement could be fast-tracked among willing non-NWS, without the need for NWS support, and would help kick-start stalled disarmament momentum. However, there are significant drawbacks to this approach: while possession-ban (like use-ban) treaty discussions may have the potential to broaden and deepen disarmament debates among advocacy states[301] and civil society groups, they will have limited practical effect unless they can attract the backing of one or more of the NWS. Also, as in the case of an NWC (and as pointed out by the NWS), it is not clear how a possession-ban treaty would operate alongside the NPT, particularly if both arrangements attract different levels of adherence.

1.8.4 The Humanitarian Dimension

1.248 The most productive way forward for both committed state and civil society actors to generate political momentum for the nuclear disarmament cause would appear to be to emphasize the catastrophic humanitarian consequences of any use of nuclear weapons. The almost indescribable horror associated with any such use informed the very first resolution of the UN General Assembly in 1946, and has been a recurring campaign theme ever since. It was the primary motivation for the challenge to the legality of nuclear weapons mounted in the International Court of Justice by the UN General Assembly on the initiative of the World Health Organization which resulted in the 1996 advisory opinion concluding that their use was indefensible except, possibly, in self-defence when a state's very survival was at stake. And this was in turn the major motivation for those who prepared the 1997 model nuclear weapons convention, as noted above. But it is only recently that the humanitarian dimension has resumed any prominence in high-level state discourse.

1.249 The ICNND in 2009 made the point that there was much to be said for focusing on nuclear disarmament not through the lens 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

301. The New Agenda Coalition (NAC) is a group of states that advocate nuclear disarmament. They have drafted a working paper that sets out a number of legal options for the achievement and maintenance of a nuclear weapon free world. See "Article VI of the Treaty on the Non-Proliferation of Nuclear Weapons" submitted by the New Agenda Coalition to the third session of the Preparatory Committee for the 2015 NPT Review Conference, NPT/CONF.2015/PC.III/WP.18.

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."[302]

1.250 This theme was picked up by the 2010 NPT Review Conference in its Final Document, which expressed "deep concern at the catastrophic humanitarian consequences of any use of nuclear weapons, and reaffirm[ed] the need for all states at all times to comply with applicable international law, including international humanitarian law."[303] At the 2012 NPT PrepCom, sixteen countries issued a "Joint Statement on the humanitarian dimension of nuclear disarmament," read by Ambassador Benno Laggner of Switzerland, arguing that "it is essential that the humanitarian consequences of nuclear weapons are thoroughly addressed."[304] The chairman of the PrepCom summarized the debates on this issue as:

> States Parties recalled their deep concern at the catastrophic humanitarian consequences of any use of nuclear weapons. Many States Parties stressed their serious concern that in such an event, these humanitarian consequences would be unavoidable and emergency relief could not be provided to affected areas. They expressed their expectation that the humanitarian consequences of any use of nuclear weapons would be addressed during the current review cycle.[305]

1.251 The momentum was sustained in the First (Disarmament) Committee of the UN General Assembly when, on 22 October 2012, Ambassador Laggner read out the same joint statement, this time on behalf of 34 countries. It stated that "the unique destructive capacity and uncontrollable effects" of nuclear weapons mean that all the international humanitarian law rules of distinction between combatants and civilians, proportionality and precaution "apply fully" to nuclear weapons. So too do the prohibitions against causing unnecessary suffering or superfluous injury and severe and long-term damage to the environment. As long as nuclear weapons exist, they will pose a threat to the very survival of humanity. Their "catastrophic humanitarian consequences … concern the community of states as a whole." Under no circumstances must they ever be used again. "The only way to guarantee this is the total, irreversible and verifiable elimination of nuclear weapons, under effective international control."[306]

1.252 The humanitarian consequences movement has continued to gather pace. In March 2013 Norway hosted a Conference on the Humanitarian Impact of Nuclear Weapons attended by representatives from 127 countries as well as several UN organizations, the Red Cross and civil society.[307] A second Conference on the Humanitarian Impact of Nuclear Weapons hosted by Mexico on 13–14 February 2014 attracted the participation of 146 states, the United Nations, the International Committee of the Red

302. ICNND, *Eliminating Nuclear Threats*, pp. 218–19, paragraph 20.18.

303. 2010 NPT Review Conference, *Conclusions and recommendations for follow-on actions* I (Nuclear Disarmament) A (Principles and Objectives) v.

304. "Joint Statement on the humanitarian dimension of nuclear disarmament," New York, 22 October 2012, http://www.psr.org/resources/joint-statement-on-the.html.

305. "Chairman's factual summary," (Working paper), paragraph 9; Preparatory Committee for the 2015 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Vienna, 30 April–11 May 2012, NPT/CONF.2015/PC.I/WP.53; http://www.un.org/disarmament/WMD/Nuclear/NPT2015/PrepCom2012/documents.html.

306. "Joint Statement on the humanitarian dimension of nuclear disarmament."

307. http://www.regjeringen.no/en/dep/ud/selected-topics/humanitarian-efforts/humimpact_2013.html?id=708603.

Cross, the Red Cross and Red Crescent movement and civil society organizations. Building on the Oslo conference, the second conference addressed the consequences of any nuclear detonation in areas such as public health, humanitarian assistance, the economy, development and environmental issues, climate change, food security and risk management.[308] A third conference, held in Vienna, Austria on 8–9 December 2014, was attended by 158 states, including four nuclear-armed states (India, Pakistan, the United Kingdom and the United States).[309] The Austrian Pledge commits Austria to work with like-minded states to "fill the legal gap for the prohibition and elimination of nuclear weapons."[310]

1.253 A statement to the 2013 First Committee of the UN General Assembly, delivered by New Zealand on behalf of 125 countries, reaffirmed that "It is in the interest of the very survival of humanity that nuclear weapons are never used again, under any circumstances" and that "The only way to guarantee that nuclear weapons will never be used again is through their total elimination."[311] At the same meeting a parallel statement delivered by Australia on behalf of 17 countries welcomed the statement delivered by New Zealand and voiced concern at the "devastating immediate and long-term humanitarian impacts of a nuclear weapon detonation."[312] A year later, on 20 October 2014, although the Australian-led group still held out,[313] support for the New Zealand-led humanitarian consequences statement had swelled to 155 UN Member States, recalling the gradual but steady increase in support for an equivalent resolution calling for a CTBT that did finally bear fruit in 1996.

308. http://www.sre.gob.mx/en/index.php/humanimpact-nayarit-2014.

309. The Vienna conference Chair's Summary can be found at: http://www.bmeia.gv.at/fileadmin/user_upload/Zentrale/Aussenpolitik/Abruestung/HINW14/HINW14_Chair_s_Summary.pdf.

310. Available at: http://www.bmeia.gv.at/fileadmin/user_upload/Zentrale/Aussenpolitik/Abruestung/HINW14/HINW14_Austrian_Pledge.pdf.

311. Joint Statement on the Humanitarian Consequences of Nuclear Weapons, 21 October 2013, http://www.un.org/disarmament/special/meetings/firstcommittee/68/pdfs/TD_21-Oct_CL-1_New_Zealand-(Joint_St).

312. Joint Statement on the humanitarian consequences of nuclear weapons, 21 October 2013, http://unrcpd.org/wp-content/uploads/2013/10/ND21_Oct_joint-statement.pdf.

313. Australia was apparently troubled by the retention in the New Zealand text of the phrase "under any circumstances" qualifying the statement "It is in the interest of the very survival of humanity that nuclear weapons are never used again."

2. NUCLEAR NON-PROLIFERATION

§2.1 Overview
§2.2 Objectives and General Strategy
§2.3 NPT Safeguards and Verification
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§2.1 Overview

2.1 The Nuclear Non-Proliferation Treaty (NPT) rests on a straightforward understanding: countries without nuclear weapons will not seek to acquire them, while those with nuclear weapons move progressively towards complete nuclear disarmament, and all parties are to cooperate in the development of peaceful applications of nuclear energy. A troubling imbalance of obligations has, however, become steadily more obvious over the years. While the non-proliferation obligation is legally binding, subject to compulsory International Atomic Energy Agency (IAEA) verification and backed up by the United Nations Security Council, the commitment to disarm is – according to the nuclear weapon states (NWS) – conditional, and not subject to international verification, enforcement or deadlines. While the non-proliferation regime has been strengthened over the life of the NPT (albeit not to the extent necessary), the disarmament effort has been deeply disappointing.

2.2 The NWS place greater emphasis and a higher value on the prevention of nuclear proliferation than they do on nuclear disarmament. Disarmament is seen as their business, to be conducted on their terms and in their own time. Non-proliferation, on the other hand, is truly a shared global responsibility. This attitude is putting the nuclear non-proliferation regime under increasing strain and reinforcing resistance to predominantly Western efforts to strengthen nuclear non-proliferation. While the NPT's record of containing proliferation has been very good thus far, UN Secretary-General Kofi Annan's High-level Panel on Threats, Challenges and Change rightly warned in December 2004 that "[w]e are approaching a point at which the erosion of the non-proliferation regime could become irreversible and result in a cascade of proliferation."

2.3 The 2010 NPT Review Conference reaffirmed calls by previous review conferences for universal adherence to the treaty; for the signing and bringing into force, by states which have yet to do so, of Comprehensive Safeguards Agreements (CSAs) and Additional Protocols (APs); for regular assessment and evaluation of IAEA safeguards; and for the application of comprehensive safeguards to all source or special fissionable material in peaceful nuclear activities. While some progress has been made in some of these areas, overall the record of achievement has been manifestly unsatisfactory.

2.4 **Safeguards**. Between 1 July 2010 and 20 November 2014, CSAs entered into force for seven states and APs for 23 but, as at 20 November 2014, twelve non-NWS parties to the NPT had still to bring CSAs into force and five with significant nuclear activities had yet to begin AP negotiations with the IAEA. While many countries, particularly members of the Nuclear Suppliers Group (NSG), argue that the AP should be recognized and accepted universally as a condition of nuclear supply, others, particularly within the Non-Aligned Movement (NAM), have stressed the AP's voluntary nature and have resisted efforts to have the AP endorsed as part of the current safeguards standard, not least because they see this as evidence of some states' determination to further entrench the imbalance between non-proliferation and disarmament obligations.

2.5 The IAEA is moving progressively to develop and implement a state-level approach to safeguards. This is an iterative process in which an analysis of all information available to the agency serves as the basis for safeguards planning, implementation and evaluation, and continues the evolution of the safeguards regime from one based almost wholly on nuclear material accounting, to one strongly focused on detection. By facilitating the adoption of "integrated safeguards" in countries which qualify – a sign of the agency's confidence in the absence of undeclared nuclear material and activities in those states – the state-level approach allows the agency to make the most efficient use of its finite resources by making "differentiated assessments about which states' nuclear programs pose more risk." Some states have labelled the approach discriminatory and have called for the focus of the system to return to traditional nuclear material accounting.

> *Overall Evaluation of Safeguards and Verification:* **Some Progress.** Some more CSAs and APs have entered into force but there is still strong resistance by some states to the idea of making the AP part of the current safeguards standard. The IAEA's evolving state-level approach to safeguards has been criticized – albeit not compellingly – as discriminatory by some states who want the emphasis to return from an information-driven and detection-focused approach to traditional nuclear material accounting.

2.6 **Compliance and Enforcement**. The 2010 NPT Review Conference failed, in the face particularly of Iranian and other strong NAM opposition, to make any progress on non-compliance and withdrawal issues. Notwithstanding the adoption of resolutions highly critical of North Korea's nuclear weapons tests in 2006, 2009 and 2013, the UN Security Council has yet to make clear, as the ICNND Report recommended, that any future 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."

2.7 Since an initial IAEA Board of Governors finding of non-compliance in September 2005, Iran has been the subject of six UN Security Council resolutions demanding a halt to its enrichment and reprocessing activities. Regular IAEA reports to its Board of Governors show that Iran has not suspended its uranium enrichment activities; nor has it clarified to the satisfaction of the international community outstanding issues giving rise to concerns about possible military dimensions to its nuclear program. The IAEA has been able to verify the non-diversion of nuclear material declared by Iran under its CSA. It has not, however, been able to provide a credible assurance of the absence of undeclared nuclear material and activities in Iran, and thus to conclude that all nuclear material in Iran is in peaceful activities. An interim deal in November 2013 led to a scale back of some Iranian nuclear activities and material in return for partial sanctions relief but a comprehensive settlement proved elusive by the mutually extended deadline of 24 November 2014. Iran and the five permanent members of the UN Security Council (P5) and Germany (P5+1) have extended the negotiation deadline to 30 June 2015.

> *Overall Evaluation of Compliance and Enforcement:* **No Progress.** The 2010 NPT Review Conference made no progress on non-compliance and withdrawal issues and none has been made since. Efforts by the P5 and Germany to negotiate a resolution of the stand-off with Iran made progress, but not enough to conclude a deal in 2014.

2.8 **IAEA Resources.** The IAEA's regular budget has seen some modest real growth in recent years but this has not been sustained and the budget is still insufficient to allow the agency to fulfil its responsibilities and to meet the expectations of member states. Important programs continue to depend on extra-budgetary contributions. The resources debate is complex and political. The IAEA is under pressure to become more cost-efficient, without letting its attention to safeguards implementation slide. While some states want the agency to pay more attention to nuclear security, others see this as likely further to diminish the resources available for the development of peaceful uses of nuclear energy, particularly in developing countries. They want priority, and more money, to be directed to technical cooperation. The debate is further complicated by concerns expressed by some states that the IAEA's evolving state-level approach to safeguards, which is driven at least partly by budget pressures, is discriminatory, subjective and unreliable.

> *Overall Evaluation of IAEA Resources:* **Some Progress.** The IAEA's regular budget has seen some modest real growth in recent years but this has not been sustained and the budget is still insufficient to allow the agency to fulfil its responsibilities and to meet the expectations of member states.

2.9 **Export Controls.** The 2010 NPT Review Conference urged all states to ensure that nuclear-related exports are not misused to assist in the development of nuclear weapons and encouraged them to draw on multilateral guidelines and understandings in developing national export controls. A growing number of countries, without themselves

being members of an international export control regime, are making use of the guidelines for this purpose. As of May 2014, nearly 90 per cent of UN member states had submitted national reports on measures taken or planned in implementation of UN Security Council counter-terrorism Resolution 1540's provisions. However, because many states have not responded to requests by the 1540 Committee for further reports, it is difficult to measure levels of national implementation.

2.10 Controversy has surrounded the most important nuclear export control mechanism, the NSG, since it decided in 2008 to exempt India from its requirement for application of comprehensive safeguards to trigger list items. This has raised questions of consistent treaty interpretation, of consistent application of NSG guidelines and finally, among states already critical of the NPT's bias towards the nuclear "haves," of the credibility of the whole nuclear non-proliferation enterprise.

2.11 The ICNND Report recommended that the NSG develop "a criteria-based approach to cooperation agreements with states outside the NPT," thereby establishing conditions for further exceptions based on new rules, rather than on an exemption from old ones. It will be hard, though, to persuade Pakistan or Israel to accept terms more rigorous than India's; or India to make additional commitments (for example, to ratify the Comprehensive Nuclear-Test-Ban Treaty (CTBT) and to end unsafeguarded fissile material production) when it already has the deal it wants. The NSG's credibility problems are compounded by China's determination to supply more nuclear reactors to Pakistan. In November 2010, the United States declared its support for Indian membership of the NSG and other international export control regimes. While there is support for India's membership bid within the NSG, there is no consensus.

> *Overall Evaluation of Export Controls:* **Some Progress.** A growing number of countries are making use of multilateral guidelines in developing national export controls. But the Nuclear Suppliers Group's 2008 decision to exempt India from its comprehensive safeguards requirement and China's determination to supply more nuclear reactors to Pakistan have damaged this key mechanism's credibility, and no progress has been made towards adopting a criteria-based approach to cooperation agreements with states outside the NPT.

2.12 **Nuclear-Weapon-Free Zones (NWFZs).** The 2010 NPT Review Conference encouraged the establishment of further NWFZs and the ratification by NWS of the relevant protocols to existing NWFZ treaties. NWFZs have been proposed for North East Asia and the Arctic. Russia ratified Protocols One and Two of the Treaty of Pelindaba in April 2011 and all five NWS signed the one protocol to the Central Asian NWFZ in May 2014. US President Barack Obama has submitted the protocols to the treaties of Rarotonga and Pelindaba to the US Senate for ratification, but there is no indication of when this might be accomplished.

2.13 The 2010 NPT Review Conference reaffirmed the central importance of the 1995 Resolution on the Middle East and called on the UN Secretary-General to convene a

conference in 2012, to be attended by all Middle East states, on the establishment of a Middle East zone free of nuclear weapons and all other weapons of mass destruction (WMD). A conference tentatively scheduled for 17 December 2012 in Helsinki was postponed. There has since been some limited progress on arrangements for the conference, but no agreement on holding it. While it is understood that there are formidable challenges to the creation of a NWFZ in the prevailing security and political environment in the Middle East, failure to convene a conference on the issue will have a negative impact on the NPT review process in 2015.

> *Overall Evaluation of Nuclear-Weapon-Free Zones:* **Minimal Progress.** No new NWFZs have been established. There has been only modest movement on protocol ratifications. The Middle East NWFZ Conference mandated by the NPT Review Conference for 2012 was postponed. There has since been some limited progress on arrangements for the conference, but no agreement on holding it, with negative implications for the 2015 NPT Review Conference.

2.14 **Other Non-Proliferation Mechanisms.** The Proliferation Security Initiative (PSI), established by the United States in 2003 to prevent the shipment of WMD, their delivery systems and associated materials to state and non-state actors of concern, has the support of over 100 countries. The ICNND recommended that it "be reconstituted within the UN system as a neutral organization," but this has not so far been seriously considered.

2.15 The proliferation of nuclear-capable missiles continues to cause concern. In parallel with the steady spread of these technologies and the absence of an international instrument specifically governing the development, production, acquisition, transfer, deployment or use of missiles, the international community has tried to elaborate measures that would increase transparency and constrain the pace of, or roll back, missile proliferation. These efforts have enjoyed some success. Over the past decade, however, many countries have acquired technologies for short- and medium-range ballistic missiles, while India, Iran, Israel, North Korea and Pakistan have been developing long-range ballistic missile capabilities.

> *Overall Evaluation of Other Non-Proliferation Mechanisms:* **Some Progress.** The Proliferation Security Initiative now has the support of over 100 countries and has helped make illicit WMD-related transfers harder. However, despite many attempted constraints, ballistic missile technologies continue to proliferate.

2.16 **Nuclear Testing.** At the 2010 NPT Review Conference, NWS undertook to ratify the CTBT "with all expediency" and not to conduct nuclear-weapon tests in the meantime. Of the five NWS, China and the United States have yet to ratify the CTBT. Of nine Annex 2 states which had not ratified the CTBT in May 2010, only one, Indonesia, has since done so. A substantial number of US Senators remain firmly opposed to US ratification and rejection by the Senate, for a second time, would be a huge setback to prospects for the CTBT's

eventual entry into force. All five NWS maintain a voluntary moratorium on nuclear tests, but at least three (Russia, the United Kingdom and the United States) and possibly China, conduct "subcritical" tests on small amounts of nuclear material at high pressure using conventional explosives without generating a sustained nuclear chain reaction. Of the non-NPT nuclear-armed states all except North Korea have observed the moratorium, North Korea having conducted a further nuclear test in 2013 and threatened more.

> *Overall Evaluation of Nuclear Testing:* **Minimal Progress.** Of nine Annex 2 states which had not ratified the CTBT in May 2010, including the United States, China, India, Pakistan and Israel, only one, Indonesia, has since done so. That said, voluntary moratoriums on nuclear testing remain in place for all nuclear-armed states except North Korea, which conducted a further nuclear test in 2013 and has threatened more.

2.17 **Fissile Material.** At the 2010 NPT Review Conference, all states agreed that the Conference on Disarmament (CD) should "immediately begin negotiation of a treaty banning the production of fissile material for use in nuclear weapons or other nuclear explosive devices" and invited the UN Secretary-General to convene a high-level meeting in September 2010 in support of the work of the CD (Action 15): it met but made minimal progress. The CD has not been able to implement a program of work in any year since the conclusion of CTBT negotiations in 1996. In recent years, Pakistan has consistently blocked the adoption of any program of work in the CD because it will not agree to fissile material cut-off treaty (FMCT) negotiations in the absence of prior agreement to include existing stocks of weapon-grade fissile material, where it believes itself to be at a particular disadvantage to India.

2.18 Of the five NWS, only China has not declared an end to the production of fissile material for weapons purposes. The United States has declared 210 tonnes of highly enriched uranium (HEU) excess to military requirements. HEU taken from dismantled Russian nuclear weapons has been converted to low enriched uranium (LEU) and sold to the United States for use in nuclear power plants under the 1993 US–Russia HEU Purchase Agreement. By the program's end in November 2013, a total of 500 tonnes of weapon-origin HEU had been eliminated, an amount equivalent to some 20,000 nuclear weapons.

2.19 Russia, the United Kingdom and the United States have each declared some plutonium excess to military requirements. A Plutonium Management and Disposition Agreement (PMDA), signed by the United States and Russia in September 2000, and tentatively scheduled to begin in 2018 under IAEA verification, commits each country to dispose of 34 tonnes of excess weapon-grade plutonium by converting it to mixed oxide (MOX) fuel and using it in nuclear power reactors. Neither China nor France has declared any stocks of weapon-grade fissile material in excess of its defence needs.

2.20 Although it has not said so, China is believed no longer to produce either HEU for weapons or weapon-grade plutonium. The current status of facilities previously used for these purposes is, however, unclear. France's military fissile material production facilities

at Marcoule and Pierrelatte are being dismantled. Russia's uranium enrichment plants are all now designated civilian facilities and its last operating plutonium production reactor was shut down in 2010. The UK's only indigenous source of HEU stopped producing HEU in 1962, closed in 1982 and is now being decommissioned. Its closed former plutonium production reactors are the subject of long-term decommissioning plans.

2.21 Most US HEU was produced at two gaseous diffusion plants, both of which stopped producing HEU for weapons in 1964. The demolition of one is progressing and a contract for the decontamination and decommissioning of the second was awarded in 2010. The last of 14 US plutonium production reactors was shut down in 1987. The United States has begun decommissioning five heavy-water plutonium production reactors at Savannah River. Five of the nine reactors at Hanford had been "cocooned" by 2005. Another is currently being cocooned, with two more to follow. The remaining reactor has been turned into a museum.

Overall Evaluation of Fissile Material: **Minimal Progress.** There has been no progress in beginning negotiations on a global ban on the production of fissile material for nuclear weapons purposes, a central non-proliferation and disarmament policy objective. Significant growth in such production is occurring in the non-NPT nuclear-armed states but, as with nuclear weapon stockpiles, their total stock is still hugely below that of the five NPT-recognized NWS. The NWS have not produced new HEU or weapon-grade plutonium for years and the facilities used for these purposes have been either shut down or converted to other uses in at least four of them; the status of facilities in China is unknown. Russia and the United States are reducing excess HEU stocks and have a bilateral surplus plutonium disposition agreement in force.

§2.2 Objectives and General Strategy

2.22 The overriding objective of all non-proliferation efforts is to ensure that no more states seek to acquire or succeed in acquiring nuclear weapons. As distilled from the language of the NPT Treaty and Review Conference outcomes, and reports of international commissions, the strategies in support of this objective may be described as:

- To strengthen NPT and non-NPT mechanisms:
  - safeguards in all their manifestations;
  - compliance and enforcement;
  - the IAEA;
  - export controls; and
  - NWFZs;
- To avoid breakout by existing non-NWS who are members of the NPT, for example Iran;

- To identify creative and innovative mechanisms and formulas by means of which the non-NPT nuclear-armed states (India, Israel and Pakistan) can be signed up to NPT-equivalent global disciplines;
- To ensure the entry into force of the CTBT; and
- To conclude an FMCT.

2.23 **NPT Treaty and Review Conference Outcomes.** States' nuclear non-proliferation obligations are set out in Articles I–III of the NPT. Under Article I, NWS states parties undertake not to transfer nuclear weapons or other nuclear explosive devices, and not to help or encourage any non-NWS to manufacture or otherwise acquire such weapons. Article II requires non-NWS not to receive, manufacture or otherwise seek to acquire nuclear weapons or other nuclear explosive devices.

2.24 Under Article III.1, non-NWS agree to accept IAEA safeguards as a means of verifying the fulfilment of their treaty obligations; while Article III.2 obliges each state party to the treaty not to provide source or special fissionable material, or "equipment or material especially designed or prepared for the processing, use or production of special fissionable material," to any non-NWS unless the source or special fissionable material is "subject to the safeguards required by this Article."

2.25 Like the disarmament undertaking in Article VI, these obligations have been shaped over the years by a succession of treaty review conferences. The Principles and Objectives for Nuclear Non-proliferation and Disarmament adopted at the 1995 NPT Review and Extension Conference have a special significance in this regard. They affirm the importance of:

- Universal adherence to the treaty;
- The IAEA's role as the competent authority responsible for verifying compliance with safeguards agreements reached in line with states' obligations under Article III.1, and for the investigation and reporting of apparent or possible non-compliance with those obligations;
- States parties which have not yet done so signing and bringing into force the CSAs required by Article III;
- A regular review of IAEA safeguards, the steady strengthening of their effectiveness, and of the agency's ability to detect undeclared nuclear activities;
- States not party to the NPT entering into CSAs with the IAEA;
- As a condition of new nuclear supply arrangements, acceptance of IAEA comprehensive safeguards[1] and internationally legally binding commitments not to acquire nuclear weapons or other nuclear explosive devices;
- Placing under agency safeguards fissile material transferred from military to peaceful use;

1. The purpose of "comprehensive safeguards" (sometimes also referred to as "full scope" safeguards) is to verify that nuclear material is not diverted from civilian uses to nuclear weapons or other nuclear explosive devices, the basic safeguards measure being nuclear material accountancy, carried out through on-site inspections, supported by containment and surveillance measures (e.g. seals and cameras). They are "comprehensive" in the sense of being required to be accepted on all a state's current and future nuclear activities.

- The maintenance of high standards of safety, accounting, physical protection and transport of nuclear materials; and
- Ensuring that the IAEA has the financial and human resources it needs to discharge its responsibilities effectively.[2]

2.26 These principles and objectives have been largely reaffirmed at subsequent NPT review conferences. As discussed further below, they have since been augmented by the emergence of the IAEA Model Additional Protocol, but diminished by the erosion of the comprehensive safeguards provision as a condition of nuclear supply.

2.27 There has been a growing convergence of non-proliferation and nuclear security goals over the past decade, with nuclear security issues assuming progressively greater prominence in the post-9/11 environment. Consistent with this trend, close to a third of the actions included under the nuclear non-proliferation heading in the final document of the 2010 NPT Review Conference were nuclear security items (discussed separately in the next chapter). Among other things, the conference encouraged states "to maintain the highest possible standards of security and physical protection of nuclear materials and facilities" (Action 40); called on states parties to the Convention on the Physical Protection of Nuclear Material (CPPNM) to ratify the amendment to the Convention as soon as possible (Action 42);[3] called on states parties "to improve their national capabilities to detect, deter and disrupt illicit trafficking in nuclear materials" (Action 44); and encouraged states parties that have not yet done so to become party to the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT) (Action 45).

2.28 **International Commissions.** The report of the UN Secretary-General's 2004 High-level Panel on Threats, Challenges and Change identified two key threats to the nuclear non-proliferation regime. The first has states parties to the NPT taking advantage of the treaty to develop either full-scale or threshold nuclear weapons capabilities, with a view to withdrawing from the treaty when caught and censured, or at the point of weaponization.[4] North Korea, which confirmed its withdrawal from the NPT in 2003 and tested nuclear weapons in 2006, 2009 and 2013 provides a ready example of this kind, and there is some concern that Iran could provide another.

2.29 The second and closely related threat to the nuclear non-proliferation regime stems from concerns about its possible collapse in the face of an erosion of confidence in and respect for the NPT's legal and normative constraints, which could lead to the sort of proliferation cascade – made so much easier now by the ever growing diffusion of sophisticated nuclear and dual-use technology – that the United States and others were predicting in the 1960s prior to the negotiation and adoption of the NPT.[5]

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2. NPT/CONF.1995/32 (Part I), Annex: Decision 2: Principles and Objectives for Nuclear Non-Proliferation and Disarmament.
3. The CPPNM applies to the international transport of nuclear material in peaceful uses. The amendment to the convention expands the scope of the CPPNM to cover, *inter alia*, the physical protection of nuclear material in domestic use, storage and transport, and the protection of nuclear materials and facilities against sabotage.
4. *A more secure world: our shared responsibility.* Report of the High-level Panel on Threats, Challenges and Change (New York: United Nations, document A/59/565, 2 December 2004), p. 38, paragraph 108.
5. *A more secure world*, pp. 38–39, paragraphs 109–11.

2.30 The various international commissions on nuclear non-proliferation and disarmament (including the Canberra (1996) and Blix (2006) Commissions, the Tokyo Forum (1999), ICNND (2009), and the more broadly mandated High-level Panel on Threats, Challenges and Change (2004)) have largely agreed on the steps needed to promote effective nuclear disarmament, prevent the spread of nuclear weapons and strengthen global non-proliferation norms. Prominent among their common themes are calls for:

- A strong IAEA, with the authority and resources necessary to carry out its mandate fully and effectively;
- Stronger safeguards, including, and with progressively more vigour since the Model Additional Protocol's emergence in 1997, global endorsement both of CSAs and APs, signed and in force, as the new international safeguards standard;
- Multilateralization of the nuclear fuel cycle (international fuel banks, enrichment, reprocessing and spent fuel storage facilities) as a means of diminishing the risk of proliferation by reducing incentives to establish national fuel cycle facilities;
- The phasing out of HEU in civil research programs (and of separated plutonium in energy programs) as alternatives become available; and
- A determination, underwritten by the UN Security Council, to hold states withdrawing from the NPT responsible for violations committed while party to the treaty.

2.31 The ICNND Report, published in the lead-up to the May 2010 NPT Review Conference, recommended that nuclear non-proliferation efforts focus on both demand and supply, by "persuading states that nuclear weapons will not advance their national security or other interests" and by making it "as difficult as possible for states to buy or build such weapons" (Recommendation 4). It proposed a group of four safeguards and enforcement priorities (Recommendation 41) for the conference to consider:

- A recommendation that all states should accept the application of the AP and that, to encourage its universal take-up, acceptance should be made a condition of all states' nuclear exports;
- A declaration 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;
- A recommendation that the Security Council make clear that withdrawal from the NPT will be regarded prima facie as a threat to international peace and security; and
- A recommendation to states that they make it a condition of nuclear exports that safeguards agreements continue to apply after any such withdrawal.[6]

2.32 With the partial exception of the first proposal (Action 28 "encourages all states parties … to conclude and to bring into force additional protocols," while Action 30 endorses universal application of comprehensive safeguards and additional protocols in a nuclear-free world), none of these found its way into the NPT Review Conference

6. International Commission on Nuclear Non-proliferation and Disarmament (ICNND) (Gareth Evans and Yoriko Kawaguchi co-chairs), *Eliminating Nuclear Threats: A Practical Agenda for Global Policymakers* (Canberra and Tokyo: ICNND, 2009), pp. 257–58.

outcomes document. The reasons for this entrenched resistance to the AP, together with a CSA, being endorsed as the current safeguards standard, and opposition from hard-line members of the NAM group to progress of any kind on non-compliance and withdrawal issues, are discussed below.

2.33 Recognizing that the three nuclear-armed states now outside the NPT – India, Pakistan and Israel – were not likely to join it "any time soon," the ICNND report recommended that they be encouraged to participate "in parallel instruments and arrangements which apply equivalent non-proliferation and disarmament obligations" (Recommendation 17) and that, "provided they satisfy strong objective criteria demonstrating commitment to disarmament and non-proliferation, and sign up to specific future commitments in this respect," they should have NPT-equivalent access to nuclear materials and technology for peaceful purposes (Recommendation 18).

2.34 It has not proven easy to find some means of accommodating, in multilateral non-proliferation and disarmament processes, nuclear-armed IAEA member states excluded from joining the NPT as NWS by the treaty's own definition (a country that manufactured and exploded a nuclear device before 1 January 1967), and unlikely to accede to the treaty as non-NWS. To the extent that effort is currently essentially India-driven (involving a coincidence of US commercial and strategic objectives with India's desire for formal admission to the nuclear club), questions have been raised of consistent treaty interpretation, of consistent interpretation and application particularly of NSG guidelines, and finally, among states already critical of the NPT's bias towards the nuclear "haves," of credibility for the whole nuclear non-proliferation enterprise. Moreover, renewed nuclear cooperation with India has thus far failed to deliver substantial non-proliferation and disarmament dividends such as an Indian moratorium on the production of fissile material for nuclear weapons and its signature of the CTBT.

2.35 The ICNND Report, conscious of these concerns, recommended that the NSG adopt "a criteria-based approach to cooperation agreements with states outside the NPT" (Recommendation 15) that would establish conditions for further exceptions based on new rules, rather than on an exemption from old ones, but this approach has yet to be embraced. Engagement with India, Pakistan and Israel should be on a reciprocal basis, with these states accepting key NPT-equivalent non-proliferation and disarmament obligations in return for civil nuclear cooperation. To give effect to such arrangements it would be necessary to develop new international instruments, as non-NPT nuclear armed states are by definition unable to join the NPT.[7] NSG related issues are discussed further later in this chapter.

7. See John Carlson, "Challenges and Opportunities for Extending NPT-Related Commitments to the Non-NPT States," APLN/CNND *Policy Brief* No. 15 (Canberra: Centre for Nuclear Non-Proliferation and Disarmament, September 2014).

§2.3 NPT Safeguards and Verification

2.3.1 "Comprehensive" Safeguards: Traditional Materials Accounting

2.36 Under Article III.1 of the NPT, the IAEA assumed responsibility for negotiating safeguards agreements with non-NWS parties to the treaty that would allow the agency to verify the fulfilment of states' obligations under the treaty "with a view to preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices."[8]

2.37 **Comprehensive Safeguards Agreements (INFCIRC/153).** Under a CSA, a state undertakes to accept safeguards "on all source or special fissionable material in all peaceful nuclear activities within its territory, under its jurisdiction or carried out under its control anywhere, for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices." The objective of the CSA is to deter diversion "by the risk of early detection."[9] The basic safeguards measure is nuclear material accountancy, carried out through on-site inspections, supported by containment and surveillance measures (for example, seals and cameras).

2.38 The 2010 NPT Review Conference reaffirmed the call by previous review conferences for the application of comprehensive safeguards to all source or special fissionable material in peaceful nuclear activities (Action 24). It called on those states which have yet to do so to bring into force CSAs (Action 25) with the assistance of the IAEA (Action 29).

2.39 Steady progress has been made on concluding CSAs with those non-NWS NPT parties yet to do so. Between 1 July 2010 and 20 November 2014, CSAs entered into force for seven states (Andorra, Bosnia and Herzegovina, Montenegro, Mozambique, Republic of Congo, Togo and Vanuatu). Over the same period, the number of states without a CSA in force had dropped to twelve, of which six have signed CSAs that are not yet in force.[10] As of 30 June 2014, 181 states (and Taiwan) had safeguards agreements in force with the agency.

2.40 **Small Quantities Protocols (SQPs).** Under a small quantities protocol (SQP), a state with little or no nuclear activity is exempted from most of the safeguards procedures set out in its CSA. A revised standard text of the SQP approved by the IAEA Board of Governors in 2005 reduced the scope of exemptions and it is not available to a state with an existing or planned nuclear facility. Of particular importance is that the amended SQP gives the IAEA the authority to verify a SQP state's initial inventory report by inspection.

2.41 The 2010 NPT Review Conference encouraged all states parties with SQPs which had not yet done so "to amend or rescind them." Between 1 July 2010 and 5 August 2014, SQPs were amended for fourteen states (Andorra, Antigua and Barbuda, El Salvador, Gabon, Gambia, Guatemala, Kuwait, Mauritania, Moldova, New Zealand, Panama, San Marino, Swaziland and Zimbabwe). In the same period Ghana and Nigeria rescinded

8. IAEA INFCIRC/153, Basic Undertaking.
9. IAEA INFCIRC/153, paragraph 28.
10. http://www.iaea.org/Publications/Factsheets/English/nptstatus_overview.html.

their SQPs. As of 26 September 2014, 60 states had accepted SQPs in accordance with the modified text endorsed by the Board of Governors.[11]

2.42 **Voluntary Offer Agreements.** Under a voluntary offer agreement, the IAEA applies safeguards to nuclear material in facilities selected by it from an NPT nuclear weapon state's list of eligible facilities. The purpose of such safeguards is "to verify that the material is not withdrawn from peaceful activities except as provided for in the agreement." Among the motives for choosing a particular facility may be its capacity to "satisfy legal obligations arising from other agreements concluded by the state."[12] All five NWS have both voluntary offer agreements and APs in force.

2.43 The 2010 NPT Review Conference called for the wider application of safeguards to peaceful nuclear facilities in the NWS (Action 30). But there has been no widening of the scope of application of safeguards to civilian nuclear facilities in states with a voluntary offer agreement since then. Wider application of safeguards in the NWS would require a substantial increase in the IAEA safeguards budget which in the current circumstances seems unlikely.

2.44 **INFCIRC/66/Rev.2.** Under safeguards agreements based on INFCIRC/66/Rev.2 (1965) safeguards are applied to specific nuclear materials, facilities and other items in three non-NPT nuclear-armed states (India, Israel and Pakistan) with a view to ensuring their exclusively peaceful use. These agreements have no substantive impact on nuclear weapons programs.

2.3.2 Additional Protocol: Verifying the Absence of Undeclared Activity

2.45 The push for stronger safeguards was given greater urgency in the early 1990s as evidence emerged of a clandestine nuclear weapons program in Iraq and of discrepancies in North Korea's initial safeguards declarations.[13] In response, the IAEA Board of Governors in May 1997 approved the model Additional Protocol (INFCIRC/540) giving the IAEA access to additional relevant sites and information.

2.46 Together, a CSA and AP in force and fully implemented enable the IAEA both to verify the non-diversion of declared nuclear material from peaceful use *and* to determine whether there is evidence of undeclared nuclear material and activities.

2.47 The ICNND Report recommended that all states should accept the application of the AP and that acceptance should be made a condition of all states' nuclear exports (Recommendations 5 and 41). While many countries, particularly members of NSG, have argued that the AP should be recognized and accepted universally as a condition of nuclear supply, others, particularly some within the NAM, have resisted efforts to have the AP endorsed as part of the current safeguards standard, not least because they see this as evidence of some states' determination to further entrench the imbalance between non-proliferation and disarmament obligations.

11. GC(57)/RES/13, September 2013, GC(58)/RES/14, September 2014.
12. IAEA Safeguards and Verification: *Safeguards Statement for 2010*, p. 7, http://iaea.org/OurWork/SV/Safeguards/es/es2010.html
13. Jack Boureston and Charles D. Ferguson, "Strengthening Nuclear Safeguards: Special Committee to the Rescue?" http://www.armscontrol.org/act/2005_12/DEC-Safeguards.

2.48 As a consequence, the 2010 NPT Review Conference could only agree to "encourage" states parties which had not yet done so "to conclude and to bring into force additional protocols as soon as possible and to implement them provisionally pending their entry into force" (Action 28). The conference president's review of the operation of the treaty nevertheless noted that "numerous" states took the view that a CSA and AP in combination were now integral parts of the IAEA's safeguards system and that, together, the measures contained in both instruments represented "the enhanced verification standard."[14] While it was for states to decide whether or not to conclude an additional protocol, a protocol in force became a legal obligation. And, in calling for the "wider application of safeguards to peaceful nuclear facilities in the nuclear-weapon states," the conference was able to agree that "comprehensive safeguards and additional protocols should be universally applied *once the complete elimination of nuclear weapons [had] been achieved*" (Action 30; emphasis added).

2.49 Between 1 July 2010 and 20 November 2014, APs, based on the Model Additional Protocol, entered into force for 23 states.[15] Of the IAEA's total membership of 162 states, 147 have signed an AP or had one approved by the IAEA Board of Governors and as at 20 November 2014, 124 APs were in force. Almost 90 per cent of the NPT non-NWS with significant nuclear activities have an AP in force. In the same period, Guinea (2011), Guinea-Bissau (2013), Myanmar (2013) and the Lao People's Democratic Republic (2014) signed APs, but these are not yet in force.[16] Five NPT states and three non-NPT states with significant nuclear activities have yet to commence AP negotiations with the IAEA.[17]

2.3.3 "State-Level" and "Integrated" Safeguards: Detection-Focused and Information-Driven

2.50 The 2010 NPT Review Conference called for regular assessment and evaluation of IAEA safeguards (Action 32). IAEA safeguards are not static and have changed considerably over time as new challenges emerged. The two main elements of recent safeguards evolution have been development of the Additional Protocol to strengthen the IAEA's ability to detect undeclared nuclear material and activities and the move to "state-level" approaches in order to improve the effectiveness and efficiency of the safeguards system.

2.51 Until the first Gulf War (1990–91), IAEA safeguards focused mainly on nuclear material and facilities declared by the state concerned. This approach failed to detect Saddam Hussein's clandestine pursuit of nuclear weapons and others like North Korea, Iran, Libya and Syria that also failed to declare all their nuclear activities.

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14. NPT/CONF.2010/L.2 (27 May 2010): Final Document: Part I: Review of the operation of the Treaty, paragraphs 18 and 19.
15. Albania, Andorra, Antigua and Barbuda, Bahrain, Bosnia and Herzegovina, Costa Rica, Gambia, India, Iraq, Kyrgyzstan, Mexico, Moldova, Montenegro, Morocco, Mozambique, Namibia, Republic of Congo, Saint Kitts and Nevis, Swaziland, Togo, the United Arab Emirates, Vanuatu, and Vietnam
16. http://www.iaea.org/safeguards/documents/sir_table.pdf. An Additional Protocol for Denmark with respect to Greenland entered into force in March 2013.
17. Argentina, Brazil, Egypt, Israel, North Korea, Pakistan, Syria and Venezuela. Brazil and Argentina argue, albeit not compellingly, that their membership of the Brazilian–Argentine Agency for Accounting and Control of Nuclear Material (ABACC) puts them in a special situation vis-à-vis the AP. "Significant nuclear activities" encompasses any amount of nuclear material in a facility, or nuclear material in excess of the exemption limits in INFCIRC/153 paragraph 37 in locations outside facilities. Neither Israel nor Pakistan is a party to the NPT.

2.52 To rescue its dented credibility, the IAEA, with the endorsement and involvement of its Board of Governors, began to develop alternative and more reliably effective inspection practices for detecting undeclared activities. The need for this became steadily more urgent as more reactors were built and commissioned and the number of facilities and the volume of nuclear material subject to safeguards grew. The IAEA response has been governed by four parameters: there are more commercial-scale nuclear fuel cycle installations being built; more facilities and materials are being brought under IAEA safeguards; there is not, and is not likely to be in the foreseeable future, any commensurate increase in the agency's resources; and most states have a demonstrable record of responsible stewardship of nuclear operations for peaceful purposes. Putting the four propositions together, to perform effectively and efficiently the IAEA had to become more targeted in its operations, focusing on states of possible concern rather than dividing its attention and fragmenting its scarce resources by mechanistically inspecting every state with nuclear facilities and activities.

2.53 This has led the IAEA to move progressively over the past two decades to develop and implement what is now described as a "state-level approach" to the planning, implementation and evaluation of safeguards. This is an iterative process in which an evaluation of all information available to the agency (that is, information provided not only by the state itself, but by other states, as well as information derived from inspections and visits, from commercial satellite imagery and from international databases on, for example, nuclear trade and illicit trafficking) serves as the basis for planning future safeguards objectives and activities. The IAEA believes that the state-level approach is flexible and responsive to change, thereby helping to ensure that peaceful use assurances provided to the international community remain credible and current.[18]

2.54 As an important step on this path, integrated safeguards – "the optimum combination of all safeguards measures available to the IAEA under comprehensive safeguards agreements and additional protocols"[19] – were implemented in 53 countries as at November 2014, an increase of six over 2010. The adoption of an integrated safeguards approach is a sign of the agency's confidence in the absence of undeclared nuclear material and activities in a state and permits the application of reduced safeguards measures at some facilities. This allows the agency to pay more attention to possible undeclared activities and to make the most efficient use of its finite resources by making "differentiated assessments about which states' nuclear programs pose more risk."[20]

2.55 Some states have raised concerns about state-level/integrated safeguards, including that such approaches could be discriminatory rather than targeted and that the state-level concept was developed without sufficient involvement of the IAEA Board of Governors. They have called for a return to a nuclear material accounting-based system of IAEA safeguards practices. There is concern in some quarters that the IAEA could be captured by the most powerful countries or by its strongest financial backers. The recent history of IAEA–Iran confrontations feeds into this narrative by some states that the

18. GC(55)/16, 26 July 2011.
19. International Nuclear Verification Series No.3, "Foreword," in *IAEA Safeguards Glossary*, 2001 ed. (Vienna: IAEA, 2002).
20. Mark Hibbs, "The Plan for IAEA Safeguards," 20 November 2012, http://carnegieendowment.org/publications/index.cfm?fa=view&id=50075.

agency's proliferation judgments can be tainted by "subjective conclusions and insufficiently vetted third-party information."[21] However, the agency's work to strengthen the safeguards system and develop "state-level" approaches was already well developed before the IAEA Board's initial finding of Iran's safeguards non-compliance in 2005.

2.56 A resolution adopted at the 2012 IAEA General Conference requested the IAEA Director General "to report to the Board of Governors on the conceptualization and development of the state-level concept for safeguards."[22] The required report was provided in August 2013, and in response to continued concerns the Director General reported further to the Board on this issue in September 2014. The agency considers state-level approaches to be essential to the future effectiveness and efficiency of the safeguards system. Consultations between the IAEA and member states are continuing with the aim of clarifying issues related to the state-level concept. IAEA Director General Yukiya Amano has stressed that "The State-level concept does not, and will not, entail the introduction of any additional rights or obligations on the part of either States or the Agency, nor does it involve any modification in the interpretation of existing rights and obligations."[23]

2.57 **Strengthening the Technology Base.** The 2010 NPT Review Conference encouraged states to "further develop a robust, flexible, adaptive and cost-effective international technology base for advanced safeguards through cooperation among Member States and with the IAEA" (Action 34). Strengthening the agency's safeguards technology base is essential both to maintain safeguards effectiveness and to contain their costs, as well as to prepare for future safeguarding challenges such as verification of an FMCT. A further challenge is to ensure that the IAEA has access to sufficient numbers of expert staff to enable it to fulfil the safeguards mission.

2.58 The IAEA continues to implement its *Medium Term Strategy 2012-2017* and the *Long-Term Strategic Plan (2012-2023)* of the Department of Safeguards. The latter addresses the conceptual framework for safeguards implementation, legal authority, technical capabilities (expertise, equipment and infrastructure) and human and financial resources necessary for the agency's verification work.[24] Ongoing budget pressures have resulted in reliance on support from member states for safeguards research, development and implementation support needs.

2.59 The IAEA is working across a broad front to strengthen the effectiveness and improve the efficiency of the safeguards system. In addition to the AP, action on SQPs and development of the state-level approach, improvements are pursued at the nuclear facility level, for example through use of remote monitoring and dual containment and surveillance. The agency continues to prepare to safeguard new types of facilities and fuel cycles such as geological repositories, pyroprocessing plants and laser enrichment facilities. An overhaul of the IAEA's safeguards information technology system includes

21. Hibbs, "The Plan for IAEA Safeguards."
22. GC(56)/RES/13, September 2012.
23. Introductory Statement to IAEA Board of Governors, 15 September 2014.
24. A summary of the *Long-Term Strategic Plan (2012-2023)* is at http://www.iaea.org/safeguards/documents/LongTerm_Strategic_Plan_(20122023)-Summary.pdf.

strengthening the protection of classified information, a concern raised by some IAEA members. Utilization of high resolution commercial satellite imagery from aerial and satellite-based sensors continues to deliver effectiveness and efficiency benefits. In 2013 the IAEA acquired 460 commercial satellite images from 22 different earth observation satellites in support of safeguards verification activities.[25] Having a variety of national providers of imagery gives the IAEA greater confidence that imagery is accurate and has not been tampered with to reinforce one country's assertions.

2.60 Through its International Project on Innovative Nuclear Reactors and Fuel Cycles and in cooperation with the Generation IV International Forum, the IAEA is working to improve safeguards on future nuclear energy systems. IAEA capabilities for the analysis of nuclear material and environmental samples are also being enhanced, including through the Enhancing Capabilities of the Safeguards Analytical Services project due for completion before the middle of 2015.[26]

2.61 **Outreach and Facilitation.** As the IAEA itself observes, "The effectiveness and efficiency of Agency safeguards depend, to a large extent, on the effectiveness of State and regional systems of accounting for and control of nuclear material – and on the level of cooperation – between State or regional authorities responsible for safeguards implementation (SRAs) and the Agency."[27] To this end, the agency provides training, at international, regional and national level, for personnel of state and regional authorities responsible for implementing safeguards obligations. In March 2012, the agency published comprehensive "Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols." In addition, an IAEA advisory service provides advice and recommendations to states on the establishment and strengthening of state systems of accounting for and control of nuclear material. By the end of June 2014, a total of nineteen such missions had been conducted since the program began in 2004.

2.62 The IAEA continues to encourage and to facilitate wider adherence to the safeguards system, consistent with the plan of action outlined in resolution GC(44)/RES/19 (September 2000) and the agency's updated Plan of Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols (September 2010). GC(44)/RES/19 calls for:

- Intensified efforts by the director general to conclude safeguards agreements and APs, especially with states which have significant nuclear activities;
- Assistance by the agency and member states to other states on how to conclude and implement safeguards agreements and APs; and
- Reinforced coordination between member states and the secretariat in their efforts to promote the conclusion of safeguards agreements and APs.[28]

2.63 The IAEA's June 2014 Status of Implementation report details ongoing implementation of the agency's Plan of Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols. This includes the holding of eleven interregional,

25. GC(58)/16, 5 August 2014.
26. GC(58)/16, 5 August 2014.
27. GC(58)/16, 5 August. 2014
28. GC(55)/16, 26 July 2011.

regional and sub-regional outreach events since June 2010, as well as consultations with IAEA member states and non-member states. Planned activities for 2014–15 include regional outreach activities in the Asian, Pacific and Caribbean regions focusing on conclusion/entry into force of CSAs and APs and on the amendment to SQPs, as well as continued bilateral outreach.[29]

2.64 At a regional level, the Asia Pacific Safeguards Network (APSN) came into operation on 1 October 2009 and held its fifth Plenary Meeting in August/September 2014. The objective of the network is "to strengthen the quality, effectiveness and efficiency of safeguards implementation in the Asia Pacific region, working closely with the IAEA, through activities such as training, professional development and sharing of experience."[30] APSN aims to "share nuclear safeguards information, knowledge, and practical experiences among countries interested in enhancing their safeguards capabilities." As well as the plenary meetings, APSN also holds technical workshops and consultations and in 2012, published a report on the Fundamentals and Good Practices of Safeguards Regulatory Authorities.[31]

§2.4 NPT Compliance and Enforcement

2.4.1 Compliance Generally

2.65 The IAEA has the mandate, authority and expertise to determine whether or not a state is complying with its safeguards obligations. The UN Security Council is responsible for enforcement. Under Article XII.C of the Statute of the IAEA, the agency's inspectors are required to report any non-compliance by a state with its safeguards obligations to the director general. The report is then transmitted to the Board of Governors and, by the board, to all members, the UN Security Council and the UN General Assembly. The Security Council's record as the ultimate guarantor of safeguards compliance is patchy at best, creating uncertainty whether states violating their safeguards obligations will be held accountable. A non-compliance finding may also be reached via paragraph 19 of INFCIRC/153 which allows the board to make the reports provided for in Article XII.C of the Statute if "upon examination of relevant information reported to it by the Director General [it] finds that the Agency is not able to verify that there has been no diversion of nuclear material … to nuclear weapons or other nuclear explosive devices."[32]

2.66 Countries found to have been in non-compliance are Iraq (1991), Romania (1992), North Korea (1993), Libya (2004), Iran (2005) and Syria (2011). Of the six, Iran and Syria are currently judged by the international community to be in non-compliance with their safeguards obligations.[33] Both are parties to the NPT and members of the IAEA,

29. IAEA, "Plan of Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols" (1 July 2013 to 30 June 2014), pp. 2, 3, http://www.iaea.org/safeguards/documents/sg_actionplan.pdf.

30. John Carlson, "Strengthening safeguards through regional cooperation: establishment of the Asia-Pacific Safeguards Network," http://www.dfat.gov.au/asno/publications/strengthening-safeguards-through-regional-cooperation.

31. http://www.apsn-safeguards.org/resources.htm

32. See John Carlson, "Defining Noncompliance: NPT Safeguards Agreements," *Arms Control Today* 39 (May 2009), pp. 22–27, www.armscontrol.org/act/2009_5/Carlson.

33. North Korea is in a different category at present, as resolution of the nuclear issue became the subject of a political process (that is, the Six-Party Talks). The IAEA's role became one of monitoring the freeze at Yongbyon under the previous Agreed Framework, and now the IAEA is on standby to do what the parties request if the Six-Party Talks resume, but no resumption was in sight as of the end of 2014.

with CSAs but not APs in force. In June 2011, the IAEA Board of Governors declared Syria to be in non-compliance with its obligations under its safeguards agreement with the agency and reported the matter to the UN Security Council. The resolution was based on an IAEA finding that an installation destroyed by Israel at Dair Alzour in September 2007 was "very likely" to have been an undeclared nuclear reactor. Recent IAEA reports to the board reveal no progress in agency efforts to secure access to Dair Alzour and three possibly functionally-related sites. Iran is discussed below. North Korea's withdrawal from the NPT and subsequent emergence as a nuclear-armed state was discussed previously in Chapter 1.

2.67 The 2010 NPT Review Conference failed, in the face particularly of Iranian and other NAM opposition, to make any progress on non-compliance and withdrawal issues. It simply underscored "the importance of resolving all cases of non-compliance with safeguards obligations in full conformity with the IAEA statute and Member States' respective legal obligations" and called on states to cooperate with the agency (Action 27).

2.68 While not serious enough to warrant a finding of non-compliance, some IAEA member states do not fully meet the obligations of their comprehensive safeguards agreements.[34] The IAEA's Safeguards Statement for 2013 recorded that some states had still not established national systems of accounting for and control of nuclear material as required under CSAs, that not all state and regional authorities "have the necessary authority, resources, technical capabilities or independence" from nuclear facility operators, and some state authorities do not provide sufficient oversight of nuclear material and accounting and control systems at nuclear facilities "to ensure the required accuracy and precision of data transmitted to the Agency."[35]

2.4.2 Iran

2.69 Iran has a growing and increasingly sophisticated nuclear program, including facilities dedicated to uranium conversion and enrichment, heavy water production, research and development, power generation and the production of isotopes for nuclear medicine. Concern about Iran's nuclear activities is based on its acquisition of uranium enrichment and other proliferation-sensitive technologies without apparent justification for its civilian nuclear power program, and that these technologies were acquired secretly and used for nuclear activities which Iran, in violation of its NPT and CSA obligations, failed to declare to the IAEA. The resulting suspicion that Iran was pursuing nuclear weapons, or the technical basis to do so quickly, was heightened by indications of a possible military dimension to Iran's nuclear program. Iran denies that there is a military dimension to its nuclear program and has undertaken to work with the IAEA to resolve these concerns.

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34. Brazil, Egypt, Syria and Thailand were singled out for safeguards implementation deficiencies in a confidential IAEA report that was leaked to the press in 2013. See Pierre Goldschmidt, "Serious Deficiencies Exposed by Latest IAEA Safeguards Implementation Report," 25 June 2013, http://carnegieendowment.org/2013/06/25/iaea-safeguards-implementation-report-for-2012-countries-of-concern.

35. http://www.iaea.org/safeguards/documents/Statement_for_SIR_2013_GOV_2014_27.pdf.

2.70 The ICNND Report called for continuing efforts to be made by the five permanent members of the Security Council (P5) and Germany (+1), the 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" (Recommendation 60).

2.71 In an annex to a November 2011 IAEA safeguards report, the agency gave a detailed account of the possible military dimensions of Iran's nuclear program.[36] This documented, for the first time in one place, a range of activities "relevant to the development of a nuclear explosive device,"[37] including warhead/missile payload design and experiments with high explosives.[38] Iran dismissed the report as dishonest in its methodology and wrong in its conclusions.[39] The IAEA has indicated that it has obtained additional corroborative information since November 2011.[40]

2.72 Since the initial IAEA Board of Governors finding of non-compliance in September 2005, Iran has been the subject of six UN Security Council resolutions demanding a halt to its enrichment and reprocessing activities.[41] A steadily increasing range of commercial and financial sanctions imposed on Iran by the United Nations and, separately, by individual states and the European Union (EU) had a significant impact on Iran's economy. Sanctions began to be eased following indications of Iranian readiness to work to resolve concerns about its nuclear program after President Hassan Rouhani took office in August 2013.

2.73 Rouhani made clear that Iran was not prepared to relinquish any rights, including enriching uranium, but was prepared to work to resolve the concerns about its nuclear program. Negotiations between the P5 and Germany (P5+1) resumed in October 2013 and in November 2013 a Joint Plan of Action specifying first steps to be taken over a six month period was agreed. Iran's main commitments included conversion or downblending of stocks of uranium enriched to just below high enrichment (20 per cent); limits on existing enrichment programs; no new enrichment or reprocessing programs and application of enhanced safeguards and monitoring. In return, the P5+1 agreed to apply no new nuclear-related sanctions and to suspend or ease some other sanctions. The Joint Plan of Action established the goal of a mutually agreed comprehensive solution whereby in return for measures to ensure the peaceful nature of Iran's nuclear program, all multilateral and national nuclear-related sanctions would be lifted.[42] A Joint Commission comprised of participants from the P5+1 countries was

36. *Implementation of the NPT Safeguards Agreement and relevant provisions of the Security Council resolutions on the Islamic Republic of Iran – Report by the Director General* (Vienna: IAEA Board of Governors, GOV/2011/65, 8 November 2011).

37. Nuclear Threat Initiative, "Iran: Nuclear," July 2012, http://www.nti.org/country-profiles/iran/nuclear.

38. S. Kile, "Iran and nuclear proliferation concerns," *SIPRI Yearbook 2012: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 2012), pp. 366–73.

39. "Iranian envoy criticizes IAEA conduct," *Press TV*, 22 November 2011, http://www.presstv.ir/detail/211406.html.

40. *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, GOV/2014/10, 20 February 2014.

41. S/RES/1696 (31 July 2006), S/RES/1737 (23 December 2006), S/RES/1747 (24 March 2007), S/RES/1803 (3 March 2008), S/RES/1835 (27 September 2008), and S/RES/1929 (9 June 2010).

42. https://www.iaea.org/sites/default/files/publications/documents/infcircs/2013/infcirc855.pdf.

established to monitor implementation of the Joint Plan of Action. The IAEA is providing verification of nuclear-related measures.

2.74 Separately, on 11 November 2013 the IAEA and Iran signed a joint framework in which they agreed to cooperate on verification activities to resolve all present and past issues. The IAEA has since confirmed that Iran had implemented several practical measures outlined in the joint framework, but that progress has stalled since May 2014. Its November 2014 report indicated that Iran has not suspended all uranium enrichment-related activities, nor all heavy water related activities, nor implemented its Additional Protocol. Consequently the IAEA "remains concerned about the possible existence in Iran of undisclosed nuclear related activities involving military related organizations, including activities related to the development of a nuclear payload for a missile."[43]

2.75 Discussions between the P5+1 and Iran on a comprehensive solution began in February 2013 but agreement was not possible within the initial six-month timeframe and the negotiations were extended for a further four months from July 2014. However, the 24 November 2014 deadline was not met for closing the deal and on that date, it was announced in Geneva that the parties had agreed to extend the deadline yet again to 1 March 2015 for a high-level political agreement, followed by 1 July for confirmation of the full technical details of the agreement. Meanwhile Iran will be permitted to access $700 million a month in frozen assets. Prospects remain cloudy and hardline opponents of any deal may well mobilize in both capitals, Tehran and Washington, to reject any deal reached, especially as the Republican Party takes control of the US Senate from January 2015.

2.76 The two sides reportedly remain apart on three sets of issues in particular.[44] First, Iran wants to operate some 9,500 centrifuges while the P5+1 want the numbers cut back to between 4,000-4,500. (Originally Tehran wanted to operate all 19,000 centrifuges while the others had favoured fewer than 2,000.) A compromise figure of 6,000 would, given the low efficiency of Iran's first-generation centrifuges, impose a timeframe of 12 months for Iran to be able to reverse course and produce enough enriched uranium to make one bomb. Second, sanctions relief so far has been limited, temporary and reversible. Iran wants all remaining sanctions lifted immediately on the conclusion of a deal while the others want a phased elimination over a ten-year horizon. From the West's point of view, while it is simple enough to lift sanctions, reinstating a dismantled sanctions architecture will be more problematical and could give Tehran a window of opportunity to proceed further down the weaponization path. From an Iranian perspective, the power to lift sanctions belongs to Congress. If this is not done at the time of a comprehensive agreement, no one can be confident that Congress would accede to the administration's request to terminate any given sanctions regime. And third, Iran wants the deal to last for five years while the others want it to be for ten years.

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43. *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran*, 7 November 2014. http://www.iaea.org/sites/default/files/gov2014-58.pdf.

44. See especially Sam Jones and Najmeh Bozorgmehr, "Diplomats eye interim Iran agreement as final deal talks stall," *Financial Times*, 22 November 2014, http://www.ft.com/intl/cms/s/0/94aa2f2e-717f-11e4-818e-00144feabdc0.html#axzz3KmmWQI4l; and BBC News, "Iran nuclear crisis: can talks succeed?", 25 November 2014, http://www.bbc.com/news/world-middle-east-11709428.

2.4.3 Response to Withdrawal

2.77 A state party has the right to withdraw from the NPT if it decides that "extraordinary events, related to the subject matter of [the] Treaty, have jeopardized the supreme interests of its country" (Article X). As discussed in Chapter 1, North Korea asserted its withdrawal from the NPT in January 2003 – the only country so far to have done so – after the United States said that Pyongyang had admitted to operating a clandestine uranium enrichment program. Several states remain unconvinced of the validity of the North Korean withdrawal from the NPT, questioning what "extraordinary events" justified it. Regardless, the IAEA has not implemented safeguards in North Korea since, and for all practical purposes that withdrawal should now be treated as a fait accompli.

2.78 The ICNND Report recommended that a state withdrawing from the NPT should not be free to use for non-peaceful purposes nuclear materials and technology acquired while a party to it (Recommendation 10). It added that states should make it a condition of their nuclear exports that safeguards agreements will continue to apply in the event of a recipient state's withdrawal from the treaty (Recommendation 11).

2.79 The 2010 NPT Review Conference consensus outcomes document made no reference at all to withdrawal from the treaty, although the conference president's summary review of the operation of the treaty (paragraph 120), while reaffirming the universally recognized right of withdrawal, recorded views expressed by "many" states that, under international law, a withdrawing party remained responsible for violations of the treaty committed prior to its withdrawal and, apparently though more elliptically, for its safeguards obligations to nuclear supplier countries. It also noted (paragraph 122) that "numerous" states acknowledged the prerogative of nuclear supplier countries to "consider incorporating dismantling and/or return clauses" in the event of withdrawal.

2.80 North Korea withdrew from the NPT in an attempt to avoid being held accountable for breaching its treaty obligations, and then used plutonium produced while it was an NPT party to make nuclear weapons. Its actions damaged all three pillars of the NPT – disarmament, non-proliferation and cooperation in the peaceful uses of nuclear energy, setting back confidence in the treaty to the detriment of all states parties. The NPT recognizes that any withdrawal is a serious matter and potentially a threat to global peace and security. Hence, Article X requires that a withdrawing party give three months advance notice to all other NPT parties and to the UN Security Council and provide a statement of the extraordinary events it regards as having jeopardized its supreme interests. Regrettably, when North Korea asserted its withdrawal in 2003, the Security Council fell short of its responsibilities, taking no action.

2.81 By Resolution 1887 (24 September 2009), the Security Council did undertake in future to address without delay any state's notice of withdrawal, including the events described in its statement of explanation, and affirmed that a state remains responsible under international law for violations of the NPT committed prior to its withdrawal. That said, notwithstanding the adoption of this resolution and others highly critical of North Korea's nuclear weapons tests in 2006, 2009 and 2013, the Security Council has yet to make clear, as the ICNND report recommended, that any future 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" (Recommendation 9).

2.82 Any attempt to remove the right to withdraw would be a bridge too far for most states, given the sovereignty and law of treaties issues involved. However, agreement at the 2015 Review Conference on some common understandings on withdrawal would be fully consistent with NPT practice, the provisions of the treaty, including the key obligations of Articles III, IV and VI, having been interpreted and elaborated by NPT review conferences throughout its history.

§2.5 IAEA Resources

2.83 The IAEA is the lead international organization for the safe, secure and peaceful uses of nuclear energy, science and technology. With a secretariat of 2,500 professional and support staff, the IAEA is the centrepiece of international efforts to combat proliferation from within the NPT regime. Although autonomous, the IAEA is a member of the UN system and reports annually to the General Assembly on its work. Several nuclear-weapon-free zones also link their regional verification systems to the global IAEA inspections regime. It pursues a three-pronged strategy to combat nuclear risks: prevention of illicit and non-peaceful use of nuclear material; the timely detection of any such efforts; and swift and decisive referral to the Security Council when nuclear risks are apparent. It has three main areas of work: confirming that nuclear material and activities (such as power generation) are not used for military purposes; protecting people and the environment from the harmful effects of radiation; and developing and promoting peaceful applications of nuclear energy.

2.84 The 2010 NPT Review Conference called on states parties "to ensure that IAEA continues to have all political, technical and financial support so that it is able to effectively meet its responsibility to apply safeguards as required by article III of the Treaty" (Action 33). The ICNND Report went further, picking up on a number of recommendations of the 2008 Zedillo Commission on the role of the IAEA to 2020 and beyond.[45] It recommended a one-off injection of funds to refurbish the Safeguards Analytical Laboratory; a significant increase in regular budget support, with no "zero real growth" constraint; and security of future funding sufficient to enable medium to long-term planning (Recommendation 13).

2.85 The Zedillo Commission saw a need for a possible doubling of the regular budget by 2020 to permit the required "expansion of work on nuclear reactors and the fuel cycle, security and safety, and support for meeting basic human needs through nuclear applications and technical cooperation." It believed that "the statutory functions of the Agency – including nuclear energy, nuclear applications, development, safety, security, and safeguards – should be fully funded from assessed contributions," and that the Technical Cooperation Fund, while still based on negotiated targets, should be

45. *Reinforcing the Global Nuclear Order for Peace and Prosperity: The Role of the IAEA to 2020 and Beyond* (Vienna: IAEA, 2008).

"predictable on a multi-year basis, and assured." Recipient states, though, should be required to meet some of the costs of technical cooperation.[46]

2.86 The IAEA's regular budget has seen some modest real growth in recent years, although the core problem of dependence on extra-budgetary (voluntary) contributions remains unresolved. In 2009, the regular budget for 2010 was increased by 2.7 per cent over 2009 levels in real terms, followed by an increase of 2.1 per cent in 2012 over 2011.[47] This trend has not been sustained. In 2013, the IAEA sought a 2.1 per cent increase in its regular budget for 2014 as compared to 2013 levels. After protracted and difficult negotiations, the IAEA Board limited the increase to 0.3 per cent for the regular budget for 2014, with the regular budget for 2015 to be at zero real growth compared to 2014.[48]

2.87 The regular budget remains inadequate to allow the IAEA to fulfil its responsibilities and to meet the expectations of member states. Important programs continue to depend on extra-budgetary contributions. Such funding is unpredictable, its level uncertain and often tied to particular uses, creating problems for program implementation, efficiency and forward planning. Extra-budgetary funding of €57.4 million and €55.9 million is predicted for 2014 and 2015 respectively.[49] For comparison, the IAEA's regular budget for 2014, including the capital budget and a 1.4 per cent price adjustment is €349.8 million. In some key areas, reliance on extra-budgetary funds is chronic – for example, almost 80 per cent of nuclear security spending for 2014 is expected to come from extra-budgetary contributions. Taking nuclear safety and security together, about half of 2014 spending in these areas will come from extra-budgetary contributions.

2.88 The resources debate is complex and political. The IAEA is under pressure to become more cost-efficient, without letting its attention to safeguards implementation slide. Its work to improve global nuclear security work has the approval of its Board of Governors and the endorsement of world leaders at successive Nuclear Security Summits but some IAEA member states question the IAEA's involvement in nuclear security, suggesting it is likely to further diminish the resources available for the development of peaceful uses of nuclear energy. The debate is further complicated by concerns expressed by some states that the IAEA's evolving state-level approach to safeguards, which is driven at least partly by budget pressures, is discriminatory, subjective and unreliable (see discussion above).

2.89 Meanwhile, the new Clean Laboratory Extension to the Environmental Sample Laboratory at Seibersdorf was officially opened on 7 September 2011. This enhances the IAEA's nuclear analytical and forensic capabilities. A new Nuclear Material Laboratory has also been built at Seibersdorf and should be operational by the end of 2014. While the former provides assurance that no undeclared activities have occurred, the latter

46. *Reinforcing the Global Nuclear Order for Peace and Prosperity*: Recommendations 9(3), 9(5) and 9(6).

47. *IAEA Programme and Budget*, 2010–11, especially pp. iii, 1, 3 and 6; http://www.iaea.org/About/Policy/GC/GC53/GC53Documents/English/gc53-5_en.pdf.

48. IAEA budget figures for 2014-15 are from *The Agency's Programme and Budget, 2014-2015*, http://www.iaea.org/About/Policy/GC/GC57/GC57Documents/English/gc57-2_en.pdf.

49. Extra-budgetary contributions predicted for 2014 and 2015 appear to show a sharp drop from the 2012 (€113.8 million) and 2013 (€107.4 million) estimates used in the first State of Play report. However, the 2012 and 2013 estimates included a one-off amount of USD 149.5 million pledged to enable the IAEA to establish an LEU fuel bank.

provides assurance that member states are providing accurate information when they make declarations about the types and quantities of nuclear materials held on their territory. The new facility will also be used to train nuclear security professionals from member states.[50]

2.90 Efforts have continued to expand the IAEA's Network of Analytical Laboratories in order to facilitate the analysis of both nuclear material and environmental swipe samples. The network currently consists of the agency's own facilities and 20 laboratories in nine member states and the European Commission. Since June 2010, laboratories in Australia, Brazil, France and South Korea have been added to the network; and laboratories in Argentina, Belgium, Canada, China, the Czech Republic, Germany, Hungary, Netherlands and the United States are either undergoing preliminary assessment or are at various stages of the qualification process.[51]

2.91 The ICNND Report recommended that consideration be given to "an external review, by the Zedillo Commission or a successor panel, of the IAEA's organizational culture, in particular questions of transparency and information sharing" (Recommendation 14). There has been no move to embrace this recommendation.

§2.6 Export Controls

2.6.1 General

2.92 There is now widespread international acceptance of the need for national export controls. These are intended to reduce the risk that nuclear trade and commerce undertaken for legitimate peaceful purposes will contribute to nuclear weapons programs. They have evolved in response to technological developments and to changes in the nature both of the proliferation threat and of business practices in the nuclear industry.

2.93 Some export control obligations are anchored in the NPT, in particular the responsibility of NWS, under Article I of the treaty, not "in any way to assist, encourage, or induce any non-nuclear-weapon state to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices." Under Article III, all parties undertake not to provide source or special fissionable material, or equipment or material for the processing, use or production of special fissionable material, to any non-NWS for peaceful purposes, unless it is subject to safeguards.

2.94 Efforts to translate NPT obligations into governance mechanisms led in 1971 to the establishment of the informal *Zangger Committee* (named after its inaugural Swiss Chairman). The Committee's 39 members include the five NWS.[52] Its decisions are taken by consensus and are not legally binding on members. It reached common understandings

50. *Safeguards for the Next 40 Years*, http://www.iaea.org/newscenter/news/2011/cleanlabext.html.

51. GC(55)/16, 26 July 2011, p. 6; GC(56)/14, 25 July 2012, GC(57)/17, 30 July 2013,GC (58)/16, 5 August 2014.

52. Zangger Committee members: Argentina, Australia, Austria, Belarus, Belgium, Bulgaria, Canada, China, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Kazakhstan, South Korea, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, and the United States.

on the definition, absent from the NPT, of what constituted "equipment or material especially designed or prepared for the processing, use or production of special fissionable material," and on the conditions and procedures that would govern their export "on a basis of fair commercial competition."[53] This enabled the committee to create a "Trigger List," which it continues to publish, of nuclear-related materials and equipment, a guide to the identification of items to which safeguards should apply. Committee guidelines establish three conditions of supply: a non-explosive use assurance, an IAEA safeguards requirement, and a re-export provision which requires the receiving state to accept safeguards on the re-exported item.

2.95 The *Nuclear Suppliers Group (NSG)* – discussed in detail below – was established in 1975 after the "peaceful nuclear explosion" by India the previous year provided evidence of the misuse of nuclear technology transferred for peaceful purposes. While the Zangger Committee aimed to promote consistent implementation of states' obligations under Article III.2 of the NPT, and does this by focusing on practical means of defining and meeting those obligations, the NSG assumed a broader mandate and coverage of nuclear-related dual-use items, and is today a much more prominent mechanism. Like its predecessor, the NSG includes the five NWS and works on a consensus basis. Its guidelines are implemented by participating governments in accordance with their national laws and licensing practices.[54]

2.96 These are not the only two currently relevant export control arrangements (leaving aside for present purposes the Proliferation Security Initiative – discussed later in this chapter – which is about export interdiction rather than control in the sense being discussed here). Such arrangements are also implicit, for example, in *nuclear-weapon-free zone (NWFZ)* treaties, discussed later in this chapter, whose clauses variously complement and reinforce the NPT provisions on the export of proliferation sensitive material and equipment.

2.97 More specifically, concerns about nuclear terrorism have prompted significant further changes to the nuclear trade's international legal and regulatory framework. *Security Council Resolution 1540* (discussed in greater detail in Chapter 3) created a legal obligation, binding on all states, to implement "appropriate and effective" export controls.[55] A growing number of states have reported legislative/enforcement measures and export licensing provisions in place for nuclear weapons-related materials; laws and regulations governing the delivery of relevant ancillary services, such as brokering or financial services; and strengthened border controls as an aid to enforcement. As of May 2014, nearly 90 per cent of UN member states had submitted national reports on measures taken or planned in implementation of the resolution's provisions,[56] but they are proving less responsive to the 1540 Committee's requests for voluntary follow-up reports on national action plans on implementation measures.

53. Zangger Committee, http://www.zanggercommittee.org/Seiten/default.aspx.

54. Nuclear Suppliers Group, http://www.nuclearsuppliersgroup. org/en/. NSG members: Argentina, Australia, Austria, Belarus, Belgium, Brazil, Bulgaria, Canada, China, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Kazakhstan, South Korea, Latvia, Lithuania, Luxembourg, Malta, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, and the United States.

55. S/RES/1540 (28 April 2004).

56. http://www.un.org/press/en/2014/dc3496.doc.htm.

2.98 The 2010 NPT Review Conference, in Action 35 of the outcomes document, urged all states to ensure that nuclear-related exports are not misused to assist in the development of nuclear weapons and encouraged them to draw on multilateral guidelines and understandings in developing national export controls (Action 36). A growing number of countries, without themselves being members of the NSG or Zangger Committee, are indeed making use of the guidelines for this purpose. In addition, Action 44 called on all states "to improve their national capabilities to detect, deter and disrupt illicit trafficking in nuclear materials" and "to establish and enforce effective domestic controls to prevent the proliferation of nuclear weapons in accordance with their relevant international legal obligations."

2.99 These mild exhortations were, however, more than balanced by calls "to observe the legitimate right of all states parties, in particular developing states, to full access to nuclear material, equipment and technological information for peaceful purposes" (Action 38), and to eliminate, with respect to nuclear transfers and international cooperation, "any undue constraints inconsistent with the Treaty" (Action 39).[57] Regime members insist that their guidelines are consistent with the obligations of all states under the NPT and do not hinder nuclear trade between NPT states parties in compliance with their treaty obligations. The conference president noted that "numerous" states believed "effective and transparent" export controls to be an important means of facilitating "the fullest possible exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy, which, in the view of those states, depends on the existence of a climate of confidence about non-proliferation."

2.100 Since the 2010 NPT Review Conference, several NPT states parties have entered into civil nuclear cooperation agreements with India, most recently Australia (signed but not yet in force),[58] and other such agreements are under negotiation in late 2014. The exceptionally loose wording of Action 37 ("consider whether a recipient state has brought into force IAEA safeguards obligations in making nuclear export decisions") seems broad enough to cover this contingency. However, it is not possible to conclude unreservedly, with respect to nuclear-related exports to nuclear-armed states outside the NPT, that such exports have not "directly or indirectly" assisted the development of nuclear weapons in those states (Action 35). In a submission to the Australian Parliament's Joint Standing Committee on Treaties on the Australia–India agreement, the former (1989–2010) Director General of the Australian Safeguards and Non-Proliferation Office has raised concerns, inter alia, on the incomplete separation of India's military and civilian nuclear programs, the extent to which the India–IAEA agreement allows material to be moved in and out of safeguarded facilities, the flexible substitution and exemption provisions under the IAEA agreement, and India's refusal to account for material under the agreement with Australia.[59]

57. NPT/CONF.2010/L.2 (27 May 2010): Draft Final Document: Part I: "Review of the operation of the Treaty," paragraph 27.

58. Issues for suppliers when considering nuclear cooperation agreements with India include its nuclear disarmament and non-proliferation policies and record and whether these might be influenced through cooperation with India; the degree of separation between India's military and civil nuclear programs; and consistency between proposed supply arrangements with India and those applied to the supplier country's other nuclear partners.

59. John Carlson, "Submission to the Joint Standing Committee on Treaties," 2 November 2014, Parliament of Australia, http://www.aph.gov.au/Parliamentary_Business/Committees/Joint/Treaties/28_October_2014/Submissions.

Table 2.1: India's Civil Nuclear Cooperation

State	Date	Type of Cooperation
Argentina	23/09/2010	Agreement on cooperation in peaceful uses of nuclear energy
Australia	5/09/2014	Agreement on cooperation in the peaceful uses of nuclear energy (signed, not yet in force)
Canada	29/06/2010	Civil nuclear cooperation deal signed in Toronto, entered into force Sept 2013
France	20/02/2006	Joint declaration on the development of nuclear energy for peaceful purposes
	26/01/2008	Joint statement on terms for India's acquisition of nuclear equipment and fuel from France
	30/09/2008	Agreement on the development of peaceful uses of nuclear energy
	19/12/2008	Agreement between the Nuclear Power Corporation of India Limited and French nuclear company AREVA for the supply of 300 tons of uranium to India
	6/12/2010	Agreement on the Protection of Confidentiality of Technical Data and Information relating to cooperation in the peaceful uses of nuclear energy
Kazakhstan	16/04/2011	Civil nuclear cooperation agreement
Mongolia	14/09/2009	Agreement for peaceful uses of radioactive minerals and nuclear energy
Namibia	14/08/2009	Agreement on cooperation in peaceful uses of radioactive materials and nuclear energy
South Korea	25/07/2011	Agreement on cooperation in peaceful uses of nuclear energy
Russia	6/12/2008	Agreement to construct four nuclear reactors at Kudankulam
	8/12/2009	Civil nuclear cooperation agreement
	12/03/2010	Agreement on cooperation in peaceful uses of nuclear energy
United Kingdom	11/02/2010	Joint declaration on civil nuclear cooperation
United States	10/10/2008	Civil Nuclear Agreement (123 Agreement)

2.6.2 Nuclear Suppliers Group

2.101 Taking account of work done by the Zangger Committee, the NSG after its creation in 1975 adopted its own guidelines for nuclear transfers with the aim of ensuring their non-diversion to unsafeguarded nuclear fuel cycle or nuclear explosive activities. Recipient governments were required to provide formal assurances to this effect. The guidelines also required particular caution to be exercised in the transfer of sensitive nuclear facilities, materials and technology; the adoption by recipient governments of appropriate physical protection measures; and incorporation of stronger re-export provisions. The IAEA published the guidelines in 1978 as INFCIRC/254.

2.102 The work of a committee reviewing implementation of Article III at the 1990 NPT Review Conference had a significant impact on the NSG, especially its recommendation that "nuclear supplier states require, as a necessary condition for the transfer of relevant

nuclear supplies to non-nuclear-weapon states, the acceptance of IAEA Safeguards on all their current and future nuclear activities" (that is, comprehensive safeguards).[60]

2.103 This, and evidence of Iraq's active pursuit of a clandestine nuclear weapons program facilitated by the acquisition from NSG participating governments of dual-use items not covered by existing NSG guidelines, prompted the NSG in 1992:

- To establish and adopt guidelines for the transfer of nuclear-related dual-use equipment, materials, software and related technology that could make "a significant contribution to an unsafeguarded nuclear fuel cycle or nuclear explosive activity." These were subsequently published as Part 2 of IAEA INFCIRC/254;[61]
- To establish procedures for exchanging dual-use-related export denial notifications; and
- To make a comprehensive safeguards agreement with the IAEA a condition of supply for future nuclear transfers to non-NWS.

2.104 The comprehensive safeguards provision was subsequently adopted at the 1995 NPT Review and Extension Conference. The requirement applies only to items that are exclusively for nuclear use, the so-called Trigger List items defined in Part I of the NSG control list: nuclear material, nuclear reactors and related equipment, non-nuclear material for reactors, plant and other equipment for the reprocessing, enrichment and conversion of nuclear material, and for fuel fabrication and heavy water production, and technology associated with each of the above items. Indeed, these items are often called trigger list items because they "trigger" comprehensive safeguards.

2.105 At its plenary meeting in Warsaw in 1992, the NSG agreed that the transfer of trigger list items "should not be authorized to a non-nuclear weapon State unless that State has brought into force an agreement with the IAEA requiring the application of safeguards on all source and special fissionable material in its current and future peaceful nuclear activities."[62] Transfers, though, are not prohibited in all cases. Paragraph IV(a) of Part I of the guidelines says that they may take place "in exceptional cases when they are deemed essential for the safe operation of existing facilities and if safeguards are applied to those facilities." Different conditions, not including a comprehensive safeguards requirement, apply to transfers of nuclear-related dual-use equipment, material, software and related technology (Part II of the control list). At its 2011 plenary meeting, the NSG agreed to strengthen its guidelines on the transfer of sensitive enrichment and reprocessing technology.

2.106 **Issues of Consistency and Credibility: The Case of India.** International export control regimes are sometimes portrayed by non-member states as supplier cartels whose aim is to intensify the existing imbalance between non-proliferation and disarmament obligations by denying states access to nuclear technology and the peaceful uses of nuclear energy in contravention of Article IV of the NPT. Outreach programs have been only modestly successful in changing this image and in encouraging non-member

60. IAEA Information Circular, 16 September 1997.
61. Nuclear Suppliers Group, http://www.nuclearsuppliersgroup. org/en/.
62. Ian Anthony and Vitaly Fedchencko, *Reforming Nuclear Export Controls: The Future of the Nuclear Suppliers Group* (Stockholm: SIPRI, 2004).

states to adopt the regimes' export control lists and guidelines as a reasonably straightforward way of meeting their NPT non-proliferation obligations.

2.107 The NSG though has a particular credibility problem, a result of the decision taken in September 2008, under strong US pressure, to exempt India from the NSG's requirement for application of comprehensive safeguards to trigger list items. It has been argued that, in doing so, the NSG missed an opportunity "to commit India to a responsible non-proliferation policy." The United States had just negotiated a bilateral peaceful uses ("123") agreement with India which exempted India from the undertaking given by all NPT non-NWS "to disavow nuclear weapons programs in order to access civil nuclear technologies."[63] The agreement imposed no constraint either on India's nuclear weapons program: "this Agreement shall be implemented in a manner so as not to hinder or otherwise interfere with … military nuclear facilities" (Article 4); or on its right to reprocess transferred nuclear material: "the Parties grant each other consent to reprocess or otherwise alter in form or content nuclear material transferred pursuant to this Agreement" (Article 6.iii).

2.108 The NSG decision to exempt India from its nuclear trade restrictions was nonetheless based on a negotiated series of commitments by India: to separate its civilian from its military nuclear facilities and to place some civilian facilities under IAEA safeguards; to sign and implement an AP with respect to civilian nuclear facilities under safeguards; to adhere to NSG guidelines and control lists; to refrain from transferring enrichment and reprocessing technologies to states that do not have them; to maintain a unilateral moratorium on nuclear tests; and to work collaboratively with other states on an FMCT.

2.109 While there are clearly some positives on this list, as the ICNND argued:

> the main substantive problem with the deal was 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 materials for nuclear weapons, either unilaterally or even upon reciprocation by Pakistan and China.[64]

2.110 India's formal recognition by NPT nuclear supplier countries as a fully credentialed nuclear trading partner outside the established global non-proliferation and disarmament framework could not but damage the integrity of the NPT and the NSG's credibility as an instrument for reliable and consistent implementation of the treaty's Article III safeguards provisions. While India has an undeniably superior non-proliferation record to Pakistan's, and is more transparent than Israel, it is still only a special case because the NSG has chosen to make it one. In doing so, the NSG stoked the fires of those who are all too ready to believe that the NPT and its supporting export control regimes are simply tools for the selective enforcement of non-proliferation norms by an elite group of countries which is ready to bend and change its own rules for commercial and strategic advantage.

63. Pierre Goldschmidt, "NSG Membership: A Criteria-based Approach for Non-NPT States," 24 May 2011, http://carnegieendowment.org/publications/index.cfm?fa=view&id=44147.
64. ICNND report, paragraph 10.7.

2.111 During a visit to India in November 2010, President Barack Obama declared his support for Indian membership of the NSG and three other export control regimes – related to missile proliferation (MTCR), chemical and biological weapons (Australia Group), and conventional weapons (Wassenaar Arrangement). While the NSG is India's priority, it considers itself well-qualified for membership of all four regimes given its firm commitment to non-proliferation, effective export controls and capacity to produce regime-regulated goods and technologies.

2.112 The NSG first considered this question at its meeting in Noordwijk in June 2011. No decision was expected and none was taken. The United States apparently suggested two possible ways forward for the group: "one would be to revise the admission criteria 'in a manner that would accurately describe India's situation.' The other would be to 'recognize' that the criteria, known as 'Factors to be Considered', are not 'mandatory criteria' and that a candidate for membership does not necessarily have to meet all of them."[65] While there is some support for India's membership within the NSG, there is still no consensus.[66] The public statement issued following the NSG's most recent plenary meeting in Buenos Aires on 26–27 June 2014 said only that the meeting had "Shared information on all aspects of the 2008 Statement on Civil Cooperation with India and discussed the NSG's relationship with India."[67]

2.113 The NSG's credibility problems are compounded by China's apparent determination to supply more nuclear reactors to Pakistan. When it joined the group in 2004, China formally advised the NSG of an existing commitment to supply two nuclear reactors (Chashma I and II) to Pakistan. As these were not new commitments, China argued that they were effectively "grandfathered" under the NSG's full scope safeguards guidelines.[68] No mention was made at the time of plans for further reactor sales but, in September 2010, China announced its intention to supply two additional reactors (Chashma III and IV) to Pakistan[69], expected to be operational in 2016 and 2017 respectively. All four reactors are subject to IAEA safeguards. In 2013, Pakistan announced that Chinese supplied reactors would be used for two new nuclear power plants to be built near Karachi, and it is reportedly negotiating with China for the supply of three additional reactors.[70]

2.114 While China may continue to insist that any number of nuclear reactors can be "grandfathered," consistent with NSG guidelines, under its 1991 nuclear cooperation agreement with Pakistan, its NSG colleagues are unlikely to find this argument compelling. They are not, however, in a strong position to argue in the aftermath of their decision on India, and have no formal dispute resolution mechanism at their disposal.

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65. Daniel Horner, "NSG Revises Rules on Sensitive Exports," July/August 2011, http://www.armscontrol.org/act/2011_%2007-08/Nuclear_Suppliers_Group_NSG_Revises_Rules_Sensitive_Exports.

66. See for example Fredrik Dahl, "Nuclear export group divided over ties with India – diplomats," *Reuters*, 2 July 2014, http://uk.mobile.reuters.com/article/lexusForwardLiving/idUKKBN0F71AL20140702.

67. Nuclear Suppliers Group Plenary Meeting, Public Statement, Buenos Aires, 26-27 June 2014, http://www.nuclearsuppliersgroup. org/images/2014_PublicStatement_BA.pdf.

68. The so-called grandfather clause refers to paragraph 4 (c) of Part I of the NSG guidelines which says that the full scope safeguards requirement on trigger list items does not apply to agreements or contracts drawn up on or before 3 April 1992.

69. "China says Pakistan nuclear deal 'peaceful'," BBC News, 17 June 2010, http://www.bbc.co.uk/news/10340642.

70. Saeed Shah, "Pakistan in Talks to Acquire 3 Nuclear Plants From China," *Wall Street Journal*, 20 January 2014, http://online.wsj.com/news/articles/SB10001424052702304757004579332460821261146.

2.115 Members can be expected to continue to voice reservations and press China for further information but, with the India exception now firmly in place, preceded by the US–India civil nuclear agreement and Russia's own earlier recourse to the "grandfather" clause as a justification for its nuclear trade with India in the 1990s, it would be surprising if China felt under any particular pressure to change course. Meanwhile, the NSG's adoption in 1992 of the comprehensive safeguards requirement, "hailed at the time as a significant accomplishment," now has a decidedly hollow ring to it, giving NPT parties "good reason to complain because the actions of NSG members have made a mockery of Article IV of the NPT by giving non-NPT parties India and Pakistan the same benefits as NPT parties but without the accompanying obligations."[71]

2.116 The ICNND Report, while recognizing the flaws in the India exception, suggested that the NSG might salvage the situation by developing "a criteria-based approach to cooperation agreements with states outside the NPT, taking into account factors such as ratification of the Comprehensive Test Ban Treaty (CTBT), willingness to end unsafeguarded fissile material production, and states' records in securing nuclear facilities and materials and controlling nuclear-related exports" (Recommendation 15). This would establish conditions for further exceptions based on new rules, rather than on an exemption from old ones.

2.117 Pierre Goldschmidt gives even more specific shape to this recommendation by suggesting that, to become a member of the NSG, a non-NPT state should, inter alia:[72]

- Undertake to comply with the requirements of Articles I, III.2 and VI of the NPT;
- Have in force a voluntary offer agreement with the IAEA whereby the non-NPT state undertakes to place all new nuclear facilities located outside existing military nuclear sites on the list of facilities eligible to be safeguarded by the IAEA under INFCIRC/66-type safeguards agreements;
- Have ratified an AP to its safeguards agreement;
- Not be in material breach of an IAEA safeguards agreement;
- Commit not to export or transfer items specified in the NSG Guidelines to a non-NWS unless it has a CSA and AP in force with the IAEA;
- Have in place legal measures to ensure the effective and uninterrupted implementation of the NSG Guidelines, including export licensing regulations, enforcement measures and penalties for violations;
- Commit to share information on "catch all" denials with the IAEA and the members of the NSG;
- Have signed and ratified the CTBT;
- Commit, pending the entry into force of the CTBT, to adhere to a unilateral moratorium on nuclear explosion tests;
- Fully implement all UN Security Council resolutions adopted under Chapter VII of the UN Charter that relate to nuclear proliferation or terrorism (in particular, Resolution

71. Fred McGoldrick, "The Road Ahead for Export Controls: Challenges for the Nuclear Suppliers Group," January/February 2011, http://www.armscontrol.org/print/4642.
72. Goldschmidt, "NSG Membership. "

1540);

- Adhere to the MTCR and have in place the corresponding export control legislation;
- Have ratified the CPPNM, as amended in 2005;
- Be party to ICSANT;
- Agree to the immediate commencement of negotiations on a treaty banning the production of fissile material for nuclear weapons purposes with a view to its conclusion within five years.

2.118 The challenge will be to persuade Pakistan, and Israel should it show any interest in joining the NSG, to accept terms more rigorous than India's. It will be just as challenging to persuade India to make additional commitments (for example, to ratify the CTBT and to end unsafeguarded fissile material production) when it already has the deal it wants.

§2.7 Nuclear-Weapon-Free Zones (NWFZ)

2.7.1 General

2.119 Nuclear-weapon-free zones deepen and extend the scope of the NPT and embed the non-nuclear-weapon status of NPT states parties in additional treaty-based arrangements.[73] This is why several NPT review conferences have repeatedly affirmed support for existing NWFZs and encouraged the development of additional NWFZs. The first NWFZ was established in (uninhabited) Antarctica in 1959. Since then, five more have been established in Latin America and the Caribbean, the South Pacific, Southeast Asia, Africa, and Central Asia. Mongolia has also declared itself a national NWFZ in law. All NWFZs seek to do two minimum things. First, they prohibit the acquisition, testing, stationing and use of nuclear weapons within the designated territory of the zone. Second, they include protocols for binding the NWS to pledges not to use or threaten to use nuclear weapons against members of the NWFZ.[74]

2.120 The 2010 NPT Review Conference encouraged the establishment of further NWFZs. It also encouraged "all concerned States … to ratify the nuclear-weapon-free zone treaties and their relevant protocols, and to constructively consult and cooperate to bring about the entry-into-force of the relevant legally binding protocols of all such nuclear-weapon-free zone treaties which include negative security assurances" (Action 9). New NWFZs have been proposed for the Middle East (discussed below) and North East Asia (also discussed below). The InterAction Council of Former Heads of State and Government has also recommended the exploration of a NWFZ in the Arctic.[75] Russia ratified Protocols One and Two of the Treaty of Pelindaba in April 2011. All five NWS signed the one protocol to the Central Asian NWFZ in May 2014. On 2 May 2011, President Obama did submit the protocols to the treaties of Rarotonga and Pelindaba to

73. Ramesh Thakur, ed., *Nuclear Weapons-Free Zones* (London/New York: Macmillan and St. Martin's Press, 1998).

74. In addition to the treaties mentioned in this paragraph, the Outer Space Treaty (1967) and the Seabed Arms Control Treaty (1972) prohibit the emplacement of nuclear weapons and other weapons of mass destruction in space and on the ocean floor respectively.

75. See Ernie Regehr, "A Nuclear-Weapon-Free Zone and the Pursuit of Cooperative Security in the Arctic," APLN/CNND *Policy Brief* No. 16 (Canberra: Centre for Nuclear Non-Proliferation and Disarmament, October 2014).

the US Senate for ratification – fifteen years after signature – but there is no indication of when, if at all, Senate ratification might be expected.

Table 2.2: The World's Nuclear-Weapon-Free Zones

Zone	Opened for signature	Entry into Force	No. of State Parties
Latin America (Treaty of Tlatelolco)	14/02/1967	25/04/1969	33
South Pacific (Treaty of Rarotonga)	06/08/1985	11/12/1986	13
Southeast Asia (Treaty of Bangkok)	15/12/1995	27/03/1997	10
Africa (Treaty of Pelindaba)	11/04/1996	15/07/2009	37
Central Asia	08/09/2006	21/03/2009	5

Notes

The five NPT nuclear weapons states (NWS) have recognized Mongolia's self-declared national nuclear-weapon-free status and have provided Mongolia with negative security assurances and pledged to respect its nuclear-weapon-free status.

Other treaties that include denuclearization provisions are the Antarctic Treaty, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty), the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement), and the Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Sea-Bed and the Ocean Floor and in the Subsoil Thereof (Seabed Treaty).

Sources:
http://www.un.org/disarmament/WMD/Nuclear/NWFZ.shtml.
http://www.opanal.org/opanal/Tlatelolco/P-Tlatelolco-i.htm.
http://www.forumsec.org/resources/uploads/attachments/documents/SPNFZ%20Status%20Report.pdf.
http://www.au.int/en/sites/default/files/pelindaba%20Treaty.pdf.

2.121 **Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean.** The Treaty of Tlatelolco prohibits the testing, use, manufacture, production or acquisition by any means, as well as the receipt, storage, installation, deployment and any form of possession of any nuclear weapon, by Latin American and Caribbean countries. The parties are also required to conclude agreements individually with the IAEA for the application of safeguards to their nuclear activities. The IAEA has the exclusive power to carry out special inspections.

2.122 The treaty includes two protocols. The first, by which parties agree to apply key provisions of the treaty to their territories within the zone, has been signed and ratified by France, the United Kingdom and the United States. All NWS have signed and ratified Protocol II, which promises respect for the treaty's aims and provisions, and provides negative security assurances (NSAs: pledges not to attack non-NWS with nuclear weapons) to states parties. The United States, however, did so with two significant reservations. First, it sought to preserve its interpretation of "the relevant rules of international law" under which contracting parties retained "exclusive power and legal competence … to grant or deny non-Contracting Parties transit and transport privileges." Second, it qualified its NSA by making clear that an armed attack by a contracting party in which it was assisted by a NWS would be incompatible with the contracting party's own obligations under the treaty.[76]

76. http://www.armscontrol.org/documents/tlatelolco.

2.123 There has been no recorded violation of the treaty by states parties. However, in February 2012, Argentina accused the United Kingdom of violating its commitment under Protocol I by sending a nuclear-capable submarine to the South Atlantic. UK Deputy Prime Minister Nick Clegg dismissed the allegation as baseless, and the issue was not pursued.[77]

Table 2.3: Dates of NWS Ratification of NWFZ Treaty Protocols

	China	France	Russia	UK	USA
Tlatelolco					
Protocol I	N/A	24/08/1992	N/A	11/12/1969	23/11/1981
Protocol II	12/06/1974	22/03/1974	08/01/1979	11/12/1969	12/05/1971
Rarotonga					
Protocol I	N/A	20/09/1996	N/A	19/09/1997	Not yet
Protocol II	21/10/1988	20/09/1996	21/04/1988	19/09/1997	Not yet
Protocol III	21/10/1988	20/09/1996	21/04/1988	19/09/1997	Not yet
Pelindaba					
Protocol I	10/10/1997	20/09/1996	05/04/2011	12/03/2001	Not yet
Protocol II	10/10/1997	20/09/1996	05/04/2011	12/03/2001	Not yet
Protocol III	N/A	20/09/1996	N/A	N/A	N/A

Notes:

Dates shown are for deposit of instruments of ratification.

The South East Asia (Bangkok) treaty's one protocol is open to the five NPT NWS but has not yet been signed by any of them. The Central Asian (Semipalatinsk) treaty's one protocol has been signed by the five NPT NWS but has not yet ratified by any of them.

Source: http://www.un.org/disarmament/WMD/Nuclear/NWFZ.shtml.

2.124 **The South Pacific Nuclear Free Zone Treaty.** The Treaty of Rarotonga prohibits the manufacture or acquisition of any nuclear explosive device, as well as possession or control of such device, by the parties anywhere inside or outside the zone, which is defined in an annex. The parties also undertake not to supply nuclear material or equipment, unless subject to IAEA safeguards, and to prevent in their territories the stationing as well as the testing of any nuclear explosive device. They undertake not to dump, and to prevent the dumping of, radioactive waste and other radioactive matter at sea anywhere within the zone. Each party remains free to allow visits, as well as transit, by foreign ships and aircraft regardless of whether they are conventionally or nuclear powered and whether they may or may not be carrying nuclear weapons. The treaty is open for signature by members of the Pacific Islands Forum. Three eligible states (Marshall Islands, Federated States of Micronesia, and Palau – which, as former members of a UN trusteeship administered by the United States, are now in "free association" with the United States) have not signed the treaty.

2.125 The treaty includes three additional protocols. Protocol II (which provides NSAs to states parties) and Protocol III (which bans nuclear testing anywhere in the zone)

77. "'Argentina submarine claim baseless', says Nick Clegg," *BBC News*, 27 March 2012, http://www.bbc.co.uk/news/uk-politics-17524714.

have been ratified by all NWS other than the United States. Protocol I, by which parties agree to apply key provisions of the treaty to their territories within the zone, has been ratified by France and the United Kingdom.

2.126 US Secretary of State Hillary Clinton told the 2010 NPT Review Conference on 3 May 2010 that the administration was preparing to submit the treaty protocols to the US Senate for approval. President Obama submitted all three protocols to the Senate in May 2011 with a view to securing the Senate's consent to ratification. The Senate has so far taken no action on the matter.

2.127 Questions have been raised about possible or potential violations of the South Pacific (and African and Central Asian) NWFZ treaties with various decisions and agreements to sell uranium to India, which is not party to the NPT. The three zones prohibit the transfer of source or special fissile material and equipment to any non-NWS that is not subject to comprehensive IAEA safeguards under Article III.1 of the NPT. Australia (and – in the case of the Pelindaba and Semipalatinsk Treaties – South Africa, Namibia, and Kazakhstan) have either decided in principle or have signed agreements to sell uranium to India, or are reported as contemplating doing so.

2.128 Some critics argue that these possibly NWFZ-non-compliant agreements confirm that the India–US civil nuclear cooperation deal drove a cart and horse through the NPT regime's prohibitions on trade in nuclear material with non-NPT countries. But others argue that, legally speaking, India has no status under the NPT as either a NWS or a non-NWS, and therefore is not covered by such NWFZ prohibitions; moreover, it does apply facility-specific IAEA safeguards to some of its civilian nuclear activities. They further argue that the 2008 NSG "clean waiver" granted to India confirms this interpretation that trade in nuclear materials with India is not inconsistent with the NPT.[78]

2.129 **Treaty on the South East Asia Nuclear-Weapon-Free Zone.** The Treaty of Bangkok prohibits the development, manufacture, acquisition or testing of nuclear weapons by the parties anywhere inside or outside the zone, as well as the stationing and transport of nuclear weapons in or through the zone. Each state party may decide for itself whether to allow visits and transit by foreign ships and aircraft. The parties undertake not to dump at sea, or discharge into the atmosphere anywhere within the zone, any radioactive material or waste, or to dispose of radioactive material on land. The parties are also required to conclude agreements individually with the IAEA for the application of full-scope safeguards to their peaceful nuclear activities. The zone includes not only the territories but also the continental shelves and exclusive economic zones (EEZs) of the states parties. The treaty is open for signature by all states of South East Asia.

2.130 The one protocol to the treaty is open for signature by the five NWS and commits the parties to "respect the Treaty … and not to contribute to any act which constitutes a violation of the Treaty or its Protocol." The protocol also commits the parties not to use or threaten to use nuclear weapons against any state party to the treaty or within the

78. For the contrasting legal analyses, see Donald R. Rothwell, *Australia's Obligations under the South Pacific Nuclear Free Zone Treaty and Uranium Sales to India*, ICAN, 23 November 2011, www.icanw.org/files/ICANW~Legal%20Opinion~FINAL.pdf; and Kalman A. Robertson, "The Legality of the Supply of Australian Uranium to India," *Security Challenges* 8:1 (Autumn 2012), pp. 25–34. Although the two analyses are specifically in the context of the South Pacific zone, because the other zones have generally equivalent clauses, they are broadly relevant to all three cases.

zone itself. None of the five NWS has ratified the protocol (although see reference to China below). Prominent among their concerns is the geographical scope of the treaty (which includes states parties' continental shelves and EEZs) and its implications for freedom of navigation in international waters.

2.131 Long-running negotiations were expected to conclude with a signing ceremony at the Foreign Ministers' Meeting of the Association of South East Asian Nations (ASEAN) in Phnom Penh on 12 July 2012, but late submission of reservations by France, Russia, the United Kingdom and the United States led to its postponement.[79] A rescheduled signing ceremony was again postponed on the eve of the ASEAN Summit in Phnom Penh in November 2012,[80] much to the ASEAN nations' disappointment.[81] China's concerns about the implications of the treaty's geographic area of application for its territorial claims in the South China Sea have been addressed separately via a Memorandum of Understanding which clarifies "the understanding among the States parties and China on the application of the treaty and the protocol."[82] At their June 2014 meeting, ASEAN foreign ministers agreed to continue engaging with the NWS on outstanding issues regarding the protocol.

2.132 **African Nuclear-Weapon-Free Zone Treaty.** The Treaty of Pelindaba prohibits research, development, manufacture and acquisition of nuclear explosive devices and the testing or stationing of any nuclear explosive device. Each party remains free to allow visits and transit by foreign ships and aircraft. The treaty also prohibits any attack against nuclear installations. The parties undertake not to dump or permit the dumping of radioactive waste and other radioactive matter anywhere within the zone. Each party should individually conclude an agreement with the IAEA for the application of comprehensive safeguards to its peaceful nuclear activities. The zone includes the territory of the continent of Africa, island state members of the African Union (AU) and all islands considered by the AU to be part of Africa. The treaty is open for signature by all states of Africa.

2.133 Eight states – Cameroon, Chad, Comoros, Congo, Ghana, Guinea-Bissau, Namibia and Zambia – have acceded to the treaty since the 2010 NPT Review Conference. The treaty currently has 37 states parties, with 16 countries yet to ratify it. Morocco signed and ratified the treaty in April 1996, but is not a member of the African Union.

2.134 The treaty includes three additional protocols. Protocols I and II (which provide NSAs to states parties and ban nuclear testing anywhere in the zone, respectively) have been ratified by all NWS other than the United States. Protocol III, by which parties agree to apply key provisions of the treaty to their territories within the zone, has been ratified by all eligible states other than Spain. Secretary Clinton told the 2010 NPT Review Conference on 3 May 2010 that the administration was preparing to submit the treaty protocols to the US Senate for approval. President Obama submitted Protocols I and II to

79. "4 nuke states postpone signing SEANWFZ protocol next week," Xinhua, 8 July 2012, http://news.xinhuanet.com/english/world/2012-07/08/c_131702340.htm.

80. "Powers Not Yet Expected to Sign SE Asia Nuke-Free Zone Protocol," *Global Security Newswire*, 15 November 2012.

81. "No signing of SE Asia nuke-free zone protocol at upcoming 21st ASEAN Summit," Xinhua, 15 November 2012, http://news.xinhuanet.com/english/world/2012-11/15/c_131976633.htm.

82. "4 nuke states postpone signing SEANWFZ protocol next week."

the US Senate in May 2011 with a view to securing the Senate's consent to ratification. The Senate has so far taken no action on the matter.

2.135 **Central Asian Nuclear-Weapon-Free Zone.** The Treaty of Semipalatinsk requires the parties not to research, develop, manufacture, stockpile or otherwise acquire, possess or have control over any nuclear weapon or other nuclear explosive device anywhere. There are five states parties to the treaty: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. The treaty has a single protocol (NSAs) which all five NWS signed in May 2014 on the sidelines of the NPT Preparatory Committee (PrepCom) meeting in New York.

2.136 **Mongolia's Nuclear-Weapon-Free Status.** In September 2012, the five NWS and Mongolia signed "parallel political declarations regarding Mongolia's self-declared nuclear-weapon-free status."[83] The P5, who have not before recognized a single-country NWFZ, reaffirmed security assurances made in connection with Mongolia's nuclear-weapon-free status at the UN General Assembly in October 2000 and agreed "to respect the nuclear weapon-free status of Mongolia and not to contribute to any act that would violate it." Mongolia confirmed that it was fully compliant with its obligations as a non-NWS party to the NPT and that it had in place laws giving it "the domestic legal status of being free of nuclear weapons."[84]

2.137 **Proposed North East Asia Nuclear-Weapon-Free Zone.** A NWFZ has been suggested for North East Asia as a means of finessing the dilemma over what to do with North Korea's nuclear weapons. Any formal acceptance of North Korea's possession of nuclear weapons would make it extremely difficult to avoid proliferation to South Korea and Japan, with commensurately enhanced risk of an armed conflict in the region in which nuclear weapons are used. But if international policy is to focus on verifiably and permanently reversing North Korea's nuclearization, then Pyongyang's security fears of an external attack must be addressed.

2.138 One way to do this could be to establish, as part of a comprehensive agreement on peace and security in North East Asia, a regional NWFZ that includes the two Koreas, Japan and, possibly, Mongolia. Consistent with the provisions of other NWFZ treaties, these states would undertake not to acquire, manufacture, test or deploy nuclear weapons or to allow them to be stored on their territory. NWS parties to the treaty (China, Russia and the United States) would agree not to store nuclear weapons in the zone and otherwise to support the objectives of the treaty. They would extend negative security assurances to non-NWS parties to the treaty who were observing its terms. France and the United Kingdom would be asked similarly to commit to treaty provisions that applied to NWS.

2.139 To accommodate the required dismantling of North Korea's nuclear weapons program, the treaty might include a transition period and be "structured so that it goes into effect when the three nuclear weapons states (the US, Russia and China) and the

83. US Department of State, "Five Permanent UN Representatives Support Mongolia's Nuclear-Weapon-Free Status," *Media Note*, 18 September 2012, http://www.state.gov/r/pa/prs/ps/2012/09/197873.htm.

84. "Five Permanent UN Representatives Support Mongolia's Nuclear-Weapon-Free Status," *AFP*; "Major powers recognize Mongolia as nuclear weapons free," *Bangkok Post*, 18 September 2012, http://www.bangkokpost.com/news/asia/312850/major-powers-recognize-mongolia-as-nuclear-weapons-free.

two non-nuclear states (Japan and South Korea) ratify it" but reserves for Japan and South Korea "the right to withdraw from the treaty after three or five years if the provisions were not being enforced effectively throughout the Korean Peninsula."[85]

2.7.2 Middle East

2.140 The 2010 NPT Review Conference emphasized "the importance of a process leading to full implementation of the 1995 Resolution on the Middle East." It further agreed that the UN Secretary-General and the co-sponsors of the 1995 resolution (Russia, the United Kingdom and the United States), in consultation with the states of the region, would convene a conference in 2012, "to be attended by all States of the Middle East, on the establishment of a Middle East zone free of nuclear weapons and other weapons of mass destruction." The NPT Review Conference Action Plan provided, among other things, for the appointment of a facilitator "with a mandate to support implementation of the 1995 Resolution by conducting consultations with the States of the region … and undertaking preparations for the convening of the 2012 Conference." The facilitator (Jaakko Laajava, Under-Secretary of State in Finland's Ministry of Foreign Affairs) was appointed and a venue for the Middle East WMDFZ conference (Helsinki) chosen.

2.141 As part of international efforts to create suitable conditions for an initial gathering of regional states, the EU sponsored Track II informal seminars (July 2011 and November 2012) in Brussels on a Middle East WMDFZ conference; and the IAEA convened (November 2011) a long-delayed forum in Vienna on "Experience of Possible Relevance to the Creation of a Nuclear-Weapon-Free Zone in the Middle East." Forum participants, which included "all States of the Middle East" apart from Iran, proposed "to continue working towards the establishment of a NWFZ in the Middle East; to consider declarations of good intentions as a first step to break the current stalemate; to make the best and most constructive use of every opportunity on the international agenda; and to identify specific and practical confidence-building measures."[86]

2.142 A three-day Middle East WMDFZ Conference was tentatively scheduled to begin on 17 December 2012 in Helsinki. However, on 23 November the United States announced that there would be no conference in 2012 "because of present conditions in the Middle East and the fact that states in the region have not reached agreement on acceptable conditions for a conference."[87] Efforts to stage the conference continued throughout 2013 but it was again postponed. Conference facilitator Laajava reported to the 2014 NPT PrepCom meeting that, following further consultations with Middle East regional states and the conveners of the Conference, there has been progress in the conference preparations.

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85. Morton H. Halperin, "A Proposal for a Nuclear Weapons-Free Zone in Northeast Asia," Nautilus Institute, 3 January 2012, http://nautilus.org/napsnet/napsnet-special-reports/a-proposal-for-a-nuclear-weapons-free-zone-in-northeast-asia/.

86. IAEA, "Forum on Nuclear-Weapons-Free-Zone in the Middle East Closes," http://www.iaea.org/newscenter/news/2011/nwfz-forum-closes.html.

87. Victoria Nuland, "2012 Conference on a Middle East Zone Free of Weapons of Mass Destruction (MEWMDFZ)," Press Statement, 23 November 2012, http://www.state.gov/r/pa/prs/ps/2012/11/200987.htm.

2.143 The UN General Assembly, on 2 December 2011, adopted without vote a resolution on the establishment of a NWFZ in the Middle East (A/RES/66/25).[88] Israel, in an explanation of vote, said that it remained "committed to a vision of the Middle East developing eventually into a zone free of Chemical, Biological, and Nuclear weapons as well as ballistic missiles." It suggested that the process begin with "modest" confidence-building measures and be followed by "the establishment of peaceful relations, reconciliation, mutual recognition and good neighborliness, and complemented by conventional and non-conventional arms control measures." A "mutually verifiable" NWFZ could follow "in due course."[89] In December 2012, Israel again joined consensus on the resolution, noting the fragility of regional security and the absence of a mechanism for regional dialogue, without which it "was not possible to build confidence and defuse tension."[90] Israel also joined the consensus on the 2013 and 2014 General Assembly resolutions on a Middle East NWFZ (A/C.1/68/L.1and A/C.1/69/L.1).[91]

2.144 As with North Korea, it has been suggested that because "the logic of using force to secure a nuclear monopoly flies in the face of international norms," Israel could trade its nuclear weapons for a stop to Iran's developing nuclear weapons capability by agreeing to a Middle East NWFZ.[92] But as in North East Asia, this begs the question of whether a NWFZ can create conditions of common security in a region, or whether it can only be negotiated in conditions free of tension in the region. This question is at the heart of differences between Israel and Arab states on actions that could lead to a Middle East NWFZ.

2.145 The present bleak security and political environment in the Middle East is particularly inauspicious for the creation of a NWFZ. Against this backdrop, expectations from any initial Middle East WMDFZ conference will need to be realistic – holding the conference would itself be a significant achievement. A report issued in October 2013 by the International Panel on Fissile Materials (IPFM) has identified possible initial steps towards an eventual Middle East zone free of nuclear weapons and other weapons of mass destruction.[93] Measures suggested in the report include Israel ending production of plutonium and HEU and placing increasing portions of its holdings of these materials under safeguards as steps towards their elimination and, for the region, no separation of plutonium, no use of HEU or plutonium as fuel, no national enrichment plants, and the launching of discussions on regional verification arrangements.

88. "General Assembly, gravely concerned about status of UN disarmament machinery, especially in Conference on Disarmament, invites States to explore options," http://www.un.org/News/Press/docs//2011/ga11182.doc.htm.

89. Beatrice Fihn, ed., *The 2010 NPT Action Plan Monitoring Report* (Geneva: Geneva Centre for Security Policy, Swiss Federal Department of Foreign Affairs, and Reaching Critical Will, 2012), p. 48.

90. "General Assembly, in wake of high-stakes debate in First Committee that championed common positions but fell short of bridging divides, adopts 58 texts," http://www.un.org/News/Press/docs//2012/ga11321.doc.htm.

91. Establishment of a nuclear-weapon-free zone in the region of the Middle East, EOP by Israel, 31 October 2013, http://www.un.org/press/en/2014/gadis3513.doc.htm.

92. Uri Bar-Joseph, "Why Israel Should Trade Its Nukes," *Foreign Affairs*, 25 October 2012, http://www.foreignaffairs.com/articles/138224/uri-bar-joseph/why-israel-should-trade-its-nukes.

93. Frank N. von Hippel, Seyed Hossein Mousavian, Emad Kiyaei, Harold A. Feiveson and Zia Mian, *Fissile Material Controls in the Middle East: Steps toward a Middle East Zone Free of Nuclear Weapons and all other Weapons of Mass Destruction*, Research Report No. 11, International Panel on Fissile Materials, October 2013, http://fissilematerials.org/library/rr11.pdf.

§2.8 Non-NPT Treaties and Mechanisms

2.8.1 Proliferation Security Initiative (PSI)

2.146 The Proliferation Security Initiative (PSI) was established by the United States in 2003 with a view to preventing the shipment of WMD, their delivery systems and associated materials to state and non-state actors of concern. Its core objectives are contained in a Statement of Interdiction Principles to which all PSI-endorsing countries commit. These include support for interdiction efforts, the rapid exchange of relevant information and the strengthening of national legal authorities to facilitate interdiction. The PSI helps to build counter-proliferation capacity through workshops and exercises for participating states and observers. The number of countries participating in the initiative has grown from eleven at inception to 104, including four of the P5 (China is the exception).[94]

2.147 North Korea has responded to the challenge posed by closer international scrutiny of its ships by making greater use of alternative means of transport, including foreign-flagged vessels and aircraft – but these, too, have proven to be vulnerable to interdiction at least occasionally. Just how much of this activity can be attributed to the PSI is contestable, not least because of the character of the initiative itself, which is designed to accommodate a range of options, including unpublicized bilateral and plurilateral diplomatic and intelligence exchanges involving only directly affected PSI-endorsing states, and transit or destination countries. On 6 March 2014, the final report by the UN Security Council's Panel of Experts on North Korea sanctions stated that North Korea is "persisting with its arms trade and other prohibited activities in defiance of Security Council resolutions" and "makes increasing use of multiple and tiered circumvention techniques." The panel recorded its strong belief that "overall implementation of existing sanctions should be significantly improved."[95]

2.148 The ICNND recommended that the PSI "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."[96] This would go a long way towards addressing the concerns of states, including some PSI-endorsing countries, who do not like the fact that it operates outside the UN framework. It would also give this still largely US-driven initiative a potentially broader focus and greater international "legitimacy" – although it must be asked if, with more than 100 countries signed up to its guidelines, the PSI really lacks legitimacy. And greater legitimacy could come at a cost, reducing intelligence flows, lengthening decision-times and making practical, timely and effective interdiction even harder than it is now. At any rate, nothing yet suggests that the PSI has seriously considered the recommendation.

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94. On 22 May 2014, Vietnam became the 104th state to declare its support for the PSI. PSI participants are listed at http://www.state.gov/t/isn/c27732.htm.
95. Report of the Panel of Experts established pursuant to resolution 1874 (2009), 6 March 2014, http://www.un.org/ga/search/view_doc.asp?symbol=S/2014/147.
96. ICNND, *Eliminating Nuclear Threats*, pp. 96–97.

2.8.2 Missile Proliferation

2.149 The growing sophistication and spread of ballistic and cruise missile technologies, and the missiles' capacity to deliver a conventional or WMD payload to targets quickly and accurately, are adding to international tensions by increasing the perceived threat posed by states with missiles, further undermining confidence in the integrity and long-term effectiveness of the nuclear non-proliferation regime and reducing incentives to wind back nuclear deterrence doctrine (see also the discussion of missile defence in Chapter 1). In parallel with the steady spread of these technologies, and the absence of any "universally accepted norm or instrument specifically governing the development, testing, production, acquisition, transfer, deployment or use of missiles,"[97] the international community has tried to elaborate measures that would increase transparency and constrain the pace of, or roll back, missile proliferation.

Table 2.4: Countries that have Ballistic and Cruise Missiles with a Range from 500km+ (2014)

This table highlights missile possession by the countries in the world that have ballistic or/and cruise land- sea- or air-launched missiles with a range from 500 km.

Country	Countries with ballistic missiles	Countries with cruise missiles
USA	x	x
Russia	x	x
France	x	x
China	x	x
Saudi Arabia	x	-
Iran	x	(x)*
Syria	x	-
North Korea	x	-
South Korea	(x)	x
Taiwan	-	x
Israel	x	-
India	x	(x)
Pakistan	x	x
UK	x	x
Turkey	(x)	(x)
Germany	-	x
Spain	-	x

* Brackets indicate the missile is under development

Sources:

National Air and Space Intelligence Center [NASIC] 2013: Ballistic and Cruise Missile Threat, http://fas.org/programs/ssp/nukes/nuclearweapons/NASIC2013_050813.pdf.

"World nuclear forces," *SIPRI Yearbook 2014: Armaments, Disarmament and International Security*, pp. 287–313.

SIPRI Arms Transfers Database, http://www.sipri.org/databases/armstransfers

Arms Control Association: Worldwide Ballistic Missile Inventories, July 2014, http://www.armscontrol.org/factsheets/missiles.

NTI, http://www.nti.org/media/pdfs/design_characteristics_iran_missiles_3.pdf?_=1360355163

97. Ban Ki-moon, *The issue of missiles in all its aspects*. Report of the Secretary-General (New York, UN Doc A/63/176, 28 July 2008), http://www.un.org/ga/search/view_doc.asp?symbol=A/63/176&referer=http://www.un.org/disarmament/WMD/Missiles/SG_Reports.shtml&Lang=E.

2.150 **The Missile Technology Control Regime (MTCR).** The MTCR was established in 1987 to address growing international concerns about the spread of nuclear-capable missiles.[98] As is the case with the other export control regimes, MTCR guidelines are not legally binding, and members are responsible for implementing and enforcing them within the context of their own legal systems. The MTCR relies for its effectiveness on the cooperation of all missile technology possessors and suppliers, but does not include all such countries.[99] In its public statements the MTCR has "expressed concerns associated with global missile proliferation activities in particular regarding ongoing missile programs in the Middle East, Northeast Asia, and South Asia, which could fuel missile proliferation activities elsewhere."[100]

2.151 In 1992, the scope of the regime was broadened to include all missiles and unmanned aerial vehicles (UAVs) capable of delivering nuclear, chemical or biological weapons. Export restrictions are applied in two categories: the most stringent (Category I) includes complete rocket systems and UAVs capable of carrying payloads greater than 500 kg to distances of more than 300 km, their production facilities and major sub-systems; while a less restrictive Category II covers complete rocket systems and UAVs not included in Category I and a wide range of dual-use items.[101]

2.152 The MTCR's successes include the cessation of ballistic missile programs by Argentina, Brazil, Egypt and South Africa, as well as the destruction of Soviet-era Scud missile inventories in former Eastern bloc countries. Although South Korea did not join the MTCR until 2000, its doing so was preceded by a long (5–6 year) bilateral discussion with the United States on range and payload caps for South Korean ballistic missiles using the MTCR 500 kg/300 km guidelines. Although South Korea decided in 2012 to abandon the range cap, the payload cap is still in place.

2.153 While Taiwan has not declared itself as adhering to MTCR guidelines, it has de facto adopted them in spite of developing a long-range missile in the 1980s. That said, Taiwan's ballistic missile research and development base has not been dismantled and its current status is opaque.

2.154 Over the past decade, many countries have acquired technologies for short- and medium-range ballistic missiles, while countries such as India, Iran, Israel, North Korea and Pakistan have been developing long-range ballistic missiles.

2.155 **The Hague Code of Conduct against Ballistic Missile Proliferation (HCOC).** In September 2001, MTCR members published the text of a draft International Code of Conduct against Ballistic Missile Proliferation and recommended its universalization. The draft was considered at a series of well-attended international meetings before a

98. The Missile Technology Control Regime, http://www.mtcr.info/english/index.html.

99. C. Ahlström, "Non-proliferation of Ballistic Missiles: The 2002 Code of Conduct," *SIPRI Yearbook 2003: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 2003), pp. 749–59. The MTCR members are: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, South Korea, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Russia, South Africa, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, United States.

100. The MTCR Plenary statement, Rome, 14-18 October 2013, http://www.mtcr.info/english/press/Italy2013.html.

101. The Missile Technology Control Regime, "Equipment, Software and Technology Annex," http://www.mtcr.info/english/annex.html.

launch and signing conference was held at The Hague in November 2002.[102] The HCOC calls on subscribing states to provide information annually on ballistic missile systems (cruise missiles are not covered by the code), Satellite Launch Vehicles (SLVs) and land test-launch sites, as well as numbers and generic classes of ballistic missiles/SLVs launched, in accordance with the pre-launch notification mechanism established under the code.

2.156 The European Union has played a prominent role in promoting participation in the HCOC and has sought to expand its scope and effectiveness by broadening participation, including by bringing other existing initiatives (such as the India–Pakistan bilateral arrangements on notification) under the HCOC umbrella; extending the code to include cruise and short-range missiles; and developing a standard baseline template for reporting. However, none of these changes has yet been agreed.[103] In 2014, the number of HCOC state signatories stood at 137. However, many states with ballistic missiles are yet to join, including in North Asia and the Middle East, limiting its normative force.

2.157 **UN Panel of Governmental Experts.** Under the auspices of the United Nations, successive groups of government experts met at intervals from 2001 to 2008. Although they were able to agree that missile proliferation posed a threat to international peace and security, they could not agree on the scope and parameters of the threat, including which missiles should be the focus of their discussions.

2.158 The third and last of the panels did, however, identify some issues for further consideration, "without necessarily agreeing on all of them." These included the growing military significance of missiles, the fact that they can be armed with conventional or non-conventional warheads, their increasing manoeuvrability, the growing use of cruise missiles as a stand-off delivery system for conventional ordnance, the commonalities between missile and SLV technology, and the associated need "to address security concerns without impinging on the peaceful uses of space-related technologies." The panel agreed on the need for a "step-by-step approach" which could include improved national export controls, voluntary transparency and confidence-building measures, the peaceful settlement of disputes and the promotion of peaceful uses of outer space.[104]

2.159 **Proposal to Expand the Scope of the INF Treaty.** The ICNND Report recommended that international efforts to curb missile proliferation should continue, but warned that failure to multilateralize the 1987 Treaty on the Elimination of Intermediate-Range Missiles (INF Treaty) between the United States and then-Soviet Union should not be used as an excuse for either of the two existing parties to withdraw from it (Recommendation 62). At the Conference on Disarmament in February 2008, Russia proposed that a treaty analogous to the INF Treaty be opened to global participation. In November 2008, France presented a similar proposal in a paper called "Basic Elements

102. A. Harris, "International Code of Conduct Against Ballistic Missile Proliferation," BASIC Notes, 18 July 2002, http://www.basicint.org/pubs/Notes/2002international_code.htm. The text of the HCOC is available at: http://www.hcoc.at/index.php#.

103. "The European Union and the Hague Code of Conduct against Ballistic Missile Proliferation," European Consilium document, April 2009, http://www.consilium.europa.eu/uedocs/cmsUpload/EN-missiles_balistiques.pdf.

104. Ban, *The issue of missiles in all its aspects*.

of a Treaty Banning Short and Intermediate Range Ground-to-Ground Missiles."[105] While, however, the INF Treaty encompasses ground-launched ballistic and cruise missiles with a range of between 500 and 5,500 km, the French proposal would lower the threshold for prohibition to 150 or 300 km. Although the idea of exploring the feasibility of a global INF treaty was endorsed by the European Union in 2008 during the French presidency, neither Russia nor the EU has pursued the issue. Prospects for an expanded INF are poor as many states have developed short and intermediate range missiles and show no interest in giving them up.

2.160 The INF is itself under pressure, with the United States in July 2014 alleging that Russia is in violation of its INF obligations for having tested a ground-launched cruise missile prohibited by the treaty.[106] Russia rejected the US finding, insisting that the missile involved has a range that puts it in the ICBM category not covered by the INF and raised counter-concerns about US compliance.[107] Russia claims that elements of planned US missile defence systems could be used to launch cruise missiles in violation of the INF. Some in the United States have called for US withdrawal from the INF in response to alleged Russian violations,[108] and Russia itself has in the past threatened withdrawal. The impact of the current problems with the INF goes beyond its immediate contribution to European security. The INF eliminated an entire class of nuclear weapons and so is of considerable importance as a practical expression of what is achievable in US–Russia nuclear arms reductions. More immediately, breakdown of the INF would detract from the already difficult climate for further US-Russia nuclear arms control agreements and undercut confidence in existing agreements.

§2.9 Nuclear Testing

2.161 The CTBT bans all nuclear explosions in all environments for civilian ("peaceful") as well as military purposes. It was adopted by an overwhelming majority of members of the UN General Assembly on 10 September 1996. Since the treaty's adoption, just a handful of nuclear-weapon test explosions have been conducted, by India and Pakistan in 1998 and by North Korea in the past decade. As of 31 December 2014, 183 states had signed the CTBT, of whom 163 had also ratified it. The CTBT, however, has yet to enter into force, being hostage to the requirement that all 44 states with nuclear reactors listed in Annex 2 of the treaty must first sign and ratify it.[109]

105. Remarks by Russian Minister of Foreign Affairs Sergei Lavrov at the Plenary Session of the Conference on Disarmament, Geneva, 12 February 2008, http://www.mid.ru/brp_4.nsf/sps/111B7DD616FD1472C32573EE0024A63D; Letter from President Sarkozy to UN Secretary General Ban Ki-Moon, 5 December 2008, http://www.francetnp. fr/IMG/pdf/Letter_from_Nicolas_Sarkozy_to_Ban_Ki-Moon.pdf; "US Response to French Global INF Proposal," WikiLeaks cable, 24 December 2008, http://www.cablegatesearch.net/cable.php?id=08STATE134228.

106. "Adherence to and Compliance with Arms Control, Nonproliferation and Disarmament Agreements and Commitments," US Department of State, July 2014, http://www.state.gov/documents/organization/230108.pdf.

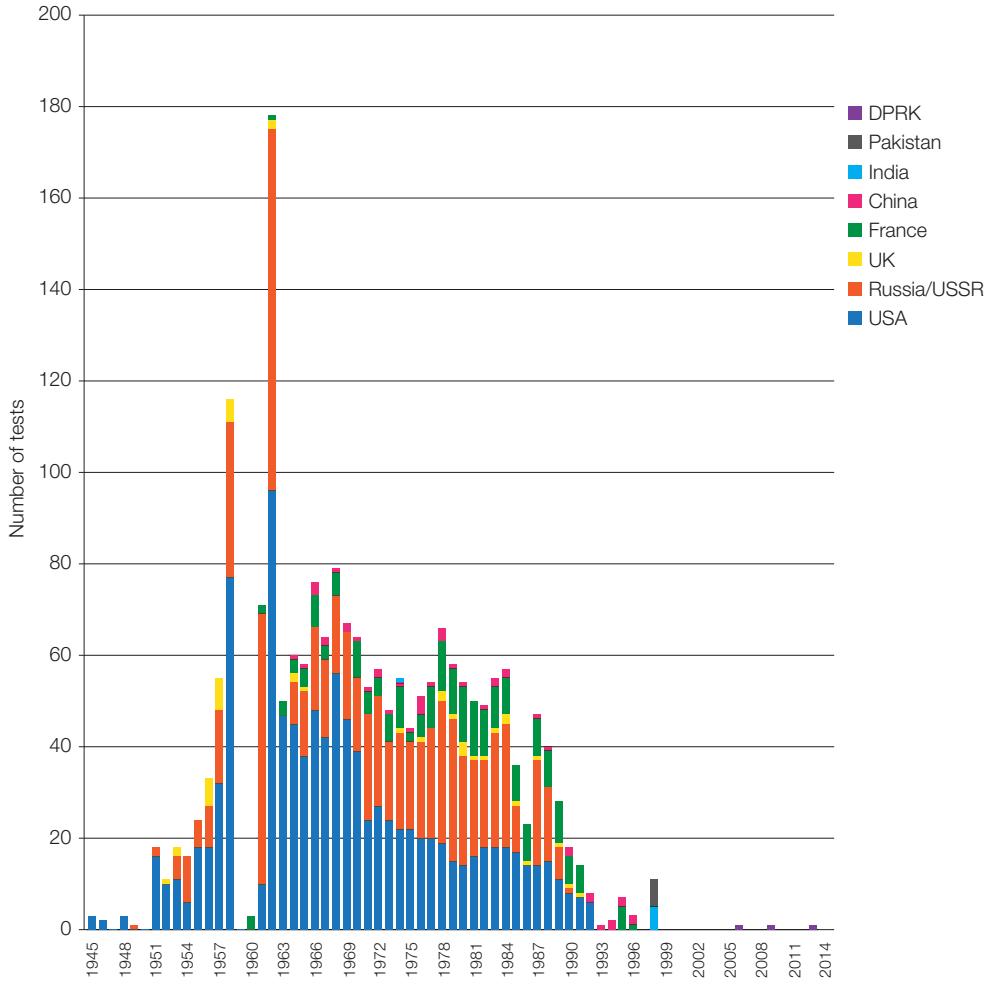
107. "US statements that Russia breaks INF Treaty unfounded – FM," *ITAR-TASS*, 30 July 2014, http://en.itar-tass.com/russia/742972.

108. See for example, Steven Pifer, "The Moscow Missile Mystery: Is Russia Actually Violating the INF Treaty?" http://www.brookings.edu/research/opinions/2014/01/31-moscow-missile-mystery-russia-violating-inf-pifer, and Bill Gertz, "Inside the Ring: Russia accused of major treaty breach," *Washington Times*, 11 June 2014.

109. Annex 2 states are: Algeria, Argentina, Australia, Austria, Bangladesh, Belgium, Brazil, Bulgaria, Canada, Chile, China, Colombia, Democratic People's Republic of Korea, Egypt, Finland, France, Germany, Hungary, India, Indonesia, Iran (Islamic Republic of), Israel, Italy, Japan, Mexico, Netherlands, Norway, Pakistan, Peru, Poland, Romania, Republic of Korea, Russian Federation, Slovakia, South Africa, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland, United States of America, Vietnam, and Zaire.

2.162 At the 2010 NPT Review Conference, all NWS undertook to ratify the CTBT "with all expediency" and acknowledged a "special responsibility to encourage Annex 2 countries, in particular those which have not acceded to the" NPT "and continue to operate unsafeguarded nuclear facilities, to sign and ratify" (Action 10). Pending its entry into force, all NPT states parties promised "to refrain from nuclear-weapon test explosions or any other nuclear explosions, the use of new nuclear weapons technologies and from any action that would defeat the object and purpose of that Treaty." They further agreed that existing moratoriums on nuclear-weapon test explosions should be maintained (Action 11).

Figure 2.1: Estimated Number of Nuclear Explosions (1948–2014)



Source: *SIPRI Yearbook 2014*, pp. 350, 351

Table 2.5: Estimated Number of Nuclear Explosions 1948–2014

	USA	Russia/USSR	UK	France	China	India	Pakistan	DPRK
1945	3							
1946	2							
1947								
1948	3							
1949		1						
1950								
1951	16	2						
1952	10		1					
1953	11	5	2					
1954	6	10						
1955	18	6						
1956	18	9	6					
1957	32	16	7					
1958	77	34	5					
1959								
1960				3				
1961	10	59		2				
1962	96	79	2	1				
1963	47			3				
1964	45	9	2	3	1			
1965	38	14	1	4	1			
1966	48	18		7	3			
1967	42	17		3	2			
1968	56	17		5	1			
1969	46	19			2			
1970	39	16		8	1			
1971	24	23		5	1			
1972	27	24		4	2			
1973	24	17		6	1			
1974	22	21	1	9	1	1		
1975	22	19		2	1			
1976	20	21	1	5	4			
1977	20	24		9	1			
1978	19	31	2	11	3			
1979	15	31	1	10	1			
1980	14	24	3	12	1			
1981	16	21	1	12				
1982	18	19	1	10	1			
1983	18	25	1	9	2			
1984	18	27	2	8	2			
1985	17	10	1	8				
1986	14		1	8				
1987	14	23	1	8	1			
1988	15	16		8	1			

	USA	Russia/USSR	UK	France	China	India	Pakistan	DPRK
1989	11	7	1	9				
1990	8	1	1	6	2			
1991	7		1	6				
1992	6				2			
1993					1			
1994					2			
1995				5	2			
1996				1	2			
1997								
1998						5[a]	6[b]	
1999								
2000								
2001								
2002								
2003								
2004								
2005								
2006								1
2007								
2008								
2009								1
2010								
2011								
2012								
2013								1
2014								

a India claims it conducted five nuclear tests, but the methodology adopted by SIPRI gives a figure of two.

b Pakistan claims it conducted six nuclear tests, but again the methodology adopted by SIPRI gives a figure of two.

Sources:

SIPRI Yearbook 2014: Armaments, Disarmament and International Security, pp. 350, 351.

Arms Control Today, http://www.armscontrol.org/act/2008_05/lookingback.

On 24 January 2013 North Korea's official news agency, the Korean Central News Agency (KCNA), issued a statement announcing that the country would conduct 'a nuclear test of higher level' as a response to the United Nations Security Council's condemnation of a North Korean rocket launch, in breach of UN sanctions. An explosion took place at 02:57 UTC on 12 February (11:57 local time). A few hours later the KCNA announced that the event was North Korea's third successful underground nuclear test that was "conducted in a safe and perfect way on a high level with the use of a smaller and light A-bomb unlike the previous ones, yet with great explosive power"; *SIPRI 2014 Yearbook*, p. 346.

2.163 Of nine Annex 2 states which had not ratified the CTBT when the eighth NPT Review Conference convened in May 2010, only one, Indonesia, has since done so (6 December 2011). Of the remaining eight, China, Egypt, Iran, Israel and the United States have signed the treaty while North Korea, India and Pakistan have not. The five NWS all maintain a voluntary moratorium on nuclear test explosions, although at least three (Russia, the United Kingdom and the United States), and possibly China, conduct "subcritical" tests of small amounts of nuclear material at high pressure using conventional explosives without generating a sustained nuclear chain reaction.

As discussed in the previous chapter, all NPT and non-NPT nuclear-armed states have long-term nuclear weapons systems modernization programs under development and in progress.

2.164 **NPT Nuclear Weapon States (NWS).** *China* maintains a voluntary moratorium on nuclear test explosions, but possibly conducts "subcritical" tests of nuclear material.[110] China has not ratified the CTBT, but supports the treaty's early entry into force, participates in the work of the Preparatory Commission for the CTBT Organization (CTBTO) and is preparing for national implementation of the treaty.[111] Presidents Obama and Hu Jintao issued a joint statement in January 2011 reaffirming both countries' support for early entry into force of the CTBT.[112] Beijing repeated this at the third session of the NPT PrepCom in New York in May 2014, stating that China "will not be an obstacle for the entry into force of the CTBT."[113]

2.165 The treaty has been presented to the National People's Congress, which is said to be going through "the ratification formalities in accordance with the relevant constitutional procedure."[114] Many experts believe that the formal conclusion of this procedure would quickly follow US ratification, but China never speaks of the status of the domestic ratification process, nor does it acknowledge or imply any link to ratification by another state.[115] It is unlikely that China would ratify the CTBT before the United States has done so, not least because it would first want to be sure of what, if any, conditions had been inserted by the US Senate. But China is being urged to do so, including by the Asia Pacific Leadership Network for Nuclear Non-Proliferation and Disarmament which at its October 2013 meeting called upon China to "ratify the CTBT without waiting upon the US or any other necessary party to complete that process first, or at least seek to negotiate simultaneous ratification with the US."[116] Such action by China would be an act of leadership and an important confidence building measure.

2.166 *France* and the *United Kingdom* have ratified the CTBT and maintain a voluntary moratorium on nuclear test explosions. The United Kingdom conducts "subcritical" tests of nuclear material.[117] In November 2010, France and the United Kingdom declared that they had decided to collaborate on nuclear stockpile stewardship in support of their "respective independent nuclear deterrent capabilities … through unprecedented co-operation at a new joint facility at Valduc in France that will model performance of …

110. Gaukhar Mukhatzhanova, *Implementation of the Conclusions And Recommendations for Follow-On Actions Adopted at the 2010 NPT Review Conference Disarmament Actions 1–22: Monitoring Report* (Monterey, CA: James Martin Center for Nonproliferation Studies, Monterey Institute of International Studies, April 2012), p. 48.

111. Viyyanna Sastry, "The Poor Prospects of the CTBT Entering Into Force," 9 January 2012, Institute for Defence Studies and Analyses, http://www.idsa.in/idsacomments/ThePoorProspectsoftheCTBTEnteringIntoForce_cvsastry_090112.

112. Office of the Press Secretary, The White House, "U.S.-China Joint Statement," 19 January 2011, http://www.whitehouse.gov/the-press-office/2011/01/19/us-china-joint-statement.

113. Statement by the Chinese Delegation on Nuclear Disarmament at the Third Session of the Preparatory Committee of the 2015 Review Conference of the Parties to the NPT, 2 May 2014, http://www.china-un.org/eng/hyyfy/t1155272.htm.

114. Statement by H.E. Ambassador Zhang Yan, to the Article XIV Conference, 4 September 2003, http://ctbto.org/fileadmin/content/reference/article_xiv/2003/statements/0309_pm/0409_am/ 05_china_e.pdf.

115. For example, see "Joint Press Conference between Mr. Gareth Evans and Ms. Yoriko Kawaguchi, Co-Chairs, International Commission for Nuclear Non-proliferation and Disarmament," ICNND, 15 February 2009, http://icnnd.org/Pages/090215_jpc_evans_kawaguchi.aspx; Deepti Choubey, "Don't wait for the United States," *CTBTO Spectrum*, April 2009, http://www.ctbto.org/fileadmin/user_upload/pdf/Spectrum/2009/2009_April_Spectrum12_p10-11.pdf.

116. APLN, *Ho Chi Minh City Declaration On Disarmament*, October 2013, http://www.a-pln.org/sites/default/files/apln-analysis-docs/HCMCDisarmDecFinPublic22x123.pdf.

117. Mukhatzhanova, *2010 NPT Review Conference Disarmament Actions: Monitoring Report*, p. 48.

nuclear warheads and materials to ensure long-term viability, security and safety."[118] *Russia* has ratified the CTBT and maintains a voluntary moratorium on nuclear test explosions. It conducts "subcritical" tests of nuclear material.[119]

2.167 The *United States* maintains a voluntary moratorium on nuclear test explosions. It conducts "subcritical" tests of nuclear material.[120] As part of the pledge made in Prague in April 2009 "to seek the peace and security of a world without nuclear weapons," President Obama undertook "immediately and aggressively" to pursue US ratification of the CTBT.[121] While the administration clearly hopes to persuade Senators that the situation has changed, to the advantage of the United States and the CTBT, since the Senate rejected a request for consent to ratify the treaty in 1999, and has been working steadily to this end, it has not submitted the CTBT to the Senate for approval. President Obama may be keen to bring the CTBT back to the Senate during his second term but a substantial number of Senators remain firmly opposed to US ratification (a two-thirds majority is required for treaty approval) and the administration has not set a timeframe for Senate reconsideration of the treaty. Ratification by the United States is critical to the treaty's eventual entry into force. Its rejection by the Senate, for a second time, would almost certainly ensure that this did not happen for many more years. Prospects for US Senate reconsideration of CTBT ratification appear even more distant following the geopolitical upheavals in the Ukraine and the November 2014 US mid-term elections.

2.168 **Non-NPT Nuclear-Armed States.** *India* has not signed the CTBT but has maintained a voluntary moratorium on nuclear test explosions since 1998. In 2005 India committed to continuing its unilateral moratorium on nuclear testing as part of the joint US–India statement establishing the basis for renewed bilateral peaceful nuclear cooperation. It is not known whether India is able to conduct "subcritical" tests of nuclear material, but it is not generally believed to have such capability. *Pakistan* has not signed the CTBT but has, since 1998, maintained a voluntary moratorium on nuclear test explosions. Again, it is not known whether Pakistan has the capacity to conduct "subcritical" tests, but this is thought to be unlikely. *Israel* may have conducted at least one nuclear test but this has never been confirmed. Israel has signed but not ratified the CTBT. It is not known whether Israel conducts "subcritical" tests of nuclear material. *North Korea* has not signed the CTBT, and tested explosive devices in 2006, 2009 and 2013. In February 2012 Pyongyang gave an undertaking to suspend nuclear testing but this was subsequently withdrawn. In November 2014 North Korea threatened to conduct a further nuclear test in response to UN action on its human rights violations.

2.169 **Promoting Entry Into Force.** At the 2010 NPT Review Conference, all states that had ratified the CTBT recognized the importance of the biennial conferences on facilitating the entry into force of the treaty (Action 12) and undertook to promote the treaty's entry into force and implementation at the national, regional and global levels

118. UK–France Summit 2010 Declaration on Defence and Security Co-operation, http://www.number10.gov.uk/news, 2 November 2010.

119. Mukhatzhanova, *2010 NPT Review Conference Disarmament Actions: Monitoring Report*, p. 48.

120. Mukhatzhanova, *2010 NPT Review Conference Disarmament Actions: Monitoring Report*, p. 48.

121. *Remarks by President Barack Obama, Hradcany Square, Prague, 5 April 2009* (Washington DC: White House, Office of the Press Secretary, 2009), http://www.whitehouse.gov/video/The-President-in-Prague#transcript.

(Action 13). Meanwhile, the CTBTO was encouraged to complete development of the treaty's verification regime, "including early completion and provisional operationalization of the international monitoring system" (IMS) (Action 14).

2.170 Representatives of ratifying states and signatories, including the five NWS, attended the 8th biennial Conference on Facilitating the Entry into Force of the CTBT in New York on 27 September 2013. Participating states again adopted a package of "concrete steps towards early entry into force and universalization of the Treaty". These included:

- Encouraging further signatures and ratifications of the treaty;
- Agreeing that ratifying states would "continue the practice of selecting coordinators to promote cooperation, through informal consultations with all interested countries, aimed at promoting further signatures and ratifications";
- Calling on the CTBTO Preparatory Commission to continue promoting understanding of the treaty, including "the benefits of the civil and scientific applications of the verification technologies" and to continue its international cooperation activities such as workshops, seminars and training programs; and
- Requesting the Provisional Technical Secretariat to continue to provide states with legal assistance with respect to the ratification process and implementation measures .[122]

2.171 On 26 September 2013 a Group of Eminent Persons was established to support and complement efforts to promote the CTBT's entry into force as well as reinvigorating international endeavours to achieve this goal. The CTBTO conducts an extensive program of outreach and capacity building around the world, including training and other assistance on maintaining and improving the CTBT's verification regime.

2.172 **Addressing Verification and Stockpile Reliability Concerns.** Even though the CTBT is not in force, construction and commissioning of the treaty's supporting verification framework (the International Monitoring System or IMS) continues. The Final Declaration of the September 2013 Article XIV Conference stressed the importance of maintaining momentum "in building all elements of the verification regime." States promised to continue to provide the "political and tangible support required to enable the Preparatory Commission to complete all its tasks in the most efficient and cost-effective way, including the building up of the on-site inspection pillar of the verification regime and the progressive development of the coverage of the International Monitoring System."[123] In April 2010, 255 of a planned total of 337 IMS facilities employing a range of technologies (seismic, radionuclide, hydro-acoustic and infrasound) had been certified. That number has since increased to 279.

122. *Final Declaration and Measures to Promote the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty*, Conference on Facilitating the Entry into Force of the CTBT, New York, 27 September 2013.

123. *Final Declaration*, Conference on Facilitating the Entry into Force of the CTBT, 27 September 2013.

Table 2.6: IMS Facilities (December 2014)

Facilities	Number
Certified	279
Installed	20
Under Construction	19
Planned	19
Total	**337**

Sources and notes:

An interactive map showing the location, type, and operational status of each IMS station is provided on the CTBTO Website, see: http://www.ctbto.org/map/.

As of December 2014, 279 of the 337 planned IMS stations had been certified and integrated into the IMS, which is more than 80 percent of the network. See http://www.ctbto.org/ and http://www.heritage.org/research/reports/2013/03/international-monitoring-system-as-a-nuclear-test-verification-tool.

2.173 Of the five NPT NWS (three of which have ratified the CTBT), only the United States could still be prevented from signing up to the treaty by concerns about its implications for the efficacy of its Stockpile Stewardship Program. This, and the possibility of states either cheating or reneging on their CTBT commitments, is why some (and quite possibly a deciding minority) of Senators are reluctant to approve US ratification. A report commissioned by the White House from the National Research Council and released on 30 March 2012 reviewed and updated a 2002 study that looked at technical concerns raised about the CTBT. The report concluded that:

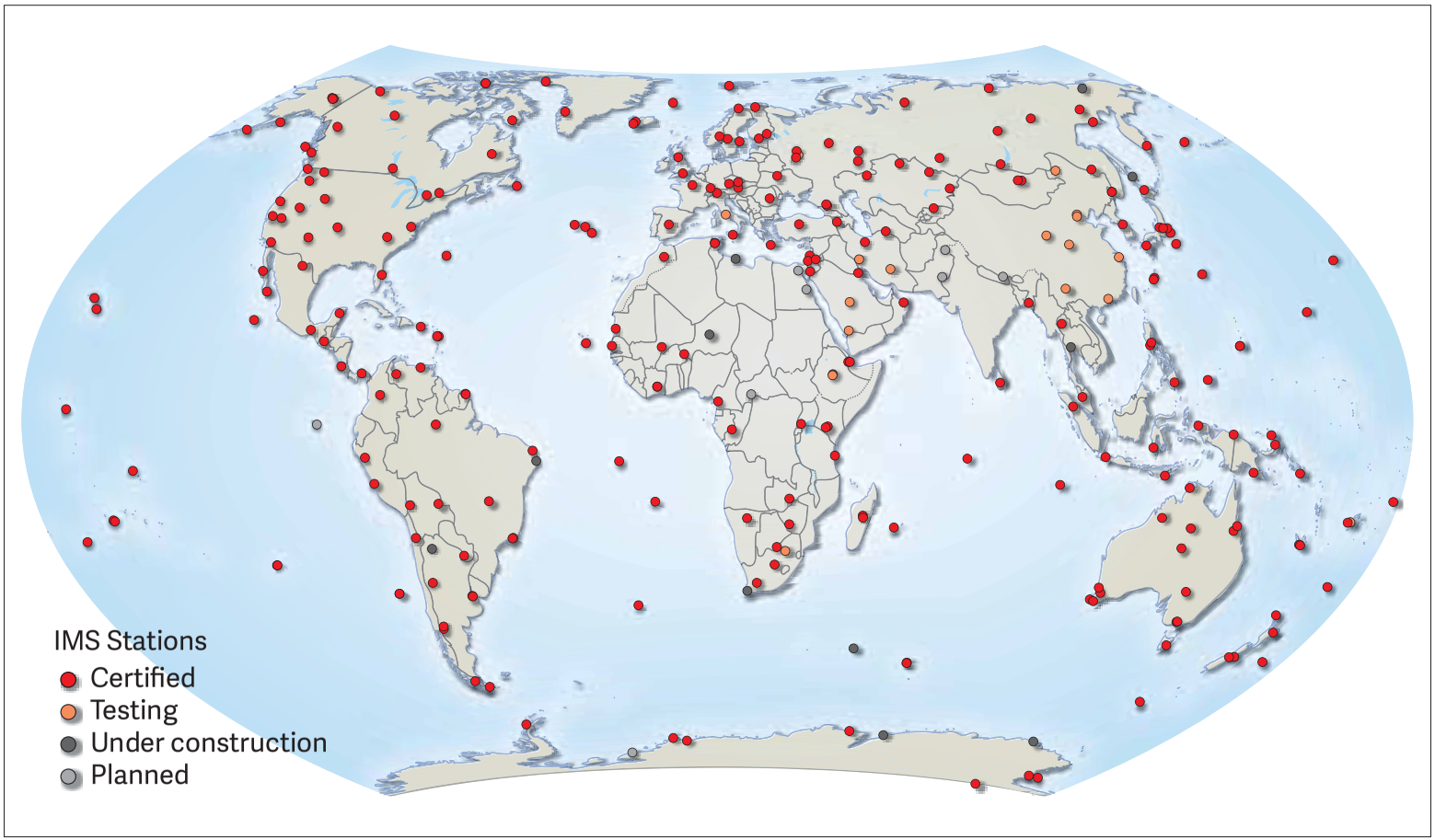
- Even for tests of well below 1 kt magnitude conducted anywhere in the world, confidence levels for IMS seismic detection are 90 per cent;
- US national technical means provide monitoring capability superior to the IMS and can focus on monitoring countries of concern to the United States; and
- The development of weapons with lower capabilities is possible with or without the CTBT for countries of different levels of nuclear sophistication, but this would not require the United States to return to testing in order to respond effectively. [124]

2.174 According to the report committee's chair, "so long as the nation is fully committed to securing its weapons stockpile and provides sufficient resources for doing so, the U.S. has the technical capabilities to maintain safe, reliable nuclear weapons into the foreseeable future without the need for underground weapons testing."[125]

124. "U.S. Stockpile Security and International Monitoring Capabilities Strengthened, Says New Report on Technical Issues Behind the Comprehensive Nuclear Test Ban Treaty," 30 March 2012, http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12849.

125. Ellen D. Williams, chief scientist at BP and chair of the committee that wrote the report: *The Comprehensive Nuclear Test Ban Treaty: Technical Issues for the United States*, http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12849.

Map 2.1: IMS Verification Regime Stations Worldwide (2014)



§2.10 Fissile Material

2.175 **Fissile Material Cut-off Treaty: Conference on Disarmament.** More energy, probably, has been devoted by more policymakers to less practical effect on this issue than any other on the global nuclear non-proliferation and disarmament agenda. In December 1993, the UN General Assembly adopted a resolution recommending "the negotiation in the most appropriate international forum of a ... treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices."[126] The "most appropriate international forum" is the Conference on Disarmament in Geneva. In March 1995, the CD decided, on the recommendation of Special Coordinator Ambassador Gerald E. Shannon of Canada, to establish an ad hoc committee to negotiate a fissile material production ban. The "Shannon Mandate" was based on the General Assembly's 1993 initiating resolution and allowed delegations to raise for consideration any concerns that they had about the appropriate scope of the convention, particularly whether it should encompass existing stocks as well as future production of fissile material.[127] The ad hoc committee process failed, but the Shannon Mandate survived.

2.176 The fifth NPT Review Conference in 1995, in addition to calls for a nuclear-test-ban treaty and progressive global efforts to reduce the size of nuclear arsenals, urged "the immediate commencement and early conclusion" of negotiations on a treaty banning the production of fissile material for nuclear weapons in accordance with the Shannon Mandate.[128] Five years later, the sixth NPT Review Conference urged the CD "to agree on a program of work which includes the immediate commencement of negotiations on such a treaty with a view to their conclusion within five years."[129]

2.177 The CD, however, has not been able to agree on and implement a program of work since the conclusion of nuclear-test-ban treaty negotiations in 1996. There have been protracted disagreements among the P5 over the priority to be given to the four main issues on the CD's forward agenda: nuclear disarmament, an FMCT, the weaponization of space,[130] and negative security assurances. Of these, only fissile material provides for immediate treaty negotiations. Previous efforts to commence FMCT negotiations in the CD have foundered on the issues of the inclusion of existing fissile material stocks, appropriate safeguards measures, verification, and links to parallel negotiations on a nuclear disarmament treaty.[131] In recent years, attention has focused almost exclusively on Pakistan, which has consistently blocked the adoption of a program of work in the CD because it will not agree to FMCT negotiations in the absence of prior agreement to include existing stocks of weapon-grade fissile material, where it believes itself to be at a particular disadvantage relative to India.

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126. A/RES/48/75L (16 December 1993).

127. *The Shannon Mandate*, http://www.fas.org/programs/ssp/nukes/armscontrol/shannon.html.

128. NPT/CONF.1995/32 (Part I), Annex: Principles and Objectives for Nuclear Non-Proliferation and Disarmament, http://disarmament.un.org/wmd/npt/1995dec2.htm.

129. Part 1, Article VI.15, http://www.acronym.org.uk/official-and-govt-documents/2000-npt-review-conference-final-document-13-steps.

130. China, Russia and the United States particularly have been at odds over the need, which the United States does not see, for a new international instrument for the prevention of an arms race in outer space (PAROS).

131. S. Kile, "A ban on production of fissile material for nuclear explosives," *SIPRI Yearbook 1997: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 1997), pp. 387–88; S. Kile, "The fissile material cut-off treaty," *SIPRI Yearbook 2007: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 2007), pp. 506–13; S. Kile, "The fissile material cut-off treaty," *SIPRI Yearbook 2008: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 2008), pp. 361–62.

2.178 Many non-NWS, not just Pakistan, consider that, in addition to banning future production of fissile material for weapons use, the FMCT should address the substantial existing stocks of fissile material held by the nuclear-armed states, particularly Russia and the United States. An FMCT limited to a ban on future production would leave the nuclear-armed states free to use existing fissile material stocks to produce more nuclear weapons, seriously undermining the FMCT's disarmament goals. However, subjecting all existing stocks of fissile material (including in nuclear weapons) to FMCT obligations would require nuclear-armed states joining the FMCT to give up nuclear weapons completely. Such comprehensive coverage of stocks is not realistic at present and insisting on such a provision would rule out what is most likely achievable in the near term – a ban on future production. The stocks issue will nevertheless need to be addressed in the negotiations and the nuclear-armed states are likely to have to give some undertakings on existing stocks.

2.179 One approach may be that states with pre-existing stocks of fissile material outside civil programs agree to progressively submit excess stocks to coverage of the FMCT. ICNND recommended that a phased approach be adopted, with the first priority being 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, ICNND called for all nuclear-armed states to 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 (ICNND Recommendations 22-25).

2.180 At the 2010 NPT Review Conference, all states again agreed that the CD should "immediately begin negotiation of a treaty banning the production of fissile material for use in nuclear weapons or other nuclear explosive devices" and invited the secretary-general of the United Nations to convene a high-level meeting in September 2010 in support of the work of the CD. The ICNND report similarly encouraged all states to negotiate "to an early conclusion" in the CD an FMCT (Recommendation 22). In the interim, all nuclear-armed states should declare or maintain a moratorium on the production of fissile material for weapons purposes (Recommendation 23).

2.181 The CD failed to reach agreement on a work program in 2010 and 2011. In March 2012, the Egyptian President of the CD proposed a draft program of work which called for the establishment of working groups under each of the conference agenda items. The fissile material working group was "to deal with elements of a multilateral treaty banning the production of fissile material" on the basis of the Shannon Mandate.[132] It was clearly hoped that the introduction of slightly less outcome-specific language (that is, the reference to treaty *elements*) might be enough to bring Pakistan to the table; but it wasn't. Pakistan rejected the Egyptian proposal as ambiguous. Pakistan did not want the CD "to become irrelevant but, if forced to choose between national security and the

132. CD/1933/Rev.1 of 14 March 2012.

future of the CD, Pakistan's national security would take priority."[133] Having again failed to adopt a program of work, the CD occupied itself with yet more rounds of inconclusive discussion of "core issues" and concluded its 2012 session on 14 September with nothing to show for it.

2.182 The deadlock continued throughout 2013 with the CD unable to reach consensus on three proposals for a program of work. An informal working group established by the CD in August 2013 met three times but did not result in a program of work for the 2013 session. The CD re-established the informal working group when it resumed in 2014, but the group's and other efforts to develop an acceptable work program again failed. The CD ended its 2014 session, as it has every session since 1996, without making any progress on its substantive agenda.

2.183 **Fissile Material Cut-off Treaty: UN Consideration.** UN Secretary-General Ban Ki-moon convened a High-Level Meeting on Revitalizing the Work of the Conference on Disarmament and Taking Forward Multilateral Disarmament Negotiations on 24 September 2010. In his closing statement, the secretary-general acknowledged "broad concern" about the current state of the UN's disarmament machinery, "in particular the impasse at the Conference on Disarmament, which is hurting its credibility and calling into question its relevance." Failure to fix this "could result in states resorting to alternative arrangements outside the Conference on Disarmament." Ban tasked his Advisory Board on Disarmament Matters to undertake a review of issues raised at the meeting. He said that he would consider further actions based on the board's recommendations, including the establishment of a high-level panel of eminent persons.[134]

2.184 The secretary-general addressed the CD itself in Geneva on 26 January 2011, warning that its record of achievement had been "overshadowed by inertia" and that continued inaction would "endanger its future as a multilateral negotiating forum." He reminded the CD that, at the previous September's high-level meeting in New York, participants had been "unanimous in stressing that limited membership of the Conference on Disarmament is a privilege. So is the consensus rule. Members of the Conference must accept that this privilege comes with responsibility."[135]

2.185 The UN General Assembly met over three days in New York in July 2011 to follow up the 2010 high-level multilateral disarmament meeting. The General Assembly had before it the report of the Secretary-General's Advisory Board on Disarmament Matters which had clearly failed to reach agreement on any particular course of action. The board could recommend only that:

133. "Conference on Disarmament Unable to Reach Consensus on Draft Programme of Work," 15 March 2012, http://www.unog.ch/80256EDD006B9C2E.

134. "Secretary-General's closing statement to High-Level Meeting on Revitalizing the Work of the Conference on Disarmament and Taking Forward Multilateral Disarmament Negotiations," New York, 24 September 2010, http://www.un.org/sg/statements/index.asp?nid=4808.

135. "Secretary-General warns Conference on Disarmament that decade-long deadlock puts its credibility at risk," Geneva, 26 January 2011, http://www.un.org/News/Press/docs/2011/sgsm13367.doc.htm.

- The secretary-general "persist in encouraging the Conference on Disarmament to seek all efforts to achieve a breakthrough to the continuing impasse," possibly by "encouraging progress on a programme of work for the Conference that facilitates work on the four core issues based on the consensus reached in document CD/1864";[136]
- Should a high-level panel of eminent persons be established, the secretary-general should ask it "to make recommendations on ways to revitalize the United Nations disarmament machinery as a whole, especially the Conference on Disarmament"; and
- The secretary-general should "continue to raise public awareness and encourage civil society groups and non-governmental organizations to offer input on ways to overcome the prolonged stalemate."[137]

2.186 The secretary-general expressed his own views more clearly. He saw "no fundamental flaw in the United Nations disarmament machinery that may be blamed for this deadlock, certainly none that cannot be overcome by changes in state policies. The problem lies not with the vehicle, but with the driver. What is needed most of all is a closer alignment between policy priorities and multilateral disarmament goals." He foresaw "no quick fixes" but believed that, if the CD remained deadlocked, the General Assembly had a "responsibility to step in … [T]he CD should not be held perpetually hostage by one or two members."[138]

2.187 The P5 for their part made clear that, its manifest shortcomings notwithstanding, "as the sole standing multilateral disarmament negotiating forum … the CD should maintain the primary role in substantive negotiations on priority questions of disarmament." The P5 reiterated their support for "immediate commencement of negotiations *at the CD* on an FMCT" (emphasis added).[139]

2.188 In December 2011, the UN General Assembly adopted a resolution on a "treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices."[140] The resolution, sponsored by Canada was more ambitious in scope than its predecessors, in that the General Assembly resolved "to consider options" for the negotiation of an FMCT should the CD "fail to agree on and implement a comprehensive program of work by the end of its 2012 session."

2.189 At the 2012 UN General Assembly session, Canada was able to secure passage of a resolution which took that modest next step, with the resolution requesting the secretary-general to seek the views of member states on an FMCT and "to establish a Group of Governmental Experts (GGE) with a membership of 25 states" to "make recommendations on possible elements which could contribute to a treaty." The GGE

136. In 2009 the CD did manage to adopt a program of work (CD/1864) based on the establishment of issue-specific working groups. Pakistan, however, blocked implementation and the program's mandate lapsed at the end of the year.

137. Ban Ki-moon, *Work of the Advisory Board on Disarmament Matters*. Report of the Secretary-General (New York: United Nations, document A/66/125, 11 July 2011).

138. "Secretary-General cites 'growing crisis of confidence' in remarks to General Assembly follow-up to 2010 high-level multilateral disarmament meeting," New York, 27 July 2011, http://www.un.org/News/Press/docs/2011/sgsm13723.doc.htm.

139. Statement by Mr. Gerard Araud, Permanent Representative of France to the United Nations, on behalf of the P5 and in a national capacity, New York, 27 July 2011, http://www.franceonu.org/spip. php?article5694.

140. UN General Assembly Resolution 66/44 (2 December 2011).

would operate by consensus, meet in Geneva for two fortnightly sessions in each of 2014 and 2015, and report back to the General Assembly in 2015. The CD would be invited to "take note" of the report and "consider further action as appropriate."[141]

2.190 The GGE met for the first time in March 2014 and held a second meeting in August 2014. A third session will take place in January 2015, followed by the final session in March 2015. The GGE chair reported to the 2014 UN General Assembly First Committee that the first two GGE meetings had been extremely productive and there was wide agreement that an FMCT should remain a priority.[142] While elaboration of the possible elements of the FMCT may be of some value, the core problem remains that the CD's structure allows any single member to frustrate the general will that exists for negotiation of an FMCT.

2.191 The advantages of negotiating the FMCT in the CD, particularly participation by all of the nuclear-armed states, do not justify indefinite tolerance of the present stand-off. UN member states need to resolve the question whether the CD remains an effective vehicle for FMCT and other disarmament and non-proliferation negotiations and, if necessary, develop alternative arrangements. In this connection, the action the UN General Assembly First Committee has taken to encourage movement on the FMCT could indicate the beginning of a drift of CD issues to the First Committee, a process likely to accelerate if the CD remains deadlocked. The FMCT resolution at the 2014 General Assembly First Committee (A/C.1/69/L.20) welcomed the GGE's work and informal discussions held in the CD on the FMCT, and was adopted by a vote of 173 in favour, 1 against (Pakistan) and 5 abstentions.

2.192 The recommendations by the 2014 NPT PrepCom chair to the 2015 Review Conference chair reaffirmed the importance of the immediate commencement of negotiations at the CD of an FMCT. Pending the conclusion of such negotiations, the moratorium on the production of fissile material for use in nuclear weapons is to be maintained.

2.193 **Fissile Material No Longer Required For Military Purposes.** The 2010 NPT Review Conference encouraged NWS to declare to the IAEA all fissile material "designated by each of them as no longer required for military purposes and to place such material as soon as practicable under IAEA or other relevant international verification" (Action 16). All states were encouraged to support the development of legally binding verification arrangements "to ensure the irreversible removal of fissile material designated by each nuclear-weapon state as no longer required for military purposes" (Action 17).

2.194 The *United States* "has been the most transparent among the" NWS[143] and has made detailed declarations for both its HEU and plutonium stockpiles. The United Kingdom has declared its total fissile material stocks.[144] The other nuclear armed states are yet to make such declarations.

141. UNGA 67 First Committee draft resolution A/C.1/67/L.41, 19 October 2012.
142. Statement by Ambassador Elissa Goldberg, Chair of Group of Governmental Experts, 20 October 2014, http://reachingcriticalwill.org/disarmament-fora/unga/2014/statements.
143. International Panel on Fissile Materials (IPFM), *Global Fissile Material Report 2013*, p. 6, http://fissilematerials.org/library/gfmr13.pdf
144. IPFM, *Global Fissile Material Report 2013*, p. 31.

2.195 While *China*, alone among the five NWS, has not declared an end to the production of fissile material for weapons purposes, it is thought not to have produced such material for more than two decades.[145] It is believed to have ceased production of HEU in 1987 and of plutonium some three years later.[146] Its IPFM-listed uranium enrichment facilities are all designated as civilian.[147] China provides no information on fissile material stocks. It is, however, estimated to have stockpiles of 16 (+/- 4) tonnes of weapon-grade HEU and 1.8 (+/- 0.5) tonnes of weapon-grade plutonium.[148] China has declared no stocks of weapon-grade fissile material in excess of its defence needs.

2.196 *France* stopped all fissile material production for weapons purposes in 1996. It provides no information on total fissile material stocks. France is, however, estimated to have a stockpile of the order of 6 (+/- 1) tonnes of weapon-grade plutonium.[149] There is significant uncertainty about France's current stockpile of military HEU which may be significantly lower than previous estimates of 26 (+/- 6) tonnes of military HEU, possibly in the order of 10 (+/-) 2 tonnes or 6(+/-) 2 tonnes. As of 31 December 2013, France had declared to the IAEA a civilian unirradiated HEU inventory of 1.3 tonnes. [150] France has not declared any fissile material in excess of defence needs.

2.197 By the time the Soviet Union announced in 1989 that it was ceasing the production of HEU, it had already done so. *Russia* has the largest HEU stockpile – an estimated 636 (+/- 120) tonnes unirradiated at the end of 2013 – of any nuclear-armed state.[151] HEU taken from dismantled Russian nuclear weapons was converted to LEU and sold to the United States under the 1993 US–Russia HEU Purchase ("Megatons-to-Megawatts") Agreement. By the program's end in November 2013, a total of 500 tonnes of weapon-grade HEU, an amount equivalent to some 20,000 nuclear weapons, had been eliminated. The down-blended HEU was delivered to the United States, fabricated into nuclear fuel and used in US nuclear power plants. "Nearly half of all commercial nuclear energy produced in the U.S. comes from nuclear fuel derived from Russian nuclear weapons."[152] The program is not subject to verification by the IAEA. It is estimated that Russia's total holdings of HEU had reduced to some 665 tonnes by the end of the blend-down program in 2013, or 636 tonnes excluding HEU in spent naval fuel and civilian use. "At 20 kg per warhead, this would be sufficient for more than 30,000 warheads."[153] In 2012, Russia announced that it was resuming limited production of HEU for naval and fast reactor fuel.[154]

2.198 Russia formally stopped producing weapon-grade plutonium in September 1994, although three plutonium production reactors remained in operation as power providers to the cities of Tomsk and Zheleznogorsk in Siberia. Under the 1997 US–Russia Plutonium Production Reactor Agreement (PPRA), Russia undertook not to use plutonium produced

145. IPFM, *Global Fissile Material Report, 2013*, p. 35.
146. IPFM, *Global Fissile Material Report 2010*, p. 97.
147. IPFM, *Global Fissile Material Report 2013*, p. 24.
148. IPFM, *Global Fissile Material Report 2013*, pp. 13, 21.
149. IPFM, "Countries: France," 4 February 2013, http://fissilematerials.org/countries/france.html.
150. IPFM, *Global Fissile Material Report 2013*, pp. 12, 13; French INFCIRC/549 report as of 31 December 2013.
151. IPFM, *Global Fissile Material Report 2013*, p. 10.
152. "NNSA Announces Elimination of 450 Metric Tons of Russian Weapons Highly Enriched Uranium," *Press Release*, 9 July 2012, http://nnsa.energy.gov/mediaroom/pressreleases/450tons070912.
153. IPFM, *Global Fissile Material Report 2010*, p. 58.
154. IPFM, *Global Fissile Material Report 2013*, p. 3.

in these reactors in its nuclear weapons program.[155] The agreement requires the cessation of weapon-grade plutonium production. The agreement's monitoring provisions ensure that the reactors that are shut down in both countries are not restarted,[156] and that plutonium produced in reactors at Seversk and Zheleznogorsk after 1994 is not used for military purposes.[157] Russia's weapon-grade plutonium stockpile is estimated to be of the order of 128 (+/- 8) tonnes.[158] While Russia does not include its excess military plutonium in its IAEA INFCIRC/549 declarations, it has declared a total of some 50 tonnes of plutonium (37.8 tonnes of which is unirradiated) as surplus to requirements.[159]

2.199 The United States and Russia signed a Plutonium Management and Disposition Agreement (PMDA) in September 2000. The agreement was amended in April 2010 and entered into force in July 2011. Disposition of surplus plutonium is tentatively scheduled to begin in 2018 under IAEA verification. The agreement commits each country to dispose of 34 tonnes of excess weapon-grade plutonium by converting it to mixed oxide (MOX) fuel and using it in nuclear power reactors. Consistent with the assumption that the average Russian and US nuclear warhead contains about 4 kg of plutonium, the US National Nuclear Security Administration (NNSA) estimates that the 68 tonnes of plutonium encompassed in the program would be enough to make 17,000 nuclear weapons.

2.200 The amended PMDA reduces the agreed rate of plutonium disposition from no less than two to no less than 1.3 tonnes per year. It also allows Russia to use the plutonium to fuel fast breeder reactors, which the IPFM considers to be "a controversial strategy as Russia plans to eventually separate the plutonium again to provide start-up fuel for a planned fleet of plutonium breeder reactors."[160]

2.201 The *United Kingdom* announced on 18 April 1995 that it "had ceased the production of fissile material for explosive purposes." In 2006, the United Kingdom declared that, as of 31 March 2002, it had a stockpile of some 21.9 tonnes of HEU, including HEU in spent naval-reactor fuel. The IPFM estimates that, by 2012, perhaps 0.7 tonnes of this HEU had been consumed by nuclear-powered submarines. The balance, 21.2 tonnes of HEU, was thought to include between 10 and 15 tonnes of unirradiated HEU, some of which was likely to have been set aside for naval propulsion. The United Kingdom does not provide details of its military HEU allocations but has declared that, as of the end of 2011, 1.4 tonnes of its HEU is civilian.[161]

2.202 As of 2012, the United Kingdom had a stockpile of 3.2 tonnes of weapon-grade plutonium. The United Kingdom includes excess unirradiated separated military plutonium in its INFCIRC/549 declarations. The United Kingdom has declared 4.4 tonnes of plutonium (including 4.1 tonnes of non-weapon-grade plutonium under European

155. IPFM, *Global Fissile Material Report 2010*, p. 46.
156. NNSA Treaties and Agreements, http://nnsa.energy.gov/aboutus/ourprograms/nonproliferation/treatiesagreements.
157. http://dtirp. dtra.mil/tic/synopses/ppra.aspx.
158. IPFM, *Global Fissile Material Report 2013*, p. 20.
159. IPFM, *Global Fissile Material Report 2013*, p. 80.
160. IPFM, *Global Fissile Material Report 2011*, p. 17.
161. IPFM, *Global Fissile Material Report 2010*, pp. 71–72; *Global Fissile Material Report 2011*, p. 10; IPFM *Global Fissile Material Report 2013*, p. 12.

Atomic Energy Community (EURATOM) safeguards) as excess to military requirements.[162] The UK has not yet begun to dispose of its excess plutonium. It is currently considering a number of options for the disposition of plutonium in civilian use: "continued long term storage (prior to disposal); reuse as fuel followed by disposal; and prompt immobilization and disposal as soon as practicable."[163] The government's current preferred approach is to reuse the plutonium as MOX fuel. A new facility for the disposition of surplus plutonium is, however, still a decade or so away.[164]

2.203 The *United States* stopped producing HEU for nuclear weapons in 1964, although it continued to produce HEU, enriched to more than 96 per cent in uranium-235, for naval propulsion until 1992. In 2006, the United States declared a stockpile, at 30 September 2004, of some 690 tonnes of HEU (including spent naval fuel). By the end of 2013, the figure for unirradiated HEU was estimated to have been reduced to around 475 tonnes, as a consequence of the progressive down-blending of 210 tonnes of HEU declared excess to military requirements for use in the nuclear power industry.[165] In 2012, the United States withdrew 24 tonnes of HEU from its stockpile of material declared excess to military requirements and earmarked for blend down; this material is now reserved for naval fuel.[166]

2.204 The United States includes excess unirradiated military plutonium in its INFCIRC/549 declarations. It has declared a total of 61.5 tonnes of plutonium as excess to military requirements. As of 2013, the United States military stockpile of separated plutonium was 42.6 tonnes, with 44.4 tonnes of separated weapons plutonium having been declared as surplus to military needs.[167] A small amount of the fissile material (HEU and weapon-grade plutonium) designated as excess to military requirements has apparently been placed under IAEA safeguards, but there are no publicly available statistics to confirm this.

2.205 The 1997 US–Russia PPRA requires the cessation of weapon-grade plutonium production. The agreement's monitoring provisions ensure that reactors shut down in both countries are not restarted.[168] In implementation of the Russia–US PMDA, the United States began building a MOX production facility at the Savannah River Site in South Carolina. The US intention was to fabricate the 34 tonnes of excess plutonium it is committed to dispose of under the PMDA into MOX fuel for use in commercial nuclear power reactors. However, long delays and increased costs with the MOX production facility have caused the United States to look at alternative strategies for disposition of this plutonium. US utilities have also been reluctant to commit to using MOX in their reactors.[169] As a result building of the MOX facility has been placed in "cold standby"

162. Albright and Walrond, "Civil Separated Plutonium in the INFCIRC/549 states – Taking Stock"; IPFM, *Global Fissile Material Report 2010*, p. 77; IPFM, *Global Fissile Material Report 2013*, p. 18.

163. UK National Decommissioning Authority, http://www.nda.gov.uk/strategy/nuclearmaterials/plutonium.

164. "U.K. to Mull Case for Plutonium Power Reactor," *Global Security Newswire*, 10 July 2012.

165. IPFM, *Global Fissile Material Report 2010*, p. 28; *Global Fissile Material Report 2011*, p. 9; IPFM, *Global Fissile Material Report 2013*, p. 11.

166. IPFM, *Global Fissile Material Report 2013*, p. 8.

167. IPFM, *Global Fissile Material Report 2013*, pp. 18, 19; and other information from IPFM.

168. NNSA Treaties and Agreements, http://nnsa.energy.gov/aboutus/ourprograms/nonproliferation/treatiesagreements.

169. "Mixed-Oxide Fuel Fabrication Plant and Plutonium Disposition," US Congressional Research Service, 28 March 2014, http://fas.org/sgp/crs/nuke/R43125.pdf.

while other options for disposition of the plutonium are studied.[170] Not all of the excess plutonium is suitable for fabrication into MOX fuel. At least some of this will be sent to a geological repository, the Waste Isolation Pilot Plant in New Mexico, for disposal. Plutonium sent to this plant will not be subject to IAEA monitoring. The IPFM believes this creates "a large uncertainty for any future international attempt to verify U.S. plutonium production and disposition."[171]

2.206 *India* is known to produce HEU and weapon-grade plutonium. Official information on India's fissile material production and holdings is sparse. HEU is thought to be produced mainly for use in India's nuclear submarine propulsion program. IPFM's 2013 report estimates India's HEU stockpile at 2.4 (+/- 0.9) tonnes and its weapon-grade plutonium stockpile at 0.54 (+/- 0.18) tonnes.[172] India has not declared any stocks of weapon-grade fissile material surplus to military needs.

2.207 Like India, *Pakistan* continues to produce fissile material for military purposes. Uncertainties about Pakistan's fissile material production histories and capacities make accurate estimates of its holdings difficult. HEU is produced for use in Pakistan's nuclear weapons program. IPFM's 2013 report estimates Pakistan's stockpile of HEU at 3 (+/- 1.2) tonnes and its weapon-grade plutonium stockpile at 0.15 (+/- 0.05) tonnes.[173] Pakistan has not declared any weapon-grade fissile material as surplus to military needs.

2.208 Little is known about *Israel*'s fissile material production capacities. Israel "may have produced enriched uranium for military purposes in the past."[174] According to the IPFM's 2013 report, Israel's estimated stock of plutonium produced for weapons stands at 0.84 tonnes.[175]

2.209 *North Korea* has a uranium enrichment plant but it is not known whether this plant or a possible second enrichment plant have produced HEU. From September 2013, North Korea appears to have resumed operating its previously disabled reactor at Yongbyon. North Korea is estimated to have produced enough weapon-grade plutonium for 6-10 warheads (see Table 1.2 for further details).

2.210 **Fissile Material Production Facilities.** At the 2010 NPT Review Conference, all states that had not yet done so were encouraged to begin dismantling or converting for peaceful uses their weapon-grade fissile material production facilities (Action 18). *China* produced HEU for weapons at two sites: Lanzhou gaseous diffusion plant (from 1964 to 1980), and Heping gaseous diffusion plant (from 1975 to 1987). China also produced HEU for its research reactors and LEU for naval reactors at these sites. China now produces LEU for civilian purposes at two gas centrifuge enrichment plants at Hanzhong in Shaanxi province and at Lanzhou in Gansu province. China may have doubled the capacity of its indigenous centrifuge plant at Lanzhou.[176]

170. NNSA Budget, http://www.nnsa.energy.gov/aboutus/budget.
171. IPFM, *Global Fissile Material Report 2011*, p. 18.
172. IPFM, *Global Fissile Material Report 2013*, pp. 13, 21.
173. IPFM, *Global Fissile Material Report 2013*, pp. 14, 21.
174. IPFM, *Global Fissile Material Report 2011*, p. 3.
175. IPFM, *Global Fissile Material Report 2013*, p. 20.
176. IPFM, *Global Fissile Material Report 2013*, p. 17.

2.211 China has produced weapon-grade plutonium at two sites: Jiuquan Atomic Energy Complex near Yumen in Gansu province (plutonium production reactor and reprocessing facility), and Guangyuan plutonium production complex in Sichuan province (plutonium production reactor and reprocessing facility). Production of weapon-grade plutonium is believed to have ended at both sites.[177]

2.212 *France*'s weapon-grade fissile material production facilities at Pierrelatte (HEU) and Marcoule (plutonium production reactor) were decommissioned in 1996.[178] In March 2008, President Nicolas Sarkozy invited international experts to observe the dismantlement of those facilities. Several site visits have since taken place.[179] France's Pacific nuclear testing facility was dismantled in 1998.

2.213 Between 1949 and 1963, the *Soviet Union* built four large gaseous diffusion plants for uranium-enrichment. By the early 1990s, all had transitioned to gas centrifuge technology, and all are now designated as civilian facilities. The last operating plutonium production reactor in *Russia* (at Zheleznogorsk) was shut down in April 2010. The Zheleznogorsk reprocessing plant completed reprocessing of the final spent fuel from that reactor in 2012 and has been shut down.[180]

2.214 The *United Kingdom*'s HEU came from two sources: from indigenous production at Capenhurst gaseous diffusion plant; and from the United States, under the 1958 Mutual Defence Agreement. HEU production at Capenhurst ceased in 1962. Thereafter, the plant was used for unsafeguarded LEU production. It closed in 1982 and is now being decommissioned. Most of the UK's weapon-grade plutonium was produced in six plutonium production reactors (the two Windscale Piles and the four Calder Hall reactors) at Sellafield. Four additional dual-use reactors at Chapelcross also produced plutonium for the UK's nuclear weapons program. All reprocessing was done at Sellafield. The Windscale Piles were shut down after a graphite fire in 1957. The Calder Hall reactors were shut down in March 2003 and the Chapelcross reactors in June 2004. Under current decommissioning plans, the reactor structures will be dismantled late in the site clearance process (2041–65 for Windscale, 2105–17 for Calder Hall, 2116–28 for Chapelcross).[181]

2.215 In the *United States*, most HEU was produced at two gaseous diffusion plants, one at Oak Ridge, Tennessee, and the other at Portsmouth, Ohio. Oak Ridge produced HEU for weapons from 1945 to 1964, after which it produced LEU for nuclear fuel until 1985. Portsmouth produced HEU for weapons between 1956 and 1964. Thereafter, it too produced mainly LEU for nuclear power plants. Portsmouth also produced some HEU for naval reactors until 1992 "when huge quantities of excess weapon-grade HEU … became available from the first post-Cold War downsizing of the U.S. weapons stockpile. Future U.S. naval reactors are being designed to be fueled with this uranium."[182] The demolition of Oak Ridge is in progress. The US Department of Energy awarded a contract for decontamination and decommissioning of Portsmouth in August 2010.

177. IPFM, *Global Fissile Material Report 2010*, pp. 98–103.

178. IPFM, *Reducing and Eliminating Nuclear Weapons: Country Perspectives on the Challenges to Nuclear Disarmament* (2010); *Global Fissile Material Report 2008: Scope and Verification of a Fissile Material (Cutoff) Treaty* (2008); www.fissilematerials.org.

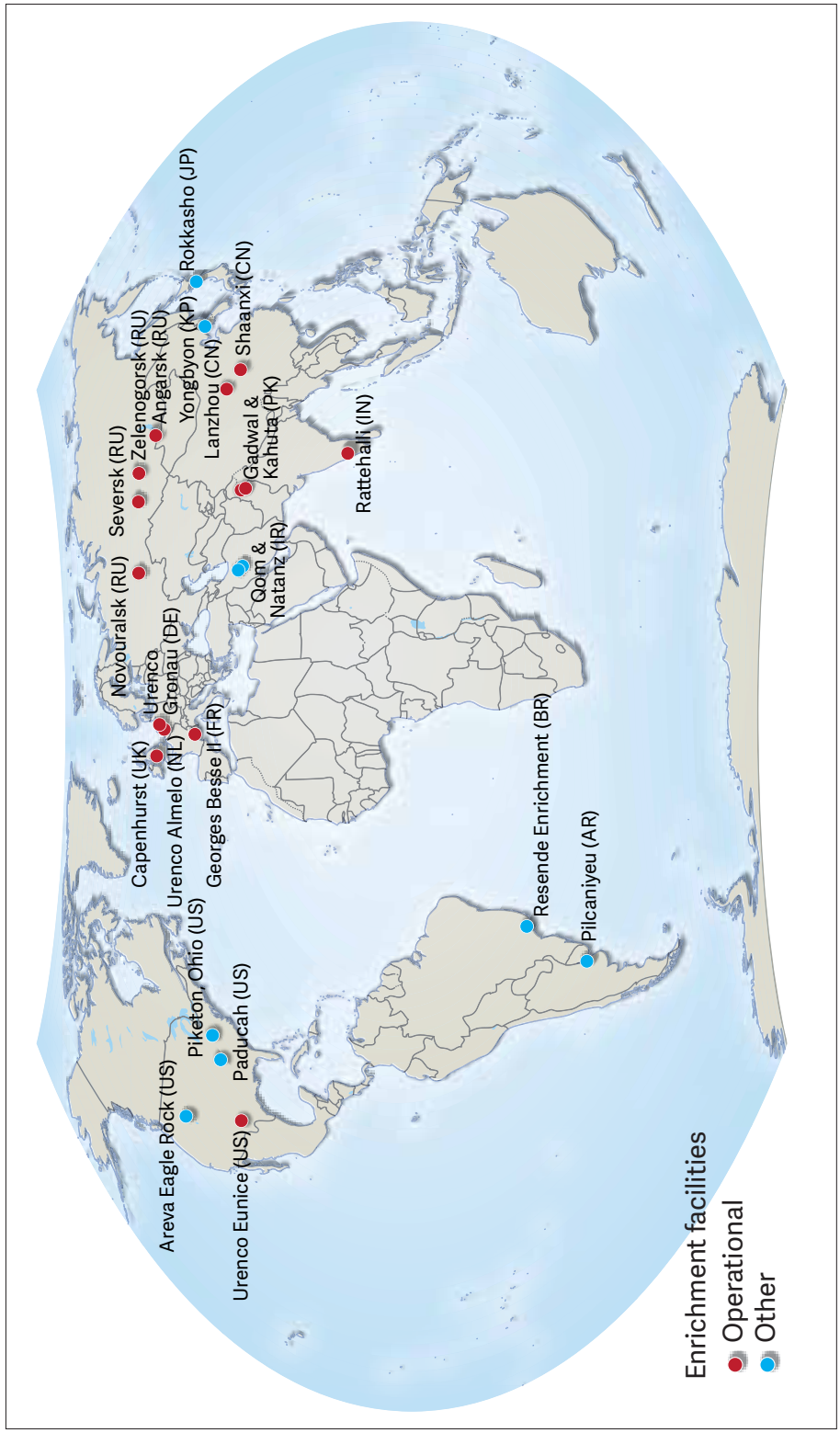
179. IPFM, *Global Fissile Material Report 2010*, p. 85.

180. IPFM, *Global Fissile Material Report 2013*, p. 20.

181. IPFM, *Global Fissile Material Report 2010*, pp. 72, 76, 83; *Global Fissile Material Report 2011*, p. 10.

182. Frank von Hippel, "Consistency Tests for the Declarations of U.S. Fissile Material Production," *Science & Global Security* 19:1 (2011).

Map 2.2: Enrichment (2014)



Map 2.3: Reprocessing (2014)

2.216 At its fissile-material-producing peak, the United States operated a total of fourteen plutonium production reactors: nine at the US Department of Energy's Hanford site in Washington state, and five at its Savannah River site in South Carolina. Nine were shut down in the 1960s, while five continued into the 1980s, producing tritium for use in "boost" gas to increase the yield of fission triggers in nuclear weapons. The remaining reactors were finally shut down in 1987. The United States has begun decommissioning the five heavy-water plutonium production reactors at Savannah River. Six of the nine reactors at Hanford have been "cocooned" – partially taken apart with their cores encased to prevent the leakage of radiation. Two more are to follow, and the remaining reactor has been turned into a museum.[183]

2.217 *India* is significantly increasing its fissile material production capacities. The existing centrifuge enrichment plant in Rattenhalli, Mysore is understood to have been improved and expanded in recent years. A second enrichment complex is being constructed in the Chitradurga district which, like Rattenhalli, will be unsafeguarded, leaving open the possibility of its use to produce HEU for weapons. India has produced weapon-grade plutonium in two reactors, CIRUS and Dhruva. The CIRUS reactor, which produced the plutonium used in India's first nuclear test in 1974, was shut down in December 2010 after 50 years of operation. India plans to build two new plutonium production reactors.[184] A new reprocessing plant at Tarapur was inaugurated in January 2011, adding to India's three existing reprocessing plants: Trombay at Mumbai, an existing plant at Tarapur and KARP at Kalpakkam. Further reprocessing plants are under construction or planned, including to provide fuel for planned fast breeder reactors. India's prototype fast breeder reactors could produce more than 100 kg of weapon-grade plutonium per year if used for this purpose, significantly increasing India's weapon-grade plutonium production capacity.[185]

2.218 *Pakistan* is understood to have been using gas centrifuges to produce weapon-grade HEU since the early 1980s, and to have had a functioning plutonium production reactor since the late 1990s. Pakistan produces HEU for nuclear weapons at its Kahuta centrifuge enrichment plant. A possible additional enrichment plant may be operating at Gadwal. Pakistan is substantially expanding its capacity to produce weapon-grade plutonium. Two production reactors are operating at Khushab, the first since 1998 and the second since late 2009 or early 2010. A third production reactor at Khushab appears to have begun operating early in 2013, and a fourth production reactor at Khushab is likely to be completed around mid-2015.[186] Reprocessing is carried out at the New Laboratories Reprocessing Facility near Rawalpindi which has been operating since 2000. Construction of the larger capacity Chashma reprocessing facility at the Kundian nuclear complex is underway or may have been completed.[187]

183. IPFM, *Global Fissile Material Report 2010*, pp. 28–30; Mukhatzhanova, *2010 NPT Review Conference Disarmament Actions: Monitoring Report*, p. 60.

184. IPFM, *Global Fissile Material Report 2013*, p. 21.

185. IPFM, *Global Fissile Material Report 2011*, pp. 10-11, 19, 23; IPFM, *Global Fissile Material Report 2013*, p. 21.

186. Zia Mian, "Pakistan begins operating third Khushab plutonium production reactor," IPFM Blog, 30 June 2014, http://fissilematerials.org/blog/2014/06/pakistan_begins_operating.html. IPFM, *Global Fissile Material Report 2011*, pp. 11, 19; IPFM, *Global Fissile Material Report 2013*, p. 21.

187. NTI Country Profiles/Pakistan/Facilities/Nuclear, http://www.nti.org/country-profiles/pakistan/facilities/.

2.219 *Israel* is widely assumed to have produced plutonium for nuclear weapons at its Dimona reactor and to have reprocessed spent fuel from Dimona at a facility in the Negev Nuclear Research Center. The Dimona reactor has operated since 1963.[188]

2.220 *North Korea* has produced weapon-grade plutonium at the Yongbyon 5MWe reactor and reprocessed spent fuel from the reactor at its Yongbyon reprocessing plant. The 5MWe reactor's cooling tower was destroyed in 2008 as part of a six-party talks agreement but North Korea appears to have resumed operating the reactor in September 2013, but the reactor may have been shut down in 2014 for remodelling. The Yongbyon reprocessing plant is understood to be on standby but not currently operating. North Korea is constructing a light water reactor at Yongbyon which as of October 2014 was not operational. Light water reactors are not typically used for weapons plutonium production but can be used for this purpose, giving rise to concern that the light water reactor could substantially increase North Korea's capacity to produce weapon-grade plutonium. In 2010, North Korea revealed at Yongbyon its only known enrichment plant, which it claimed was intended to produce LEU fuel for the light water reactor under construction. North Korea is believed to be operating the Yongbyon enrichment plant and significantly expanding it.[189] According to South Korean media reports, North Korea has completed and is operating a new centrifuge enrichment facility at Yongbyon.[190]

188. NTI Country Profiles/Israel/Facilities/Nuclear, http://www.nti.org/country-profiles/israel/facilities/.

189. David Albright and Serena Kelleher-Vergantini, "Yongbyon: Centrifuge Enrichment Plant Expands while 5 MWe Reactor is Possibly Shut Down," 3 October 2014.

190. "New North Korea nuclear facility could boost weapons fuel: report," *Reuters*, 5 November 2014, http://uk.reuters.com/article/2014/11/05/uk-northkorea-nuclear-idUKKBN0IP0A420141105.

3. NUCLEAR SECURITY

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§3.1 Overview

3.1 "Nuclear security" means measures designed to address the risks associated with theft and trafficking in nuclear and radiological materials (including for the benefit of would-be proliferators), sabotage of nuclear facilities, and the danger of terrorists acquiring and using a nuclear weapon. Despite recent advances global nuclear security is inadequate. Because a major nuclear security incident would have far-reaching consequences worldwide, effective nuclear security must be a global concern. But most countries regard nuclear security as primarily a national concern, devoting insufficient attention to the development, promotion and application of international standards.

3.2 The nuclear security regime consists of agreements, regulations, resolutions and guidelines that either existed or were close to being finalized before 2010. Further progress has been made in national implementation since leaders' level biennial Nuclear Security Summits (NSS), of which three have been held (in Washington DC 2010, Seoul 2012, The Hague 2014) and a fourth is scheduled (Chicago 2016). However in late 2014 Russia announced it would not be attending the Chicago summit, dampening prospects for a meaningful outcome. National ratifications of treaties and several projects were accelerated so that they could be announced at the summits. But nuclear security still lags well behind the other nuclear regimes for safety, safeguards and arms control. The current regime is reliant almost entirely on national protection and control systems in those countries that possess nuclear and radiological materials. It also suffers from a critical omission: it does not cover nuclear materials (plutonium and HEU) under military control. The regime needs to be comprehensive, integrated, reinforced through effective monitoring requirements and mechanisms, and backed by authority, procedures and institutions for enforcing agreed commitments.

3.3 **Global Nuclear Security Architecture**. Globally, nuclear security is less well developed than nuclear safeguards and nuclear safety. The three main elements of the nuclear security regime are national laws and regulations; international agreements, instruments and institutions; and ad hoc and voluntary cooperative measures. The main global components are: The Convention on the Physical Protection of Nuclear Material (CPPNM) (1980) which applies primarily to the protection of nuclear material in international transport; the CPPNM Amendment (2005) which extends the convention's application to protection of nuclear material in domestic use and of facilities against sabotage; the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT); United Nations Security Council Resolution (UNSCR) 1540 (28 April 2004); IAEA guidance documents like INFCIRC/225/Rev.5, the Fundamental Principles of Physical Protection of Nuclear Material and Nuclear Facilities, and INFCIRC/153; and various multilateral, regional and bilateral agreements and initiatives.

3.4 The need for effective nuclear security has been widely recognized. The Final Document of the eighth NPT Review Conference (2010) noted "the paramount importance of effective physical protection of all nuclear material and the need for strengthened international cooperation in physical protection," and supported nuclear security improvements. Three NSS have been held so far, on 12–13 April 2010 in Washington, DC, 26–27 March 2012 in Seoul, and 24-25 March 2014 at The Hague. Nuclear security was an important issue for the International Commission on Nuclear Non-Proliferation and Disarmament (ICNND), with its 2009 report including a number of recommendations on strengthening the international regime (ICNND Recommendations 27–31).

3.5 The CPPNM has 151 states parties, which means that nearly one-quarter of the world's states have still not acceded to it. By December 2014, only 83 of the 101 accessions needed for the 2005 amendment to enter into force had been received. The long delay with entry into force of the CPPNM amendment is starkly at odds with continued international concern about nuclear security standards.

3.6 The Nuclear Security Series are International Atomic Energy Agency (IAEA) publications "relating to the prevention and detection of, and response to, theft, sabotage, unauthorized access and illegal transfer or other malicious acts involving nuclear material and other radioactive substances and their associated facilities." They embrace such fields as nuclear security fundamentals, recommendations, implementing guides and technical guidance. In the series, INFCIRC/225/Rev.5, a set of non-legally-binding guidelines, is the cornerstone of the international physical protection regime for nuclear materials and facilities and has been incorporated into the domestic law of many states. Effective nuclear security demands that all nuclear suppliers include the INFCIRC/225 condition (and a requirement that recipients be party to the CPPNM) in their bilateral nuclear supply agreements.

3.7 ICSANT is an important legally binding multilateral instrument establishing obligations to take domestic measures to prevent and punish nuclear terrorism and strengthen international cooperation in this area. The convention came into effect in 2007 but remains far from universal. A total of 115 nations have signed and 99 have ratified the convention to date.

3.8 UNSCR 1540, passed by the UN Security Council to counter the dangers of nuclear terrorism by improving and enhancing international cooperation on nuclear security, has resulted in some significant progress but has yet to be fully implemented.

3.9 The Code of Conduct on the Safety and Security of Radioactive Sources, approved by the IAEA Board of Governors in 2003 with a supplement approved in 2004, established detailed, non-legally binding guidance on international best-practice standards to prevent the misuse of radioactive sources including for "dirty bombs." By December 2014, 123 states had expressed support for the Code of Conduct and 63 countries supported all aspects of the supplementary guidance as well. Continued regional and global assistance to states requiring it is vital to the effective control of radioactive sources.

3.10 Global cooperation mechanisms have made an important contribution to improving nuclear security, particularly those launched in the post-Cold War period to reduce the risk of leakage of nuclear and radioactive materials, technology and expertise from the former Soviet republics. Among the most successful and effective is the Cooperative Threat Reduction (CTR or Nunn-Lugar) program. In October 2012, Russia announced that it would let the program expire in May 2013 because it no longer needs foreign assistance and has concerns about nuclear security information being leaked. Russia–US nuclear security cooperation suffered further setbacks in the wake of the 2014 Ukraine crisis, although they seemed to have continued working together at a "programmatic level." Another initiative to have made a significant contribution to nuclear security is the $20 billion Global Partnership of the Group of Eight (G8) countries. The G8 Global Partnership's mandate was to expire in 2012 but has been extended until 2022. The Global Initiative to Combat Nuclear Terrorism (GICNT), set up by Russia and the United States in 2006, had by December 2014 expanded its membership to include 85 countries plus 4 observers.

> *Overall Evaluation of Global Nuclear Architecture.* **Some Progress.** States have implemented many NSS commitments, additional states have ratified the CPPNM and its Amendment, more are taking advantage of IAEA tools and services, and states have cooperated with one another. However, NPT 2010 and ICNND 2009-recommended support for universal application of the CPPNM and early entry-into-force through the requisite number of ratifications of the 2005 amendment is not in sight. Much of the architecture lacks any means to judge whether commitments are being met and no sensitive nuclear materials held anywhere for military purposes – about 85 per cent of the total – are subject to international standards or assurance.

3.11 **Role of the IAEA.** The IAEA's lead role in strengthening international nuclear security – in particular through the services and assistance it provides under the Nuclear Security Plan for 2014–17, the fourth plan of its kind – is not reflected in the funding available for the agency's nuclear security work which, as well as being insufficient, is not guaranteed because it overwhelmingly comes from voluntary contributions. In addition to the funding issue, further consideration is needed on whether the IAEA's authority and responsibilities in the nuclear security area should be expanded.

Overall Evaluation for the Role of the IAEA. **Some Progress.** The IAEA is providing a wide range of advisory services and other assistance on nuclear security issues. The centrality of the IAEA's role makes a predictable and stable budget for nuclear security essential.

3.12 **International Cooperation.** In 2011 the IAEA published a reference text on computer security at nuclear facilities and several countries and organizations have held workshops and other events on this subject. A total of 125 states have joined the Incident and Trafficking Database (ITDB). International cooperation such as the US Megaports Initiative is providing training, technical assistance and equipment to strengthen detection and interdiction capabilities. But the historical bias towards national secrecy and sovereignty on nuclear security continues to result in inadequate transparency and accountability, notwithstanding the global consequences of vulnerability. This is reflected in insufficient international cooperation on developing and implementing nuclear security best practice, although it is demonstrably possible to develop and share such practices consistent with the confidentiality of commercially or militarily sensitive information.

Overall Evaluation for International Cooperation. **Some Progress.** Significant international cooperation is taking place on detecting and thwarting illicit trafficking, but this needs to be expanded as gaps are identified. States need to commit more fully to cooperation in developing and sharing nuclear security best practices. The 2014 NSS built on earlier progress, but Russia's subsequent decision not to attend the next NSS in 2016, and uncertainties over the future of US–Russia nuclear security cooperation, are potentially serious setbacks.

3.13 **National Nuclear Security Regulations.** As of May 2014, nearly 90 per cent of UN member states had submitted national reports on measures taken or planned in implementation of UN Security Council Resolution 1540. However, many national reports lack detail, and many states have not responded to requests by the 1540 Committee for further information. Continued provision of assistance to states requiring it is essential.

Overall Evaluation for National Nuclear Security Regulations. **Significant Progress.** UNSCR 1540 has played a significant role in this area, resulting in a substantial increase in the number of states with legislative measures to prohibit proliferation of nuclear weapons. But more needs to be done in national implementation.

3.14 **Sensitive Nuclear Materials: Civilian and Military.** With civilian uses, progress continues to be made on global efforts to eliminate excess weapon-grade plutonium and to shift from highly enriched uranium (HEU) to low enriched uranium (LEU). The industrialized countries have assisted many others in HEU to LEU conversion efforts, but

there has been a reluctance to ban outright HEU use in civilian applications. As to non-civilian uses, the United States and Russia have committed to the elimination of significant quantities of excess weapon-grade plutonium and in December 2013, completed the conversion of 500 tonnes of Russian HEU to LEU. But no sensitive nuclear materials held anywhere for military purposes are subject to any international standards or assurance, for example IAEA nuclear security guidelines or the CPPNM and its 2005 Amendment. These materials are also not subject to international best-practice exchanges, information sharing, peer review, or other voluntary mechanisms to build confidence in the effectiveness of their security (except in cases where some bilateral cooperation has occurred between the United States and Russia). Security Council Resolution 1540 is more comprehensive in the sense that it obliges states to secure both civil and military-origin materials that could be acquired by non-state actors for use in nuclear, chemical or biological weapons. But Resolution 1540 lacks an effective monitoring mechanism; while states are obliged to report to the 1540 Committee on the steps they are taking to implement the resolution, the national reports are patchy, international oversight is weak, and compliance is encouraged rather than enforced.

> *Overall Evaluation for Sensitive Nuclear Materials: Civilian and Military.* **Some Progress.** While progress is being made on of minimization of civil HEU use, states have been reluctant to ban HEU use in civilian applications. With the partial exception of UNSCR 1540, aimed at securing against access by non-state actors, and some US-Russia bilateral cooperation, no sensitive nuclear materials held anywhere for military purposes are subject to any international standards or assurance.

3.15 **Nuclear Forensics.** Nuclear forensics needs to continue to develop and expand with the aim of increasing its capacity to provide information on the source, production and history of nuclear material outside regulatory control. The IAEA in particular has published descriptions of nuclear forensics tools and procedures and provided training to states on this.

> *Overall Evaluation for Nuclear Forensics.* **Some Progress.** In addition to significant work going on at the national level in some countries, the IAEA continues to provide assistance with building nuclear forensics capacity in member states, both through its own activities and by teaming with member states to hold workshops and other training.

3.16 **Role of Nuclear Industry.** The shared responsibility for nuclear security between state authorities and the nuclear industry has been recognized, including at the three NSS. But implementation of public–private sector cooperation to strengthen nuclear security is not significant. The World Institute for Nuclear Security (WINS) has been leading an important industry training initiative, but much more work is needed in this area.

Overall Evaluation for Role of Nuclear Industry. **Minimal Progress.** There is general understanding that effective nuclear security is strongly in the interests of the nuclear industry. More work is needed on identifying practical ways the nuclear industry and state authorities can work together to improve nuclear security.

3.17 **Nuclear Security and Safety Interface.** The interface between nuclear safety and security has been recognized by the NSS. The overlaps between nuclear safety and security need to be fully reflected in the regulation, design and operation of nuclear facilities, including in risk assessments and training.

Overall Evaluation for Nuclear Security and Safety Interface. **Some Progress.** The IAEA in cooperation with member states is providing training and other assistance in this area. A number of training centres have been established which emphasize an integrated approach to nuclear safeguards, safety and security.

3.18 **Nuclear Security Culture.** In the absence of universal, binding nuclear security standards and adequate transparency and accountability mechanisms, a robust nuclear security culture is critical. The IAEA organizes training activities and workshops based on findings from the work of advisory missions. Its International Physical Protection Advisory Service (IPPAS) is particularly noteworthy in helping states to develop and improve national nuclear security on request.

Overall Evaluation for Nuclear Security Culture. **Some Progress.** Increasing organizational activity suggests some progress here. However, the extent to which a genuine nuclear security culture exists is unclear because of the lack of monitoring and reporting on whether states are implementing best practice standards and recommendations.

§3.2 Objectives and General Strategy

3.19 Nuclear disarmament, nuclear non-proliferation and peaceful uses of nuclear energy are the three main pillars of the NPT regime. Particularly since the terrorist attacks of 11 September 2001 (9/11), nuclear security concerns have been heightened owing to several developments: fears that terrorist groups with cadres of suicide bombers not deterred by the thought of their own deaths are interested in acquiring radioactive and fissile material or in attacking nuclear facilities; revelations of illicit trafficking in nuclear materials, components and technology; unresolved security vulnerabilities at nuclear facilities in Russia and some other former Soviet republics; and several nuclear security incidents in recent times (see Box 3.1).

Box 3.1: Nuclear and Radiological Security Incidents (1998–2014)

According to the IAEA, between 1993 and 2014, there were more than 2,470 cases of illegal trafficking, theft, or loss of nuclear and radiological materials around the world, 16 of which involved unauthorized possession of HEU or plutonium.[1] Five of the seven most recent cases of unauthorized HEU possession occurred in the Black Sea region.[2] Some of the incidents worldwide include:[3]

- In 1998, insiders at a Russian nuclear weapons facility were discovered trying to steal 18 kg of HEU;
- In 2006, Russian citizen Oleg Khinsagov was arrested in Georgia with 100 grams of HEU, attempting to find a buyer for several kilograms of HEU;
- On 8 November 2007, two groups of armed men broke into South Africa's Pelindaba nuclear research facility outside Pretoria from two different directions, deactivated several layers of security, penetrated into the control room for 45 minutes and escaped but without taking any nuclear material. The site is believed to store enough weapon-grade HEU for up to 25 nuclear bombs,[4] held in "locked-down" secure conditions;
- In April 2012, another violation of protective measures at the Pelindaba facility was described as an act of "common" criminality. The national nuclear regulator spokesperson Gino Moonsamy was quoted as saying that thanks to "adequate physical protection, no nuclear or radioactive material was accessed, lost or stolen";[5]
- In May 2008, nuclear bombs were despatched from a North Dakota base without proper controls; three US Defense Threat Reduction Agency staff were dismissed;
- In 2009, about 100 grams of HEU, lodged inside a nuclear fission chamber that likely came from a decommissioned Soviet nuclear facility, was recovered from a scrap metal yard in Rotterdam;
- In November 2010, Belgian activists evaded NATO guards to expose security weaknesses at a base in Kleine Brogel where nuclear weapons are kept;
- In 2011, Moldavian authorities arrested six people for smuggling 4.4 grams of weapon-grade uranium. They had plotted to sell up to 9 kg for $31 million. The Russian ringleader is still at large;

1. 2014 Fact Sheet, IAEA Incident and Trafficking Database, http://www-ns.iaea.org/security/itdb.asp.
2. Lyudmila Zaitseva and Friedrich Steinhäusler, "Nuclear Trafficking Issues in the Black Sea Region," Non-Proliferation Paper No. 39 (EU Non-Proliferation Consortium, April 2014), p. 1.
3. Peter Goodspeed, "Ongoing nuclear threat looms over Seoul summit," *National Post* (Toronto), 24 March 2012; Jonathan Tirone, "Missing nukes fuel terror concern as Obama drawn to Seoul," *Bloomberg News*, 23 March 2012, http://www.bloomberg.com/news/2012-03-22/missing-nukes-fuel-terror-concern-as-seoul-meeting-draws-obama.html, "Another infiltration reported at South African atomic site," *Global Security Newswire*, 13 July 2012, http://www.nti.org/gsn/article/new-infiltration-reported-south-african-atomic-plant.
4. Goodspeed, "Ongoing nuclear threat looms over Seoul summit."
5. "Another infiltration reported at South African atomic site," *Global Security Newswire*, 13 July 2012.

- Serial attacks have done little to dispel international fears over "the risk of terrorists breaching Pakistan's defences."[6] Just before dawn on 16 August 2012, several gunmen wearing military uniforms and suicide vests attacked the Minhas base of the Pakistan Air Force in Kamra, about 60 km northwest of Islamabad.[7] In September 2012, the Inter-Services Intelligence (ISI) reportedly intercepted plans by the Tehreek-e-Taliban Pakistan (TTP) to attack one of the country's largest nuclear facilities in Dera Ghazi Khan in what a military officer described as "the first-ever serious security threat" from the TTP;[8]
- On 13 August 2013, a plutonium-beryllium neutron source was stolen from storage at Tabriz University in Iran; a preliminary investigation indicated that it had been removed from its shielding;
- In December 2013, thieves in Mexico stole a truck that was transporting a device containing cobalt-60 to a disposal centre. The thieves were arrested and the device recovered;
- Also in 2013, another cobalt-60 source (known as a "gamma knife") was reported missing in Canada and has not been recovered.

These incidents show the urgent need to raise international nuclear security standards.

3.20 It is possible to interpret these in either of two contradictory ways. The first is to argue that the catalogue is unnecessarily alarmist and exaggerates and magnifies the importance of the incidents: none of them has actually led to anything consequential. The alternative conclusion is that significant risks are inherent in this sphere and that the authorities have to be vigilant and succeed in preventing theft and attacks every single time.

3.21 Like the list of incidents involving temporary loss of secure control over nuclear weapons in storage or during transport, accidental or false reports of incoming attacks, and the like, the truth is that so far, no such alarms have resulted in a major incident, let alone a catastrophe. Unfortunately, however, this is no guarantee of the good luck holding always and forever. After all, the boy who cried wolf did indeed get killed and eaten by a wolf.

3.22 The working definition of nuclear security used by the IAEA since 2003 is: "The prevention and detection of and response to theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities."[9] A comprehensive definition of nuclear security would include regimes and protection, control and enforcement measures:

6. Banyan, "Nuclear profusion," *The Economist*, 25 August 2012.
7. "Gunmen storm military air base in Pakistan," *BBC News*, 16 August 2012, http://www.bbc.co.uk/news/world-asia-19278302.
8. Abdul Manan, "Taliban threat: Nuclear site in DG Khan cordoned off," *The Express Tribune*, 6 September 2012, http://tribune.com.pk/story/432295/taliban-threat-nuclear-site-in-dg-khan-cordoned-off/.
9. IAEA, *Nuclear Security Plan 2010–2013*, document GOV/2009/54-GC(53)/18 (17 August 2009), p. 1 n2.

- To prevent, detect and respond to acts of nuclear terrorism using fissile material and radiological sources, illicit transfers or thefts of fissile material and radiological sources, and sabotage of nuclear and radiological facilities;
- To promote a nuclear security culture; and
- To strengthen a comprehensive, integrated and global regime as well as a suite of national laws, agreements, instruments and systems to this end.

3.23 In his speech in Prague on 5 April 2009 in which he outlined his dream of a world free of nuclear weapons, US President Barack Obama also announced the start of "a new international effort to secure all vulnerable nuclear material around the world within four years."[10] The justification was to reduce the risk of nuclear terrorism, which the president described as both the most immediate and the most extreme threat to global security.

3.24 Nuclear terrorism is defined in Article 2 of ICSANT as the making, demanding, possession, use, or threat of use of radioactive material or device by any person with the intent to cause death or serious bodily injury; cause substantial damage to property or the environment; or to compel a person, legal entity or international organization to do or refrain from doing an act.[11]

3.25 While "defense against terrorism must succeed every time … 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."[12] Although a successful act of nuclear terrorism remains difficult for terrorists, the potential consequences are such that it must be treated as a serious threat.

3.26 Several regimes have been refined and additional ones promulgated to treat nuclear terrorism as a matter subject both to domestic and to international law, to outlaw it, to require states to use and, if necessary, strengthen domestic legal systems to fight nuclear terrorism, to use international law as a basis and the United Nations as a key forum for international collaboration and action to meet the threat of nuclear terrorism, and in other ways to encourage and facilitate interstate cooperation in meeting the challenge. However, the development and widespread adoption of international best practice in nuclear security culture is inhibited by concerns over national sovereignty if multilateral standards are made more stringent and international institutions are given an expanded remit to monitor compliance.

3.27 As distilled from the sources described below, the objective of nuclear security is to ensure that nuclear weapons and materials are secure from unauthorized access and theft, the facilities in which nuclear weapons and radioactive material are manufactured and stored are secure from sabotage, and terrorists and criminals are prevented from acquiring, making and using nuclear explosive devices.

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10. *Remarks by President Barack Obama, Hradčany Square, Prague, 5 April 2009* (Washington DC: White House, Office of the Press Secretary, 2009), http://www.whitehouse.gov/video/The-President-in-Prague#transcript.
11. http://untreaty.un.org/cod/avl/ha/icsant/icsant.html.
12. Michael Levi, quoted in International Commission on Nuclear Non-Proliferation and Disarmament (ICNND), *Eliminating Nuclear Threats: A Practical Agenda for Global Policymakers* (Canberra and Tokyo: ICNND, 2009), p. 47, paragraph 4.26.

3.28 The strategies for ensuring nuclear security may be described as:

- To protect nuclear facilities, weapons and material against theft and sabotage by:
  - minimizing the number of locations at which nuclear weapons and fissile materials are stored;
  - strengthening security at all locations;
  - encouraging the switch from highly enriched uranium (HEU) to low enriched uranium (LEU);
  - reducing the size of global nuclear weapons and fissile materials inventories; and
  - bringing all remaining excess military and civilian stockpiles of fissile materials under international monitoring;
- To prevent, detect and respond to the theft and sabotage of nuclear material during international transport;
- To prevent, detect and respond to any illicit trafficking in nuclear material;
- To prevent, detect and respond to acts of terrorism using nuclear material and radiological sources;
- To promote the adoption of rigorous and reliable nuclear and radiological material and inventory control systems;
- To strengthen the nuclear security regime of national laws and regulations, bilateral and multilateral agreements, UN resolutions and international guidelines in order to fully and effectively implement the above strategies.

3.29 These descriptions are derived from the outcomes of the three Nuclear Security Summits (NSS) held in Washington (2010), Seoul (2012) and The Hague (2014); the outcomes document of the eighth NPT Review Conference (2010); and the ICNND report (2009). The NSS, a fourth and probably last of which is planned for 2016 in Chicago, have been convened to strengthen, consolidate, elevate and energize the many existing national, multilateral and cooperative institutions and structures to ensure nuclear security and prevent nuclear smuggling. They are important for having affirmed US presidential leadership on this critical area of the nuclear challenge and for elevating the issue to the level of a global leaders' summit.

3.30 In January 2014 the Nuclear Threat Initiative (NTI) published a second edition of its benchmark study, *The Nuclear Materials Security Index*.[13] Based on five categories (quantities and sites, security and control measures, global norms, domestic commitments and capability, and risk environment), subdivided further into 19 indicators that went beyond "guns, guards and gates" and also beyond nuclear materials control and accountancy practices, the study concluded that although states are making progress in securing materials and strengthening global security:

- The existing legal foundation for global nuclear security remains weak;
- Participation in international peer review is still limited; and, above all

13. *NTI Nuclear Materials Security Index: Building a Framework for Assurance, Accountability, and Action, Second Edition* (Washington DC: Nuclear Threat Initiative, January 2014).

- 85 per cent of global stocks of weapon-usable nuclear materials remain in military programs and, as such, outside and beyond existing international nuclear security mechanisms.

3.31 The NTI Index Second Edition was complemented by an Arms Control Association and Partnership for Global Security assessment of progress made on 13 joint statements that had been presented two years earlier at the 2012 NSS.[14] Joint Statements are ad-hoc, voluntary agreements by self-selected groups of participating countries to make improvements in priority areas of fissile materials security, from collaboration on technical processes to improving national legislation and implementing best practices. At the 2012 NSS, 42 of the 53 participant countries signed at least one joint statement.

§3.3 Global Nuclear Security Architecture

3.32 The three main elements of the nuclear security regime, addressed in sequence below, are international agreements, instruments and institutions; ad hoc and voluntary cooperative measures; and national laws and regulations. The three NSS to date have reaffirmed the international treaties, instruments and institutions that backstop national efforts to strengthen nuclear security and prevent nuclear terrorism. But all three summits took care to reaffirm the rights of states to develop and utilize nuclear energy for peaceful purposes and that measures to strengthen nuclear security must not hamper these rights.

3.33 At the 2010, 2012 and 2014 NSS the leaders accepted that all states are responsible for ensuring the security of nuclear materials and facilities under their control, to seek assistance from others if necessary and to provide assistance to others if asked. The leaders have used the summits to renew their commitment to ensure that nuclear materials under their national control are not lost through theft or diversion, evaluate the threat and improve security as required on a continuing basis, and to share information and exchange best practices to these ends.

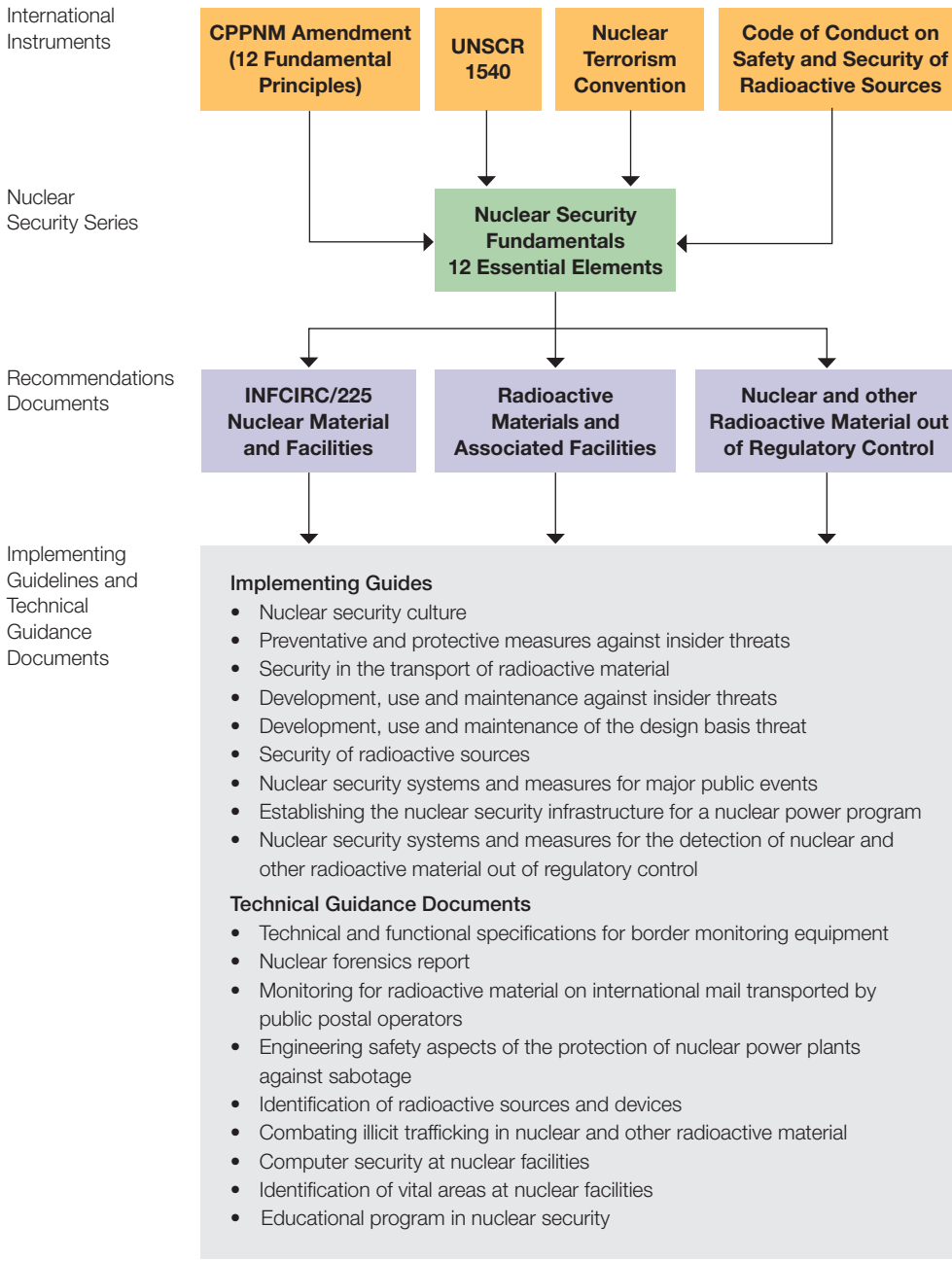
3.34 The main global components of the nuclear security regime, discussed in detail in the following sections, are:

- The Convention on the Physical Protection of Nuclear Material (CPPNM) which applies primarily to the protection of nuclear material in international transport, together with the CPPNM Amendment which extends the convention's application to protection of nuclear material in domestic use and of facilities against sabotage;
- International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT);
- United Nations Security Council Resolution (UNSCR) 1540;
- IAEA guidance documents like INFCIRC/225/Rev.5; the Fundamental Principles of Physical Protection of Nuclear Material and Nuclear Facilities; and INFCIRC/153; and
- Various multilateral, regional and bilateral agreements and initiatives,[15] in particular the successor to the Cooperative Threat Reduction (CTR or Nunn-Lugar) program, the Global Partnership of the Group of Eight (G8) countries, and the Global Initiative to Combat Nuclear Terrorism (GICNT).

14. Michelle Cann, Kelsey Davenport and Sarah Williams, *The Nuclear Security Summit: Assessment of Joint Statements* (Washington DC: Arms Control Association, March 2014).

15. "Strengthening the Global Nuclear Security System," Global Dialogue on Nuclear Security Priorities (Washington DC: Nuclear Threat Initiative, 10 July 2012), p. 2.

Figure 3.1: The Global Nuclear Security Regime



Sources:

IAEA Nuclear Security Series, No. 20, 2013, Nuclear Security Fundamentals, Objective and Essential Elements of a State's Nuclear Security Regime, http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1590_web.pdf.

IAEA, Nuclear Security Series Publications, http://www-ns.iaea.org/security/nss-publications.asp.

3.35 All these various elements were the subject of close attention by the 2010 NPT Review Conference. Noting "the paramount importance of effective physical protection of all nuclear material and the need for strengthened international cooperation in physical protection," the 2010 Final Document welcomed the 2005 CPPNM Amendment, affirmed the important role of the IAEA in promoting international cooperation by establishing "a comprehensive set of nuclear security guidelines" and in helping member states, on request, enhance national security (paragraphs 27–28). It also acknowledged the need for international cooperation and coordination, with IAEA support, "in preventing, detecting and responding to illicit trafficking in nuclear and other radioactive material" (paragraph 29). Importantly, the conference noted that "While nuclear safety and nuclear security are national responsibilities, the IAEA should play the key role in the development of safety standards, nuclear security guidance and relevant conventions based on best practice" (paragraph 58).

3.36 As well as endorsing the non-legally binding Code of Conduct on the Safety and Security of Radioactive Sources, the conference encouraged all non-parties to the CPPNM to accede to it and to ratify the 2005 amendment "so that it may enter into force at an early date" (paragraphs 62–63). The conference also took note of the first NSS held in Washington in April 2010, welcomed the voluntary efforts by states to minimize the use of HEU in the civilian sector and encouraged states to promote the sharing of best practice in nuclear safety and security, including through dialogue with the nuclear industry and the private sector (paragraphs 65–69). These were translated into action points 40–46.

3.3.1. Convention on the Physical Protection of Nuclear Material (CPPNM) 1980

3.37 The basic knowledge and skill to make a crude nuclear explosive device is readily available and acquired. But it is far more challenging to produce fissile material – weapon-grade HEU (90 per cent U-235) or separated plutonium – on any substantial scale. Only states are likely to have the necessary level of infrastructure. But if their material, facilities and personnel have security vulnerabilities, then terrorists, criminals or other unauthorized actors could steal the nuclear material or even a nuclear bomb (see Box 3.1). They will raid not the facility or the country with the most nuclear material, but that which is the most vulnerable. Any country could be a target; all could feel the effects.

3.38 This is why measures for the physical protection of all nuclear materials, facilities and activities are an essential and critical component of nuclear security. As well as guards, gates and fences at nuclear plants and facilities, this requires thorough background checks on personnel employed there and rigorous training after recruitment in order to inculcate a culture of nuclear security. In a 'whole-of-nuclear-security-chain', the amount of nuclear material could be reduced; the physical protection of materials and facilities could be reinforced; security measures could be strengthened for materials during transportation and transit; and export and border controls could be made more stringent. In sum, both HEU and separated plutonium, even for peaceful purposes, should be subject to security

controls no less stringent than those prescribed for nuclear weapons, or what the US National Academy of Sciences describes as "the stored-weapon standard."[16]

3.39 The CPPNM, adopted in Vienna on 26 October 1979 and signed in Vienna and New York on 3 March 1980, entered into force on 8 February 1987. It establishes measures related to the physical protection of nuclear material during international transport and a general framework for cooperation among states in the protection, recovery and return of stolen nuclear material. At the end of 2014, the CPPNM had 151 states parties.[17] That is, about one-quarter of the world's states have still not acceded to it. Countries which attended one or both of the NSS and have not ratified or acceded to the CPPNM are Egypt, Malaysia and Thailand.

3.40 A diplomatic conference was convened in 2005 to strengthen the convention in light of the terrorist attacks of 11 September 2001 and an amendment was adopted by consensus on 8 July. The name was amended to the Convention on the Physical Protection of Nuclear Material and Nuclear Facilities. The amendment was promoted and justified as a key measure of nuclear security. The obligations for physical protection under the original CPPNM covered nuclear material during international transport. The amendment requires states parties to protect nuclear facilities and material in peaceful domestic use, storage and transport. In addition, it also provides for expanded cooperation among states on measures to locate and recover stolen or smuggled nuclear material, and mitigate any radiological consequences of sabotage. It will enter into force upon ratification by two-thirds of the states party to the convention. By the end of 2014, it had only 83 of the 101 required number of accessions.[18]

3.41 On 11 September 2001 (the day of the terrorist attacks in New York and Washington), the IAEA Board of Governors approved twelve "Fundamental Principles of Physical Protection of Nuclear Materials and Facilities." These were incorporated into the CPPNM Amendment (Article 3) and thus will apply to the states that are party to the amendment once it is in force.

3.42 Table 3.1 summarizes the current status of the CPPNM, CPPNM Amendment, and ICSANT. Although the CPPNM was already adhered to quite widely (but not universally) before the first NSS in Washington in April 2010, the summit process does seem to have injected fresh momentum into states becoming parties to the other two instruments. In the last four years, the number of states parties to the CPPNM Amendment has almost doubled, with 41 states becoming parties to it since the Washington NSS, and those acceding to ICSANT have increased by about one-quarter (52 additional states parties since April 2010).

16. Weapons of Mass Destruction Commission, *Weapons of Terror: Freeing the World of Nuclear, Biological and Chemical Arms* (Stockholm: Weapons of Mass Destruction Secretariat, 2006), p. 84. However, while the "stored-weapon standard" would apply to plutonium metal, it would not necessarily apply to everything, for example plutonium in mixed oxide (MOX) powder or fuel assemblies.

17. http://www.iaea.org/Publications/Documents/Conventions/cppnm_status.pdf.

18. http://www.iaea.org/Publications/Documents/Conventions/cppnm_amend_status.pdf.

Table 3.1: Status of CPPNM, CPPNM Amendment, and ICSANT (December 2014)

	Date adopted	Entry into Force	Parties	Signed but not Parties
CPPNM	26.10.1979	08/02/1987	151	1
CPPNM Amendment	08/07/2005	–	83	N/A
ICSANT	13/04/2005	07/07/2007	99	46

Sources:
http://www.iaea.org/Publications/Documents/Conventions/cppnm_status.pdf;
http://www.iaea.org/Publications/Documents/Conventions/cppnm_amend_status.pdf;
http://treaties.un.org/Pages/ViewDetailsIII.aspx?&src=TREATY&mtdsg_no=XVIII~15&chapter=18&Temp=mtdsg3&lang=en

3.43 In 2013, ten states ratified or officially accepted the CPPNM amendment: Belgium (22 January), France (1 February), Uzbekistan (7 February), Cyprus (27 February), Slovakia (7 March), Albania (26 April), Armenia (22 May), Cuba (26 September), Malta (26 September), and Canada (3 December).[19] In 2014 twelve states followed suit: Jamaica (10 January), Columbia (18 February), Peru (27 March), Djibouti (22 April), and South Korea (29 May), Japan (27 June), Tajikistan (10 July), Burkina Faso (7 August), Dominican Republic (22 September), Ireland (22 September), Singapore (22 October), and Qatar (11 November).

3.3.2. International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT) 2005[20]

3.44 How can states prevent, investigate and punish acts of nuclear terrorism, and promote law enforcement and judicial cooperation with one another to do so? Drafted during seven years of negotiations by the ad hoc group based on a text presented by Russia, and its importance and interest in it increasing dramatically owing to the terrorist attacks of 11 September 2001, ICSANT was adopted unanimously at the UN General Assembly on 13 April 2005. It makes it a crime to possess or demand a radioactive device or material with the aim of causing death or serious injury or substantial damage to property. The convention came into effect in July 2007, 30 days after Bangladesh became the 22nd state to deposit its instrument of ratification with the United Nations secretary-general. As of 31 December 2014, a total of 115 nations had signed, of whom 99 had also ratified the convention.[21]

3.45 The background to the heightened concern was the so-called problem of "loose nukes" in Russia after the end of the Cold War. There were many reports awash in the international media of substantial amounts of enriched fissile material that remained unaccounted for from the days of the former Soviet Union, leading to fears that some or much of the material might be being smuggled across international borders into and out

19. http://www-ns.iaea.org/conventions/physical-protection.asp?l=42.
20. http://untreaty.un.org/cod/avl/ha/icsant/icsant.html.
21. http://treaties.un.org/Pages/ViewDetailsIII.aspx?&src=TREATY&mtdsg_no=XVIII~15&chapter=18&Temp=mtdsg3&lang=en.

of Central Asia.[22] The CPPNM was limited to nuclear material used for peaceful purposes, not covering nuclear material of a military nature.

3.46 ICSANT is closely linked to UN Security Council Resolution 1540 (discussed below). The convention seeks to do three things: to protect against attacks on a broad range of nuclear targets, punish the perpetrators through domestic criminalization of acts of nuclear terrorism, and promote international cooperation in the prevention and investigation of acts of nuclear terrorism and the prosecution or extradition of the alleged terrorists. To this end, states parties are required to make the offences specified in the convention criminal offences under national law, and to provide stiff penalties appropriate to the gravity of the crimes.

3.47 The convention's scope extends to a range of acts and potential targets, including nuclear power plants and reactors, and attempts or threats to commit terrorist acts or participate in them as accomplices. To facilitate the "prosecute or extradite" regime, these offences are explicitly described as "non-political" so that the defence of any of these acts being a political offence is not available to anyone seeking to block extradition.

3.48 In taking all necessary measures to ensure the protection of radioactive material, states are enjoined to take into account the relevant recommendations and functions of the IAEA. Should states detect and find unauthorized radioactive material, they must take steps to render it harmless, ensure that it is held in accordance with applicable IAEA safeguards, exercise due diligence with regard to IAEA physical protection and health and safety standards, and ensure its return to specified parties.

3.49 ICSANT was deliberately designed to have the broadest possible coverage in order to fill perceived CPPNM gaps in scope and enforcement.[23] However, ICSANT is limited to international offences involving more than one state, and does not apply where the offence is committed within a single state and the alleged offender and victims are nationals of that state.[24] The convention is not subject to any particular monitoring mechanism and responsibility for its implementation lies with states parties.

3.50 Nor does the convention take a position on the legality or otherwise of the use and threat of use of nuclear weapons. Its focus is on individual criminal responsibility of persons for specific acts of a terrorist nature. Agreement on the text was delayed for several years because of the demand by some states that the use or threat of use of nuclear weapons must also be addressed and, therefore, acts of state actors too should be brought within the scope of the proposed convention. Others countered that the legal regime underlying the existing sectoral conventions is of a law-enforcement nature and exclusively focused on the individual criminal responsibility of persons for specific acts of a terrorist nature; questions of state responsibility are regulated by other principles of international law. The issue was resolved on the basis of a package, whereby the use of a nuclear device by a state during an armed conflict is explicitly excluded from the scope of the convention but without conferring or implying impunity.

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22. Rohan Perera, "Historical context for the International Convention for the Suppression of Acts of Nuclear Terrorism," http://untreaty.un.org/cod/avl/ha/icsant/icsant.html.

23. "UN officials call for stronger global measures to counter nuclear terrorism," 28 September 2012, http://www.un.org/apps/news/story.asp?NewsID=43106&Cr=nuclear&Cr1=#.UG6uMVG2WZR.

24. O. Jankowitsch-Prevor, "International Convention for the Suppression of Acts of Nuclear Terrorism," OECD/NEA, *Nuclear Law Bulletin* 76 (2005).

3.3.3. UN Security Council Resolutions

3.51 **Resolution 1540 (2004).** On 28 April 2004, the Security Council adopted Resolution 1540, establishing for the first time binding obligations on all UN member states under Chapter VII of the Charter to take and enforce effective measures against the proliferation of weapons of mass destruction (WMD), their means of delivery and related materials to non-state actors. Controversy arose over the authority of the Security Council to impose general obligations of a "legislative" kind for UN member states under Chapter VII of the UN Charter, but after seven months of negotiations, the resolution was adopted by consensus.[25] Since 2004, Resolution 1540 has gained legitimacy as the legal basis for a range of national and international counter terrorism activities.

3.52 The goal of Resolution 1540 is to ensure that no state or non-state actor is a source or beneficiary of WMD proliferation. Affirming WMD proliferation as a threat to international peace and security and expressing concern over the threat of WMD terrorism and of illicit trafficking in WMD material, weapons and delivery systems, UNSCR 1540 requires all states:

- To enact and enforce laws to prohibit non-state actors to develop, acquire, transfer or use WMD;
- To take and enforce effective domestic control, physical protection, accounting and border control measures to prevent proliferation to non-state actors and to prohibit assisting or financing such proliferation;
- To control the provision of funds and services that contribute to non-state proliferation; and
- To set up a committee of the whole to oversee implementation of the resolution.

3.53 UNSCR 1977, adopted unanimously on 20 April 2011, extended the mandate of the 1540 Committee by ten years. To facilitate the work of the committee, an expert group consisting of eight members was set up to deal with technical issues. UNSCR 2055 (29 June 2012) increased the maximum number of experts on the group to nine. However, in 2014, there were just six 1540 experts, from China, Germany, Mexico, Pakistan, South Africa and the United Kingdom.[26] Over the years, the composition of the expert group has been a politically sensitive issue, with appointments complicated by the need to ensure that individuals have the requisite expertise and developed and developing states are represented under the principle of "equitable geographical representation."

3.54 The implementation of UNSCR 1540 will mean that each state's actions will significantly strengthen the international standards relating to the export of sensitive items and support for proliferators (including financing) and ensure that non-state actors, including terrorist and black-market networks, do not gain access to chemical, nuclear or biological weapons, their means of delivery, or related materials.[27]

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25. C. Ahlström, "Appendix 11A. United Nations Security Council Resolution 1540: non-proliferation by means of international legislation," *SIPRI Yearbook 2007* (New York: Oxford University Press, 2007), p. 461.
26. http://www.un.org/en/sc/1540/committee/expert-group. shtml.
27. See also the section on UNSCR 1540 in the previous chapter 2 on non-proliferation.

3.55 All member states were requested to report on the progress of their implementation to the 1540 Committee six months after the adoption of the resolution, and by 28 October 2004, 59 member states (and the European Union) had submitted their first reports.[28] UNSCR 1673 (27 April 2006) noted that not all member states had yet submitted their first national report, and that full implementation of the resolution is a long-term task. Many states have not responded to requests by the 1540 Committee for further reports, which makes it difficult to measure levels of implementation and identify which states need assistance to meet their 1540 obligations. Some states have submitted six or seven reports since 2004, while others have only submitted one. To address this problem, Resolution 1977 (20 April 2011) encouraged states to submit National Action Plans to the 1540 Committee, outlining the progress they have made in implementing the resolution, and identifying priority areas where assistance is required. By December 2014, only 14 states had submitted such plans. Thus while states are obliged to report to the 1540 Committee on the steps they are taking to implement the resolution, the national reports are patchy, international oversight is weak, compliance is encouraged rather than enforced and action taken has been less than substantial.

3.56 **Other Security Council Resolutions.** UNSCR 1373 (28 September 2001) called on all states to prevent and suppress the financing of terrorism and to criminalize the wilful provision or collection of funds for such acts. The funds, financial assets and economic resources of those who commit or attempt to commit terrorist acts, participate in or facilitate the commission of terrorist acts, and of persons and entities acting on behalf of terrorists, were to be frozen without delay. To this end, the resolution imposed uniform legislative and reporting requirements and established the Counter-Terrorism Committee (CTC), made up of all fifteen members of the Security Council, to monitor implementation and increase state capacity.[29]

3.57 The scope of Resolution 1373 is quite broad, encompassing domestic legislation, national executive machinery and international cooperation. Operative paragraph IV links the resolution to nuclear security, noting the close connection between international terrorism and, among other things, the illegal movement of nuclear and other potentially deadly materials, and emphasizes the need for coordination from national to international level to strengthen the global response to this serious threat to international security.

3.58 Under Resolution 1535 (26 March 2004), the Security Council also established the Counter-Terrorism Executive Directorate (CTED) to assist the work of the CTC and coordinate the monitoring of the resolution's implementation.[30] UNSCR 1624 (14 September 2005) pertains to the incitement to commit acts of terrorism. It targets terrorism in general, and refers to nuclear terrorism only when it calls on states to give priority consideration to the signing of ICSANT in one preamble paragraph. This resolution also guides the work of the CTC and requires states to report to the committee on their implementation of the resolution. The CTC is further directed to include Resolution 1624 in its dialogue with states to help build capacity through spreading best

28. Ahlström, "Appendix 11A. United Nations Security Council Resolution 1540," p. 468.
29. Information on the CTC is available at www.un.org/Docs/sc/committees/1373.
30. United Nations, "About the Counter-terrorism Committee," http://www.un.org/en/sc/ctc/aboutus.html.

legal practices and promoting the exchange of information. In addition, the CTC helps with the capacity building of member states through dissemination of best practices; provision of technical, financial, regulatory and legislative expertise; and facilitating cooperation between national, regional and international organizations. But the CTC has neither the resources nor the capacity to monitor state compliance with UNSC-imposed obligations.

3.59 In accordance with Resolution 1624, the CTED prepared two reports summarizing the responses submitted by UN member states, acknowledging that fewer than half of them have reported to it on their steps to implement Resolution 1624.[31] The mandate of the CTED was extended to the end of 2017 by Resolution 2129 (17 December 2013), which called for an interim review by 31 December 2015, and for increased cooperation between the CTED and the 1540 Committee and group of experts.[32]

3.3.4. Radioactive Sources

3.60 The Code of Conduct on the Safety and Security of Radioactive Sources, approved by the IAEA Board of Governors in September 2003 with a supplement endorsed a year later, is meant to apply to the development and harmonization of policies, laws and regulations on the safety and security of radioactive sources from initial production to final disposal.[33] Thus it applies also to radioactive wastes not covered by the CPPNM.[34] More detailed and prescriptive than an international convention, the Code of Conduct includes provisions on national registers of high-activity sources, the international trade in radioactive sources, security requirements and prompt notification to potentially affected states of loss of control of sources, or incidents with potential cross-border effects. It prescribes the principles for states to ensure the security of radioactive sources within their territory, the training of personnel and the establishment of channels of information and communication. The 2004 supplement recommends that every state designate a point of contact. But it notably does not apply to radioactive sources within military or defence programs.

3.61 By December 2014, 123 states had expressed support for the 2003 Code of Conduct, 63 countries supported all aspects of the supplementary guidance as well, and only four (Madagascar, Paraguay, Turkmenistan and Uzbekistan) had not designated a national point of contact. But several have failed to respond to the IAEA's self-assessment questionnaire.[35]

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31. Letter dated 18 January 2008 from the Chairman of the Security Council Committee established pursuant to resolution 1373 (2001) concerning counter-terrorism addressed to the President of the Security Council, S/2008/29.
32. S/RES/2129 (2013). Full text available at http://www.un.org/en/sc/ctc/resources/res-sc.html.
33. http://www-ns.iaea.org/tech-areas/radiation-safety/code-of-conduct.asp.
34. Radioactive waste is covered, however, by a 1997 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.
35. http://www.iaea.org/Publications/Documents/Treaties/codeconduct_status.pdf. The list of national points of contact is published by the IAEA at http://www-ns.iaea.org/downloads/rw/imp-export/import-export-contact-points.pdf; and the directory of national regulatory bodies is published at http://www-ns.iaea.org/downloads/rw/code-conduct/reg-auth-directory.pdf.

3.3.5. Global Cooperation Mechanisms

3.62 **US-Managed Threat Reduction Programs.** Since the early 1990s and the end of the Cold War, the United States has implemented a series of programs and projects, mainly on the territory of the former Soviet Union, to reduce the risk that nuclear and radioactive materials would escape from safe custody.[36] The Department of Defense managed the implementation of the Cooperative Threat Reduction (CTR or Nunn–Lugar) Program, which began in 1991, and was named after the two US Senators who initiated it: Sam Nunn and Richard Lugar.

3.63 The CTR set of programs has been among the most successful and effective. It has helped the countries of the former Soviet Union to destroy nuclear, chemical and biological weapons and associated infrastructure under agreed procedures; to transport bomb-making materials to central and more secure storage sites; to upgrade security perimeters around sensitive sites and screening of personnel working there; and to install monitoring devices at border crossings. The programs have facilitated the elimination of significant quantities of nuclear materials, promoted habits of international cooperation and reinforced nuclear disarmament and non-proliferation norms. Since 2003 the CTR program has incorporated several new initiatives that are relevant to nuclear security. The WMD Proliferation Prevention Initiative, a biosecurity effort, is intended to assist partners strengthen their border controls, including the installation of monitoring and detection equipment at border crossings and in other appropriate locations on the border.

3.64 In 2004 a number of projects (not including the CTR program) were consolidated into the Global Threat Reduction Initiative (GTRI) under the management of the Department of Energy (DOE). These were intended to reduce and protect vulnerable nuclear and radiological material worldwide by a combination of reactor conversion, removal of material and physical protection. In 2011 the Global Nuclear Lockdown program was initiated to support efforts to secure weapon-useable materials in Russia, among other things. In 2012 a number of the efforts noted above were combined under the Global Nuclear Security program.

3.65 By 29 May 2014, the GTRI and its predecessor programs had converted or verified the shutdown of 88 HEU research reactors and isotope production facilities; removed or confirmed the disposition of more than 5,140 kg of HEU and plutonium – more than enough material for over 205 nuclear bombs; secured more than 775 bombs worth of HEU and plutonium associated with the BN-350 reactor in Kazakhstan; secured more than 1,700 radiological sites around the world; recovered more than 36,000 orphaned and disused radiological sources in the United States; and recovered 810 radioisotope thermoelectric generators from Russia containing millions of curies of activity.[37]

3.66 The $500 million per annum program had been extended twice since inception in 1992. But in October 2012, Moscow announced that it would let the program expire in

36. See Amy F. Woolf, *Nonproliferation and Threat Reduction Assistance: U.S. Programs in the Former Soviet Union* (Washington DC: Congressional Research Service 7-5700, 6 March 2012).

37. "GTRI: Reducing Nuclear Threats," NNSA Fact Sheet, 29 May 2014, http://nnsa.energy.gov/mediaroom/factsheets/reducingthreats.

May 2013 because it no longer needs foreign assistance and has concerns about nuclear security information being leaked. In June 2013, prior to the expiration of the Nunn-Lugar umbrella agreement, Presidents Barack Obama and Vladimir Putin reached an agreement to continue US–Russian nuclear security efforts, albeit in a truncated form. The new arrangement was intended to operate under the 2003 "Framework Agreement on a Multilateral Nuclear Environmental Programme in the Russian Federation" (MNEPR) and a related protocol signed on 14 June 2013. Under the terms of this new framework, the US agreed to continue most of its nuclear security-related work, but to cease joint efforts to dismantle missiles, bombers and chemical weapons.[38]

3.67 In spring 2014, Russia's annexation of Crimea and military involvement in Ukraine led to a sharp deterioration in US–Russia relations, with potentially serious implications for the MNEPR. Questions were raised in both countries over the merits of continuing the program.[39] In November 2014, US media reports claimed that Russia was planning to curtail bilateral nuclear security cooperation with the United States, with no new projects envisioned for 2015.[40] Officials in the Obama administration confirmed they were concerned about the prospects for joint security efforts if new projects were not agreed upon before current contracts expired at the end of 2014.[41] This followed a decision, relayed to the US Department of State by the Russian Foreign Ministry in mid-October 2014, that Russia would not attend the 2016 NSS, which it said suffered from various shortcomings including discrimination against all participants except for the host countries of previous and upcoming summits.[42] US officials have since announced that, despite disappointment over Russia's NSS decision, the United States and Russia are still working together at a "programmatic level" on projects such as the MNEPR. According to spokesperson Jen Psaki, the US has "not received official notification" from Russia about cancelling nuclear security cooperation" and continues to believe that "we have a shared interest and a shared responsibility in promoting nuclear security."[43]

3.68 Other parts of the US government have also had important and active programs relevant to nuclear security. The International Nuclear Materials Protection program is particularly noteworthy in this context. This is a DOE umbrella program whose First Line of Defense projects cover nuclear materials protection and cooperation. The program is intended to prevent "the spread of materials, technology, and expertise relating to weapons of mass destruction; detect the proliferation of weapons of mass destruction worldwide; provide for international nuclear safety; and eliminate

38. Justin Bresolin, "Fact Sheet: The Nunn-Lugar Cooperative Threat Reduction Program," The Center for Arms Control and Non-Proliferation, July 2013, http://armscontrolcenter.org/publications/factsheets/fact_sheet_the_cooperative_threat_reduction_program/.

39. Nickolas Roth, "United States Should Chew Gum and Walk on Nuclear Security," *Nuclear Security Matters*, 19 November 2014, http://nuclearsecuritymatters.belfercenter.org/blog/united-states-chew-should-chew-gum-and-walk-nuclear-security; Bresolin, "Fact Sheet: The Nunn-Lugar Cooperative Threat Reduction Program."

40. See, for example, Michael R. Gordon, "Russia to curtail nuclear security efforts with US," *New York Times*, 13 November 2013.

41. Gordon, "Russia to curtail nuclear security efforts with US."

42. This explains Russia's failure to send a representative to the preparatory 'sherpa' meeting in Washington DC in October 2014. Karen De Young, "Russia to skip Nuclear Security Summit scheduled for 2016 in Washington," *Washington Post*, 5 November 2014.

43. "US to Continue Nuclear Security Cooperation with Russia: State Department," 15 November 2014, http://sputniknews.com/us/20141115/1014753942.html.

inventories of surplus fissile materials useable for nuclear weapons."[44] The program thus addresses the danger of hostile nations or terrorist groups acquiring WMD weapons, material, expertise or technology. To achieve these ends the program has supported security upgrades at a large number of civilian and military sites of different kinds, predominantly in Russia. The program also supports projects to reduce the quantities of weapon-useable materials or make it less attractive to would-be nuclear terrorists.

3.69 The DOE has also implemented the Second Line of Defense and Megaports Initiatives, under National Nuclear Security Administration (NNSA) management,[45] which are intended to reduce the risk of smuggling of nuclear and radioactive materials, and in particular to reduce the risk that such materials will enter the United States. The DOE programs have also included projects focused on radiological dispersal devices, which have merged with others into an International Nuclear Materials Protection Program. Since December 2012, these programs have come under increasing pressure from funding cuts. The FY 2015 budget request for the NNSA reduced funding for the GTRI and IMPC by 25 per cent and 27 per cent, respectively – the third year in a row of budget cuts to these programs.[46]

3.70 **G8 Global Partnership (G8–GP) 2002.** The Global Partnership is an initiative of the Group of Eight (G8) countries (Canada, France, Germany, Italy, Japan, Russia, United Kingdom, and United States) committed to preventing terrorists, or those who harbour them, from acquiring or developing nuclear, chemical, radiological or biological weapons, missiles, or related equipment and technology. Launched at the 2002 G8 Summit in Kananaskis, Canada, the $20 billion G8 Global Partnership initially implemented projects in Russia and Ukraine but has expanded to deal with the spread of WMD weapons and materials worldwide. Non-G8 countries participating in the Global Partnership include Australia, Belgium, the Czech Republic, Denmark, Finland, Hungary, Ireland, Netherlands, New Zealand, Norway, Poland, South Korea, Sweden, Switzerland, and Ukraine, and also the European Union. Hungary is the newest member, having joined the partnership in December 2013. The G8 Global Partnership's mandate was to expire in 2012 but was extended until 2022. Following events in Ukraine, Russia's membership of the group was suspended in March 2014 – a development made even more significant by the fact Russia held the 2014 G8 Presidency and was due to host the G8 Summit in Sochi on 4–5 June. Russia was excluded from its meeting in Brussels in May.

3.71 Achievements of the Global Partnership include:[47]

- Strengthened accounting, control, and physical protection of nuclear and radiological materials in Russia and Ukraine;
- Destruction of over 20,000 tons of chemical weapons;
- Dismantling of nuclear submarines and safe storage of removed spent fuel;

44. Department of Energy, FY 2004 Congressional Budget Request, *Budget Highlights*, DOE/ME-0023, February 2003, p. 25.
45. NNSA was established by Congress in 2000 as a semi-autonomous agency within DOE, responsible for the management and security of US nuclear weapons, nuclear nonproliferation, and naval reactor programs.
46. Kingston Reif, "Fact Sheet: FY 2015 Budget Request for Nuclear and Radiological Material Security and Nonproliferation Programs," The Center for Arms Control and Non-Proliferation, 16 April 2014, http://armscontrolcenter.org/issues/nuclearterrorism/articles/fact_sheet_fy_2015_budget_request_for_nuclear_and_radiological_material_security_and_nonproliferation_programs/.
47. US Department of State, "G8 Global Partnership," http://www.state.gov/t/isn/184759.htm.

- Improved detection of nuclear and radiological materials and prevention of illicit trafficking by strengthening border security capabilities; and
- Engagement of scientists, technicians and engineers with WMD and missile expertise to redirect their efforts towards peaceful purposes. The International Science and Technology Center in Moscow and the Science Technology Centre of Ukraine, funded by the Global Partnership's partners, provide economic support for scientists during a transition period. At the time of writing, it is unclear how the centre's work will be affected by Russia's suspension from the G8 and the stalling of US–Russian scientific exchange.

3.72 **The Global Initiative to Combat Nuclear Terrorism.** GICNT is an international partnership working towards the individual and collective implementation of a set of shared nuclear security principles. It was set up by Presidents George W. Bush and Vladimir Putin in St. Petersburg on 15 July 2006. Its mission is to strengthen global capacity to prevent, detect and respond to nuclear terrorism by conducting multilateral activities that strengthen the plans, policies, procedures and interoperability of partner nations. Its eight guiding principles are:[48]

- Improve accounting, control and protection of nuclear and radiological material;
- Enhance security of civilian nuclear facilities;
- Detect and suppress illicit trafficking of nuclear and radiological material;
- Improve ability to search for, confiscate and establish safe control of nuclear and radiological material;
- Assure denial of safe haven and resources to terrorists seeking to acquire or use nuclear and radiological material;
- Ensure adequate legal frameworks to combat activity related to nuclear terrorism;
- Respond to and mitigate the consequences of nuclear terrorism; and
- Promote information sharing to prevent and respond to acts of nuclear terrorism.

3.73 The United States and Russia serve as co-chairs of the GICNT and the Republic of Korea is serving as Coordinator of the Implementation and Assessment Group through 2015. The Global Initiative has made some effort to improve the global nuclear and radiological detection architecture, including the installation of radiation detection equipment at major sea and air ports. By December 2014 its membership included 85 countries plus four observers (IAEA, European Union, UN Office on Drugs and Crime (UNODC), and INTERPOL).[49] Argentina, Mexico, Philippines, Thailand and Vietnam joined GICNT in 2010; Singapore in 2011; and Algeria, Azerbaijan and Malaysia in 2012. The plenary meeting in 2010 noted nuclear detection (working group chaired by the Netherlands) and nuclear forensics (working group chaired by Australia) as the two priority functions; the 2011 plenary added response and mitigation (working group chaired by Morocco) as a third priority function.

48. http://www.state.gov/documents/organization/145499.pdf.
49. US Department of State, "Partner Nations List" for the GICNT, http://www.state.gov/t/isn/c37083.htm.

3.74 GICNT facilitates information sharing among partners and official observers through expert-level workshops, seminars, exercises and other activities. As of December 2014, it had held nearly 50 multilateral activities and seven senior-level meetings to share best practices and lessons learned in order to strengthen individual and collective capabilities for preventing, detecting, deterring, and responding to nuclear terrorist incidents. The three working groups presented their findings at the 2013 plenary meeting, which was hosted by Mexico. In addition, Australia provided a briefing on the importance of incorporating joint working group and cross-disciplinary activities into the GICNT plan of work for 2013–15 which continues to prioritize capacity-building in nuclear detection, nuclear forensics, and response and mitigation.[50]

3.75 So far, the GICNT has remained unaffected by tensions over Ukraine. A GICNT Joint Statement, published on 20 March 2014 at the height of international tensions over the annexation of Crimea, stated that the GICNT Co-Chairs (Russia and the United States) "remain committed to working with GICNT partner nations to pursue focused efforts and activities that foster nuclear security collaboration and advance nuclear security goals."[51] Since then, there have been no official statements on the subject. The next plenary meeting will be hosted by Finland in 2015.

§3.4 Role of the IAEA

3.76 As discussed in Chapter 2, the IAEA carries the chief international institutional responsibility for marrying the NPT's promise of assistance with peaceful uses of nuclear energy to non-nuclear weapon states to assurances of safety and non-diversion to weapons purposes. Because nuclear security is a much more recent concern, this has not been a priority item in the distribution of funding and agenda for the agency. Yet even here the IAEA has now taken on a lead role, if by default, because of its technical expertise, institutional credibility and legitimacy, and the lack of practical alternatives. This distinctive status quo – combining lack of mandated IAEA authority in nuclear security comparable to nuclear safeguards; technical capabilities to strengthen the global nuclear security regime through advisory services to member states on request; and the need to provide added resources to the IAEA in this field – is reflected in the decisions made at the 2010 NPT Review Conference and the 2010, 2012 and 2014 NSS.

3.77 The 2010 NPT conference encouraged all states parties to "broaden their support for the relevant IAEA programmes" and apply IAEA recommendations on the physical protection of nuclear materials and facilities; and encouraged the agency to assist states to strengthen their national regulatory controls of nuclear material (Actions 41 and 46). All three NSS have also stressed the importance of the IAEA's nuclear security role. The most recent summit communiqué emphasized that "the role of the IAEA will be crucial in the years ahead" and encouraged "greater political, technical and financial support for

50. US Department of State, "2013 Global Initiative to Combat Nuclear Terrorism Plenary Meeting Joint Co-Chair Statement," 24 May 2013, http://www.state.gov/t/isn/rls/prsrl/2013/210575.htm.

51. *Joint Statement on the Contributions of the Global Initiative to Combat Nuclear Terrorism (GICNT) to Enhancing Nuclear Security*, 20 March 2014, http://www.state.gov/r/pa/prs/ps/2014/03/223761.htm.

the IAEA, including through its Nuclear Security Fund, to ensure that it has the resources and expertise needed to carry out its mandated nuclear security activities."[52]

3.78 For all the IAEA's role, its nuclear security mandate does not cover materials in military and defence programs, and the primary responsibility for nuclear security rests with individual states. In the near term, therefore, the main focus will be on universalization of the existing framework and its full implementation, plus filling gaps in existing arrangements. The extent of voluntary reporting by states at the Seoul and Hague NSS in 2012 and 2014 on the compliance of their nuclear security systems with commitments made at the previous summit, was encouraging. That is, the threshold of compliance of legally binding international commitments has been raised significantly higher with voluntary promises of a heads of state/government involvement in summit diplomacy.[53]

3.4.1 Setting Guidelines

3.79 The IAEA publishes a Nuclear Security Series, providing detailed guidance "relating to the prevention and detection of, and response to, theft, sabotage, unauthorized access and illegal transfer or other malicious acts involving nuclear material and other radioactive substances and their associated facilities."[54] They embrace such fields as nuclear security fundamentals, recommendations, implementing guides and technical guidance. Since 2012, the Nuclear Security Guidance Committee, established by the IAEA director general, has been tasked with making recommendations to the agency on the development and review of the series. The committee is composed of representatives from all IAEA member states. Its objective is to improve the quality, increase transparency and encourage consensus and coherence among the member states while working on international publications in the field of nuclear security. Representatives of international organizations and non-governmental bodies can attend the committee meetings. Recent publications in the series include *Nuclear Security Systems and Measures for Major Public Events* (2012), and the most important document that has been produced in the series so far: *Objective and Essential Elements of a State's Nuclear Security Regime: Nuclear Security Fundamentals* (2013).[55] The latter synthesizes existing international nuclear security instruments and the experiences of IAEA experts and member states in the areas of nuclear security, safety and safeguards.

3.80 In the Nuclear Security Series, Information Circular 225 (INFCIRC/225) is generally considered to be the cornerstone of the international physical protection regime for nuclear materials and facilities. First published in 1975 and revised four times since, INFCIRC/225 is a set of guidelines, not a treaty or binding resolution, and not requiring legal commitments, signature or ratification. This makes assessment of state compliance problematical.

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52. "The Hague Nuclear Security Summit Communiqué," http://www.government.nl/documents-and-publications/directives/2014/03/25/the-hague-nuclear-security-summit-communique.html.

53. Nuclear Security Governance Experts Group (NSGEG), *Improving Nuclear Security Regime Cohesion: Summary Report and Initial Policy Recommendations* (Muscatine, Iowa: Stanley Foundation, September 2012), p. 6.

54. IAEA website, http://www.iaea.org.

55. *Objective and Essential Elements of a State's Nuclear Security Regime: Nuclear Security Fundamentals*, IAEA Nuclear Security Series No. 20 (February 2013), http://www-ns.iaea.org/security/nss-publications.asp?s=5.

3.81 The 2011 revision (INFCIRC/225/Rev. 5) reflects the threat of nuclear terrorism and the need to align the document with the changed security standards set forth in the 2005 amendment to the CPPNM. It introduced the concept of a physical protection "regime" and a graded approach to physical protection to take into account the nature, severity and likelihood of the threat, the relative attractiveness of the material, and the possible consequences of theft or sabotage. It included guidance for the rapid recovery of nuclear material found to be missing and for the mitigation of sabotage. And it included recommendations on physical protection for states embarking on the development of peaceful nuclear energy for the first time.

3.82 INFCIRC/225/Rev. 5 serves as the international standard that has been incorporated into the domestic law of many states. But because the nuclear security series are guides for countries to use voluntarily, it is impossible to know how widely they are actually read or used by states. States have obligations written in their comprehensive safeguards agreements (CSAs) with the IAEA and in some cases, Additional Protocols, and some of those obligations overlap with what is written in the Nuclear Security Series.

3.83 The IAEA guidelines have also been incorporated in some suppliers' bilateral agreements as a condition of peaceful nuclear cooperation. The US "section 123"[56] civil nuclear cooperation agreement with the United Arab Emirates (UAE) is a good example of this. Inclusion of this requirement in bilateral agreements provides a means for making the application of INFCIRC/225 legally binding in particular states. The United States has 26 nuclear cooperation agreements that require partner countries to guarantee the physical protection of US-origin nuclear material. The US Nuclear Regulatory Commission and State and Energy departments visit partner countries to check on the physical protection measures.[57] Australia, Canada and the EURATOM (European Atomic Energy Community) countries also have similar bilateral agreements. In addition, the Pelindaba and Semipalatinsk treaties establishing nuclear-weapon-free zones in Africa and Central Asia respectively (see chapter 2) also require member states to apply security measures comparable to IAEA recommendations.

3.84 Although there is resistance among many states to developing a formal and permanent nuclear security regime, discussions during the summit process and the 2013 Conference on Nuclear Security suggest that some states are beginning to think along these lines.[58] In this regard, a key development occurred in March 2014, when the hosts of the three NSS – the United States, South Korea and the Netherlands – issued a joint statement on strengthening nuclear security implementation. The statement subscribed to the IAEA *Nuclear Security Fundamentals* and pledged to meet the intent of the recommendations contained in three core IAEA guidance documents: INFCIRC225/Rev.5; the Code of Conduct on the Safety and Security of Radioactive Sources; and the

56. The reference is to agreements pursuant to s.123 of the Atomic Energy Act that are commonly referred to as "123 agreements."

57. "Options for Strengthening the Global Nuclear Security System," Global Dialogue on Nuclear Security Priorities (Washington DC: Nuclear Threat Initiative, 2 October 2012), p. 8, https://www.nti.org/media/pdfs/Options_for_Strengthening_the_Global_Nuclear_Security_System_4.pdf?_=1353437739.

58. Tanya Ogilvie-White, "Hard-Won Progress at the Nuclear Security Summits," *Australian Outlook*, 4 April 2014, http://www.internationalaffairs.org.au/australian_outlook/hard-won-progress-at-the-nuclear-security-summits/.

IAEA Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control.[59] The Strengthening Nuclear Security Implementation Initiative, an important outcome of the 2014 NSS, was supported by 35 states.[60]

3.4.2 Advisory and Peer Review Services

3.85 The IAEA also offers advisory and peer review services in the realm of nuclear security to member states on request, specifically, by providing them with professional assistance such as Nuclear Security Advisory Assistance Service and nuclear security publications. The IAEA has helped states to develop integrated plans for nuclear security improvements and assistance. In consultation with the hosting state, the IAEA drafts an Integrated Nuclear Security Support Plan (INSSP) which is tailored to the state's specific needs on the basis of findings and recommendations from various technical services. A typical INSSP presents five components of work related to nuclear security: legislative and regulatory framework, prevention, detection, response, and sustainability. The INSSP identifies the needs of the state, responsible entities and organizations within the state, and the timeframe for the implementation of agreed activities.

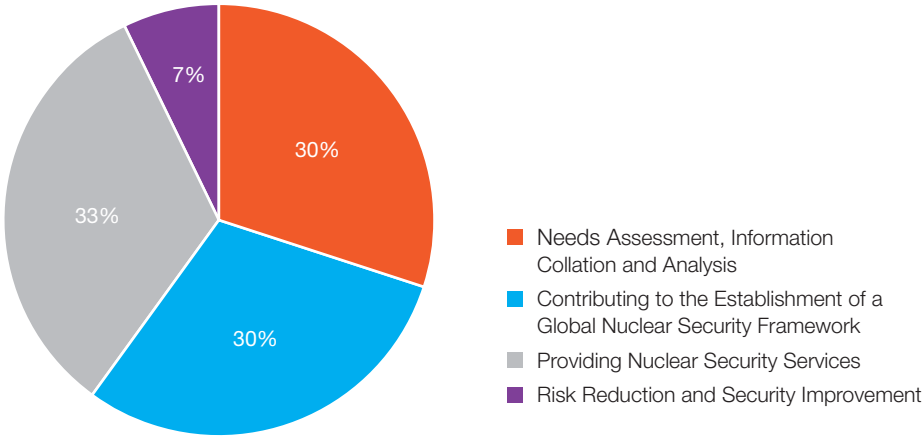
Table 3.2: IAEA Nuclear Security Advisory Services

Nuclear Security Advisory Services		Objective
International Nuclear Security Advisory Service	INSServ	Facilitate the identification of a state's broad nuclear security requirements and measures
International Physical Protection Advisory Service	IPPAS	Evaluate existing physical protection arrangements in member states
SSAC Advisory Service	ISSAS	Provide recommendations and suggestions for the requesting states for improvements to their state systems for accountancy and control
International Team of Experts	ITE	Monitor states' adherence to or implementation of international instruments for protection against nuclear terrorism
Integrated Regulatory Review Service	IRRS	Support states to improve the effectiveness of national regulatory bodies and to implement national safety legislation and regulations
Integrated Nuclear Security Support Plan	INSSP	Provide a general approach for nuclear security capacity-building

59. Strengthening Nuclear Security Implementation (25 March 2014).

60. Algeria, Armenia, Australia, Belgium, Canada, Chile, Czech Republic, Denmark, Finland, France, Georgia, Germany, Hungary, Israel, Italy, Japan, Kazakhstan, Lithuania, Mexico, Morocco, the Netherlands, New Zealand, Norway, Philippines, Poland, the Republic of Korea, Romania, Spain, Sweden, Turkey, Ukraine, United Arab Emirates, the UK, the US and Vietnam.

Figure 3.2 Resources Required for Implementing Nuclear Security Plan 2014–17



Subprogram	2013 Resource Requirement*	Per Cent
Needs Assessment, Information Collation and Analysis	1 372 728	30.2
Contributing to the Establishment of a Global Nuclear Security Framework	1 342 588	29.5
Providing Nuclear Security Services	1 496 854	32.9
Risk Reduction and Security Improvement	336 642	7.4

* The figures in this column show only the regular budget. Actual IAEA expenditure on implementing the nuclear security plan is four times higher and is mostly drawn from extra-budgetary contributions.

Source: Document GC(57)/2, The Agency's Programme and Budget 2014–2015 (preliminary estimates).

3.86 The establishment of the INSSP has enabled the IAEA, the states concerned and any donors financing the work to plan and coordinate activities from both a technical and a financial point of view. It also permits some states to prepare and implement the necessary nuclear security improvements internally and without external assistance. The most recent IAEA data states that by the end of December 2013, the Agency had worked with a total of 67 states to establish and/or implement INSSPs.[61]

3.87 In 2002, the IAEA established the Nuclear Security Fund (a voluntary funding mechanism) and for the first time elaborated a Nuclear Security Plan to combat nuclear security risks and support member states in the implementation of nuclear security instruments. The current Nuclear Security Plan, which covers the period 2014–17 and is the fourth such plan, includes seven program elements:[62]

- Needs assessment, information and cyber security;
- External coordination;
- Supporting the nuclear security framework globally;

61. http://www-ns.iaea.org/security/inssp. asp?s=4&l=26.
62. http://www.iaea.org/About/Policy/GC/GC58/GC58InfDocuments/English/gc58inf-8_en.pdf

- Coordinated research projects;
- Assessment through self-assessment and/or through peer review missions;
- Human resources development; and
- Risk reduction and security improvement.

3.88 The first three Nuclear Security Plans (2002–05, 2006–09, and 2010–13) relied in large part on extra-budgetary (voluntary) contributions. The fourth plan is likely to do the same, despite making it clear that the agency needs a more reliable funding stream for its nuclear security activities.[63] The proposed regular budget allocations for the four IAEA nuclear security subprograms in 2015 total $6.6 million, around one quarter of the funding from extra-budgetary contributions, estimated to be $24.53 million in 2015.[64] About half of the funding from voluntary contributions is earmarked specifically for subprogram 5.3.2 Nuclear Security of Materials and Facilities. According to the IAEA Annual Report 2013, 17 states,[65] the European Union, and one private company donor contributed to the Nuclear Security Fund in 2013.[66]

3.4.3 Filling the Gaps

3.89 Because nuclear security is a new "fourth" leg of the global nuclear regime (along with disarmament, non-proliferation and peaceful uses), it suffers by comparison from lack of clear authority, resources and governance architecture. The advantage of a leaders' summit is that it can help to break down political barriers and overcome bureaucratic inertia, and the NSS have generally been given good reviews. According to studies published by the Arms Control Association in March 2012 and March 2014, significant progress has been made in ratifying international conventions, securing and removing HEU and plutonium stocks, developing new nuclear security centres of excellence, conferences, and training activities, providing new funding support for HEU conversion and material removals and the like.[67] The March 2014 study details the progress made on the 13 joint statements (voluntary political commitments) presented at the 2012 NSS. Notable achievements include:

- Development of a national legislation implementation kit;
- The expansion and creation of additional national registries and databases accounting for and tracking radioactive sources;
- A meeting and exercise to improve transport security, leading to the development of a best practice guide;
- The development of LEU fuel powder for fuel fabrication and testing to aid in the conversion of research reactors from HEU;

63. GOV/2013/42-GC(57)/19, 2 August 2013, p. 12.
64. The Agency's Programme and Budget 2014-15, Table 17, p. 134, http://www.iaea.org/About/Policy/GC/GC57/GC57Documents/English/gc57-2_en.pdf.
65. Australia, Belgium, Canada, China, Estonia, Finland, France, Italy, Japan, the Netherlands, New Zealand, the Republic of Korea, Romania, the Russian Federation, Spain, the UK and the US.
66. http://www.iaea.org/Publications/Reports/Anrep2013/anrep2013_full.pdf.
67. Michelle Cann, Kelsey Davenport and Margaret Balza, *The Nuclear Security Summit: Assessment of National Commitments* (Washington DC: Arms Control Association, March 2012); Michelle Cann, Kelsey Davenport and Sarah Williams, *The Nuclear Security Summit: Assessment of Joint Statements* (Washington DC: Arms Control Association, March 2014).

- The establishment of nuclear security training and support centres, coordinated by the IAEA;
- Steps to convert all medical isotope facilities in Europe from HEU by 2015;
- The launch of five new projects under the Global Partnership against the spread of weapons and materials of mass destruction sub-working group on nuclear and radiological security;
- The conclusion of more than a decade of work to secure weapon-usable material at a Soviet-era nuclear test site;
- Targeted engagement of non-summit countries on nuclear security principles; and
- A series of nuclear security exercises, workshops and seminars, held under the auspices of the Global Initiative to Combat Nuclear Terrorism.

3.90 The 2014 NTI Nuclear Materials Security Index also concluded that major progress has been made in nuclear security since the 2012 Seoul NSS. It identified three areas of significant improvement: decreasing quantities of materials; strengthening physical protection measures; and passing new domestic laws and regulations aimed at better securing materials at facilities and during transport.[68] However, a great deal of work is still needed, especially in the area of comprehensive regime-building. The study drew attention to the fact that there is still no effective global system for how nuclear materials should be secured: no common international standards and practices for nuclear materials security; no governing body with the necessary mandate and the resources to provide sufficient oversight; and no mechanism for holding states accountable for lax security procedures.[69] As a result, approaches to nuclear security vary widely among states, creating dangerous weak links. For example, some states with weapon-usable nuclear materials do not require facilities to have their own armed guards on site to protect against attack, while some do not require operators of facilities with weapon-usable nuclear materials to address the risk of insider threats when they design their security systems.

3.91 Clearly, there are still significant gaps in the nuclear security architecture that need to be plugged. A plethora of initiatives exist, but there is no consensus on whether these should be combined under the IAEA umbrella or not. At present, the agency lacks the mandate and resources to allow this to happen. It adopts a nuclear security plan and the Board of Governors expects an annual report on nuclear security from the director general, but nuclear security remains a peripheral part of the IAEA institutionally. Moreover, the scope of existing IAEA nuclear security activities is mostly limited to materials security in the non-NWS. The fact that 85 per cent of weapon-useable material is designated for non-civilian use in the nuclear-armed states should help to concentrate minds when thinking about the potential alternative futures beyond the final summit meeting in 2016: if the NSS is replaced by a process within the IAEA, 85 per cent of relevant material will immediately be put beyond the discussion.

68. *NTI Nuclear Materials Security Index*, Second Edition.
69. *NTI Nuclear Materials Security Index*, Second Edition, p. 7.

3.92 Despite this, the IAEA's work on nuclear security has been given much greater prominence, visibility and importance since the 2010 NSS. Its dedicated office on strengthening nuclear security provides global leadership as well as invaluable technical information, guidance, training and assistance. But in addition to its fundamental lack of authority over military materials, the IAEA lacks authority to establish mandatory baseline standards for nuclear security and to monitor and enforce compliance with the standards. Regular, independent international review of safety, security and safeguards measures should be the international norm. As the UN's – that is, the world's – premier nuclear regulator, the IAEA must be mandated to negotiate binding agreements that establish global nuclear security standards. The IAEA must also be given the authority and the responsibility to certify compliance with these standards by monitoring national implementation. The IAEA should have the lead role in setting international standards, promoting cooperation, and providing on-request peer reviews.

3.93 The lack of predictable and stable funding for the IAEA regular budget is a serious problem. An annual budget of 344 million euros (2014) is modest for such an ambitious enterprise. Consistent with trends in most areas of the UN system, much of IAEA nuclear security activities are funded through extra-budgetary support for the Nuclear Security Fund; that is, on a voluntary instead of an assessed basis. The net result is that the funding base is neither secure nor sufficient. As the Secretariat noted in August 2013, this will become an even more serious problem if extra-budgetary contributions decline, as predicted.[70] The share of funding that comes from the regular budget needs to be increased, to cover "activities that are designed to benefit the greatest number of Member States." These include the maintenance of the Incident and Trafficking Database, the development of guidance in the Nuclear Security Series and the development of education and training programs to assist states to implement that guidance. One of the issues with extra-budgetary funds is that they tend to be directed towards activities that benefit an individual state or group of states.

3.94 The Nuclear Security Plan 2014–2017 also highlights the funding complications caused by the restrictions that contributing states place on their voluntary contributions, which make it difficult for the agency to fund some of its core activities.[71] As with most international organizations, the IAEA also faces the added problem of tardy payments, and non-payments, by member states. In September 2010 (the year of the first NSS), around 60 member states owed outstanding contributions totalling almost €90 million to the agency; almost 50 states still had outstanding dues of €15.6 million from previous years.[72] In September 2013, outstanding payments to the regular budget from nearly 80 states totalled nearly €106 million.[73] More than half of the outstanding dues are owed by the United States, with Brazil, the Dominican Republic, Germany, Greece, Iran, Portugal, Spain and Venezuela also owing large amounts.

70. GOV/2013/42-GC(57)/19, 2 August 2013, p. 12.
71. GOV/2013/42-GC(57)/19, 2 August 2013, p. 12.
72. Report by the Director General, *Statement of Financial Contribution to the Agency*, GC(54)/INF/9, 17 September 2010.
73. Report by the Director General, *Statement of Financial Contribution to the Agency*, GC(57)/INF/7, 13 September 2013, p. 6 of Annex.

3.95 Should the IAEA become the main focal point for nuclear security cooperation? This was one of the important issues at the 2014 NSS. The NSS process was always envisaged as an ad hoc and temporary mechanism, not a permanent institution. There is a serious issue of how to sustain the commitment needed. Despite the significant progress made through the NSS "Gift Baskets" (national and joint commitments to tackle specific nuclear security challenges), it is neither practical nor desirable to keep bringing large numbers of world leaders together to announce what are essentially minor, incremental steps. One option would be for the IAEA to take over the NSS agenda after the fourth summit in 2016.

3.96 To institutionalize the response under the IAEA will call for a major task of persuasion, requiring as it would the IAEA mandate, authority and powers to be greatly strengthened. Many IAEA members are concerned that incorporating a nuclear security budget into the regular budget while simultaneously freezing the regular budget will displace activities they see as more important (the IAEA Technical Cooperation Programme, in particular). At present states seek voluntary help and assistance from the IAEA to help improve their domestic regulatory, protection, control and accounting systems through services, guidance and recommendations, without needing to provide mandatory reports on implementation back to the IAEA.

3.97 Taken in conjunction with the effort to develop the so-called "state level approach" to safeguards (discussed in Chapter 2), this feeds into the wider complaint of some states that the IAEA is being re-configured as an instrument to implement Western priorities (non-proliferation, counter-terrorism) at the expense of global concerns (disarmament and development). For example, the Non-Aligned Movement (NAM) insists that "measures and initiatives aimed at strengthening nuclear safety and security must not be used as a pretext or leverage to violate, deny or restrict the inalienable right of developing countries to develop research, production and use of nuclear energy for peaceful purposes without discrimination."[74]

3.98 CNND believes that such complaints are not justified in this context and that the concerns that the IAEA is seeking to redress are genuinely global, and should be shared by all members of the international community. However, it is difficult within the foreseeable future to visualize enough states agreeing to give the IAEA mandatory and intrusive authority and powers, and the status quo – of IAEA services on request and non-binding recommendations as a de facto international nuclear security standard – is set to continue. Thus national statements at the 2013 IAEA General Conference and the 2014 NSS and NPT PrepCom were supportive of IAEA nuclear security activities, but did not indicate broad support to expand the IAEA nuclear security mandate beyond its current coordination and advisory role. One price of this is lack of uniformity in the interpretation and unevenness in the implementation of IAEA guidelines from one country to another.

3.99 Another possibility is the negotiation of a framework convention on nuclear security,[75] similar to the UN Framework Convention on Climate Change (UNFCCC),

74. Final Document of the 16th Summit of the Non-Aligned Movement, 26-31 August 2012, NAM 2012/Doc./Rev.2, p. 65, http://nam.gov.ir/Portal/File/ShowFile.aspx?ID=212cfdbf-6dbc-4185-a4f5-01fe30a0c772.

75. As argued by Kenneth C. Brill and Kenneth N. Luongo, "A security system commensurate with the risk of nuclear terrorism," *Bulletin of the Atomic Scientists*, 16 April 2012.

which would bring together the existing disparate and loosely-defined nuclear security conventions, rules and standards. Such a convention would establish an agreed overarching framework, set out common principles, express political commitments, and create a periodic review mechanism (for example, meetings at regular intervals like two or five years). The Fissile Materials Working Group (FMWG) believes that a framework convention would solve the present problem of a "patchwork of voluntary, nonbinding, non-transparent national commitments, ad hoc bilateral and multilateral initiatives, and vague legally binding measures" without specific standards. The IAEA, the group further argues, should be made the convention's executive agent to monitor and assess national implementation of the international standards and requirements.[76] However, given the continuing sensitivity of issues surrounding the UNFCCC, an explicit parallel with that may not be helpful.

3.100 A more mainstream view is that steps can only be taken nationally (since that is where the legal authority and resources are) and that it is not necessary to pursue either new legal instruments (we need to implement what we have) or a new coordination mechanism (if anything we already have too many). The IAEA is and will continue to be an outstanding technical resource, but it may not help either the agency or the cause of nuclear security to introduce the question of a leading role in governance. An NTI-sponsored global dialogue on nuclear security has concluded that while legally binding mechanisms may be desirable in the future, the search for it now, when no consensus for it exists, is likely to delay urgently needed security upgrades that are feasible within voluntary mechanisms.[77] The 2014 NSS joint statement on strengthening nuclear security implementation, through which 35 states pledged to meet the intent of the recommendations contained in the IAEA guidance documents, was the best that could be achieved in these circumstances.

§3.5 International Cooperation

3.5.1. General

3.101 Major nuclear reactor accidents – Three Mile Island, Chernobyl and, most recently, Fukushima – have triggered substantial reviews and produced major advances in nuclear safety governance. Because of the added gravity of the risks in the case of nuclear terrorism, advances in nuclear security governance to identify and plug vulnerabilities, both domestic and international, must precede and prevent major security crises, not follow one. Nuclear security is a sovereign responsibility. But because the economic and security consequences of a nuclear security breach or failure could be catastrophic for some or all others, "other governments and the global public have an equity in having some insight into how well the global nuclear security system is functioning."[78] A major nuclear security vulnerability or crisis anywhere would pose an unacceptable risk and threat everywhere. Individual state determination of adequate nuclear security

76. FMWG, *Preventing Nuclear Terror in the 21st Century: Policy Recommendations* (Washington DC: January 2012), p. 8.
77. "Strengthening the Global Nuclear Security System," Global Dialogue on Nuclear Security Priorities (Washington DC: Nuclear Threat Initiative, 10 July 2012), p. 2.
78. "Options for Strengthening the Global Nuclear Security System," p. 7.

standards and national implementation of the standards will not be enough by themselves. In addition, strengthened international standards and accountability are required on early detection, prevention of attacks, thefts and sabotage, as well as recovery of missing nuclear materials. Securing the world's most dangerous materials is the universal responsibility of all states and a common responsibility to all humankind.

3.102 Yet security lags well behind the other two nuclear "Ss" of safety and safeguards. The historical bias towards national secrecy and sovereignty must give way to international needs and standards of transparency and accountability. With safety, security and safeguards alike, states operating peaceful and/or weaponized nuclear programs must both manage the programs to international standards and be seen by the international community to be doing so.

3.5.2. Information Exchange

3.103 States Parties are not required to report on how they are observing the terms of the CPPNM, the CPPNM Amendment, or the IAEA nuclear security recommendations. In addition to the lack of any reporting mechanism, there is no review mechanism. Nuclear safety has a mandatory peer review mechanism: the members of the World Association of Nuclear Operators (WANO) have accepted such reviews. The CPPNM has no such peer review mechanism, nor an external review of any other type, nor any form of international inspection system or provision. Sharing and exchange of information,[79] and external reviews of national performance and reporting establish international confidence, may act as a check against vulnerabilities that may have escaped detection by national authorities, enable states to provide support and assistance to one another, and facilitate the development of international best practices. But for all the heightened concerns and awareness of the risks and dangers of nuclear terrorism, nuclear security is lacking in minimum transparency, reporting and accountability mechanisms.[80]

3.104 In 2005 INTERPOL started project GEIGER with a goal of collecting and analyzing information on illicit nuclear trafficking and other unauthorized activities involving nuclear and radiological materials.[81] In 2010 the IAEA launched the Nuclear Security Information Portal available for all member states in order to provide an "interactive knowledge-based environment to enhance nuclear security cooperation, facilitate implementation of joint activities and share relevant information."[82]

3.105 The 2012 NSS communiqué encouraged states to share best practices, and the 2014 NSS communiqué stressed the primary responsibility of nuclear operators in this area, including the importance of intensive dialogue between industry and government. Nuclear security standards and best practices play complementary and parallel roles in ensuring security. A "standard" is established by authority, custom or general practice. It defines

79. Some information will have to remain confidential for national security or commercial proprietary reasons. But some other information can be shared with other governments, the IAEA, or trusted friendly or allied states, on a confidential basis.

80. It should be noted that some of the reporting on these issues is done via the UNSCR 1540 national reports. Using the reports it is possible to discern to some extent how states are living up to certain commitments.

81. CBRNE Terrorism Prevention Unit, Interpol, http://www.interpol.int/Crime-areas/Terrorism/CBRNE-Terrorism-Prevention-Programme/Radiological-and-Nuclear-Terrorism-Prevention-Unit.

82. IAEA, *Nuclear Security Report 2011*, GC(55)/21, 5 September 2011.

objectives: performance requirements, specifications, guidelines or characteristics.[83] It is static. It represents a consensus judgment – that is, a minimum level of agreement – on goals. It is politically or institutionally authoritative but can be slow to develop. The IAEA INFCIRC/225/Rev.5 is the primary nuclear security standards document.

3.106 A "best practice," by contrast, is a method or technique that produces results consistently superior to those obtained with other means. It describes a process, not a goal, and aims to reach an optimum level of performance. Best practices can help to implement standards and also to inform their creation. They develop from the experience of many individuals and groups in government and industry in many countries and are constantly evolving.

3.107 The only existing schemes are voluntary and operated by the IAEA and the World Institute for Nuclear Security (WINS). Modelled on WANO, which was created after the Chernobyl nuclear accident as a forum for nuclear power plant operators to share best practices and exchange lessons learnt on reactor safety, WINS was founded in Vienna in September 2008. It facilitates the sharing of information and experience among security professionals in the nuclear industry, promotes training and best practices, and develops peer review systems. Much of its effort so far has concentrated on the preparation of a portfolio of best practice guides. In consultation with both industry and government stakeholders, WINS has published 30 best practice guides – six of which were revised and updated in 2013 – in multiple languages.[84]

3.108 Both the IAEA and WINS have demonstrated that it is possible to develop and share best practices consistent with the confidentiality of commercially or militarily sensitive information. The best practice guides offered by WINS cover topics from nuclear security culture to threat assessment and effective security regulation and implementation. It offers a peer review mechanism for security management on a voluntary basis on request. It provides training for professional managers and operators of nuclear security and is thus creating "a community of practice" in nuclear security. By the end of 2013, WINS had organised 49 workshops in 18 countries, providing training to a total of 1,797 participants.[85] In 2014 the training focused on three priority areas: security by design, insider prevention and the security of mobile sources.

3.109 Canada and Japan have helped to host and fund nuclear security best practice workshops with WINS. Canada pledged $100 million for new bilateral security cooperation with Russia. Japan set up a new Integrated Comprehensive Regional Support Centre for Non-proliferation and Nuclear Security in December 2010, and helped to fund R&D on nuclear detection and forensics techniques. Japan and the United States also set up a bilateral Nuclear Security Working Group to promote cooperation and collaboration. Nuclear security centres of excellence, training centres, workshops and conferences have been established or promised in China, India, Kazakhstan, France, Italy, Saudi Arabia and South Korea, often with US assistance.[86] The meetings of the Institute of

83. The descriptions of standards and best practices is summarized from "Options for Strengthening the Global Nuclear Security System," pp. 2–3.

84. *Adapting to New Challenges*, WINS Annual Report 2014, p. 14.

85. *Adapting to New Challenges*, p. 16.

86. See Cann, Davenport and Balza, *Nuclear Security Summit*, pp. 8–11.

Nuclear Material Management and the International Technical Working Group on Nuclear Smuggling have also become important information exchange and standard setting forums.

3.5.3. Security of Sensitive Nuclear Information

3.110 Information security is defined as the preservation of the confidentiality, integrity and availability of information.[87] The past few years have witnessed new forms of nuclear security threats mirroring rapid changes in technology. In 2011, Iran experienced a high failure rate of its IR-1 centrifuges installed at a fuel enrichment facility in Natanz.[88] A computer code named Stuxnet was responsible, and while Iranian officials denied that it had caused significant damage, the incident marked the first international incident of this nature.[89] The incident increased international awareness of threats to nuclear security due to gaps in information security. In light of the increased attention to the issue, in 2011 the IAEA published a reference text on computer security at nuclear facilities as part of its Nuclear Security Series. The publication highlights the specific situations where information security can be compromised to perpetrate an attack against a nuclear facility, viz:

- Information gathering attacks aimed at planning and executing further malicious attacks on nuclear facilities;
- Attacks disabling or compromising the attributes of one or several computers crucial to nuclear facility security;
- Compromise of one or several computers combined with simultaneous methods of attack, such as physical intrusion.

3.111 The more recent IAEA publication "Objective and Essential Elements of a State's Nuclear Security Regime" (Nuclear Security Series 20), also addresses information security, as does the forthcoming "Protection and Confidentiality of Sensitive Information in Nuclear Security" (Nuclear Security Series 22), which will provide guidance on establishing an effective framework for protecting the confidentiality of sensitive information, including the necessary legislation and regulations; identification of information assets that may be considered as sensitive information; considerations for sharing and disclosure of sensitive information; and methodologies for protecting confidentiality.[90]

3.112 Several states have recently released information on the voluntary measures they are taking to ensure the effective protection of sensitive nuclear information.[91] The United States issued formal regulations in 2009, requiring nuclear power plant operators to submit cyber-security implementation schedules. Australia included a

87. "Computer Security at Nuclear Facilities." IAEA Nuclear Security Series No. 17 (2011), http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1527_web.pdf.

88. D. Albright, P. Brannan, and C. Walrond, "Did Stuxnet take out 1,000 centrifuges at the Natanz enrichment plant? Preliminary assessment," Institute for Science and International Security (ISIS), *ISIS Reports*, 22 December 2010, http://isis-online.org/isis-reports/category/iran/.

89. "Iran says nuclear programme was hit by sabotage," *BBC News*, 29 November 2010, http://www.bbc.co.uk/news/world-middle-east-11868596.

90. http://www-ns.iaea.org/security/nuclear_security_series_forthcoming.asp?s=4&l35.

91. *UK Statement on Nuclear Information Security: Progress Update*, Nuclear Security Summit, The Hague, March 2014.

cyber-security component in its national design basis threat and has started to develop detailed guidance for the classification of nuclear security-related information. Australia's 2013 International Physical Protection Advisory Service (IPPAS) mission also included a review of arrangements for information security and cyber security at nuclear facilities.[92] Belgium and the Netherlands have taken similar steps, and Norway plans to follow suit in 2015.[93] In December 2013, France adopted a law on cyber-security and new regulations on the protection and control of nuclear materials. This includes a mandatory obligation for operators to report cyber-incidents. Canada, the Czech Republic, Hungary and South Korea are in the process of establishing national standards for the protection of electronic data and data systems that align with IAEA guidance and best practice.

3.113 At the 2012 NSS, 31 states supported the UK-sponsored Multinational Statement on Nuclear Information Security and at the 2014 NSS 35 states supported it. The initiative, which was also strongly promoted by the Netherlands as host of the 2014 NSS, recognizes the fundamental need to protect the sensitive nuclear information, technology and expertise necessary to acquire or use nuclear materials for malicious purposes, or to disrupt information technology based control systems at nuclear facilities. As part of this and other initiatives, several countries and organizations have conducted workshops and other events to train employees of nuclear power plant facilities in information security. These include the dedicated information security workshops run by WINS in Vienna in 2011, Toronto in 2012 and Amsterdam in 2013, which have led to the publication of a WINS international best practice guide in 2014 titled *Information Security for Operators: Challenges and Opportunities*.

3.114 Despite these positive developments, much more needs to be done to reduce cyber vulnerabilities, including:[94]

- Implementation of company-wide cyber security strategies in the nuclear industry, to include cyber design basis threats and training staff in the highest standards of 'cyber hygiene';
- Steps by states to introduce mandatory reporting of major cyber incidents (as occurs in France);
- The launch of public–private partnerships dedicated to cyber-security in the nuclear sector;
- Introduction of additional certification systems for software and hardware intended for use in nuclear facilities;
- Implementation of IAEA INSSPs and IPPAS Missions with a cyber-security element;
- Expansion and strengthening of the Multinational Statement on Nuclear Information Security at the 2016 NSS, and steps by existing signatory states to demonstrate their commitment to and the value of the initiative (for example, by continuing to report on voluntary measures);

92. Tanya Ogilvie-White and David Santoro, *Preventing Nuclear Terrorism: Australia's Leadership Role* (Canberra: Australian Strategic Policy Institute, January 2014).

93. *UK Statement on Nuclear Information Security*.

94. See Vincent Boulanin and Tanya Ogilvie-White, "Cyber Threats and Nuclear Dangers," APLN/CNND *Policy Brief* No. 17 (Canberra: Centre for Nuclear Non-Proliferation and Disarmament, November 2014).

- Development of a legally-binding instrument prohibiting cyber attacks against civilian nuclear infrastructure; and
- Establishment of an international response centre for dealing with major cyber incidents (as proposed by Russia).

3.5.4. Transport Security

3.115 Responsibility for the security of radioactive materials in transport rests with the state, but as with all other areas of nuclear security, international cooperation is crucial. Guidance on implementing necessary regulations is provided by the IAEA Nuclear Security Series, with Number 9 specifically dealing with security in the transport of radioactive material, including international shipments.[95] Other guides in the series also cover this issue.[96] The NSS have also promoted greater awareness and international collaboration on transport security. At the 2012 NSS, France, the Republic of Korea, the United Kingdom, and the United States supported a Japan-sponsored Joint Statement aimed at strengthening security in this area. This led to a joint table-top exercise, held in Tokyo on 12–14 November 2013, to share good practices, strengthen collaboration and promote the continuous improvement of transport operations.[97] Participants included officials and experts from the five states and additional observer states, plus the IAEA, WINS, the World Nuclear Transport Institute and the Japan Nuclear Energy Safety Organization. A report[98] on the exercise was shared with participants at the 2014 NSS and helped inform a new, re-worded joint statement, which emphasizes the need to develop new technologies to improve transport security; encourage more collaborative training (including through the nuclear security Centres of Excellence); and share knowledge on best practices.[99] These goals are also reflected in Paragraph 31 of the 2014 NSS communiqué.[100]

3.5.5. Combating Illicit Trafficking

3.116 The IAEA has operated the Incident and Trafficking Database (ITDB) (formerly known as the Illicit Trafficking Database) since 1995 as an information system on incidents of illicit trafficking and other unauthorized activities and events involving nuclear and other radioactive material. Additional activities include performing analyses of confiscated samples, assisting states with border controls, testing detection and monitoring equipment, and conducting training courses. The IAEA encourages all its member states to participate and a total of 125 states have joined the ITDB as of 2014. From January 1993 to December 2013, a total of 2,477 confirmed incidents were reported to the ITDB by participating states. Of these, 424 incidents involved unauthorized possession and related criminal activities, 664 involved reported theft or loss, and 1,337 involved other unauthorized

95. IAEA, *Security in the Transport of Radioactive Material*, Nuclear Security Series No. 9 (Vienna: IAEA, 2008).
96. Chapters 3 and 6 of *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities* (no. 13); chapters 5 and 6 of *Establishing a Nuclear Security Infrastructure for a Nuclear Power Programme* (no. 19); and chapter 3 of *Objective and Essential Elements of a State's Nuclear Security Regime* (no. 20).
97. https://www.nss2014.com/sites/default/files/documents/joint_statement_on_transport_security_final.pdf.
98. https://www.nss2014.com/sites/default/files/documents/ttx_report_transport_security_final.pdf.
99. https://www.nss2014.com/sites/default/files/documents/joint_statement_on_transport_security_final.pdf.
100. https://www.nss2014.com/sites/default/files/documents/the_hague_nuclear_security_summit_communique_final.pdf.

activities and events. In the remaining 69 cases, the reported information was not sufficient to determine the category of incident.[101] During 2013 alone, 1,461 incidents were confirmed to the ITDB. Of these, 6 involved possession and related criminal activities, 47 involved theft or loss and 95 involved other unauthorized activities.

3.117 Information reported to the ITDB demonstrates that the availability of unsecured nuclear and other radioactive material persists; effective border control measures help to detect illicit trafficking, although effective control is not uniformly implemented at all international border points; and individuals and groups are prepared to engage in trafficking this material. The most notorious example (albeit for non-proliferation rather than nuclear security) is the underground nuclear arms bazaar run by Pakistan-based Abdul Qadeer Khan, which showed the urgent and compelling need to detect, interdict and criminalize the clandestine trade in nuclear and dual-use components, materials, technology and skills. The other side of that enterprise is to secure them against unauthorized and illicit acquisition and use. Once they have been removed from regulatory control, some sensitive nuclear materials are very difficult to detect, especially in small quantities. But new technologies are helping to overcome this challenge, including a machine developed in the UK, which can detect attempts to smuggle nuclear material through airports and seaports.[102] In 2012, the US, EU and IAEA launched a joint initiative known as the Illicit Trafficking Radiation Assessment Program (ITRAP+10) test campaign, which attempts to evaluate new detection technologies against a set of common performance goals. A new US study, shows that X-ray imaging can be enhanced to detect gram quantities of HEU hidden in baggage, which may also lead to the development of a new tool to impede nuclear trafficking.[103]

3.118 For obvious reasons, law enforcement and intelligence agencies are shy of publicizing their efforts to detect and thwart illicit trafficking in nuclear materials and components. But we know that significant cooperation is taking place. For example, the NNSA manages the Megaports Initiative within the US Second Line of Defense program to prevent and respond to incidents of nuclear and radioactive smuggling. It provides training, technical assistance and equipment to strengthen detection and interdiction capabilities in the maritime ports of partner countries. Italy, New Zealand, Norway and the United Arab Emirates have also contributed to the Nuclear Smuggling Outreach Initiative launched by the United States with several donor partners that has engaged a number of key states bilaterally.[104]

3.119 In December 2011 Russia hosted a meeting with American experts to cooperate in improving national capacities to combat trafficking of nuclear materials.[105]

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101. IAEA Incident and Trafficking Database (ITDB), *Incidents of Nuclear and Other Radioactive Material out of Regulatory Control 2014 Fact Sheet*, http://www-ns.iaea.org/security/itdb.asp.

102. Oliver Wright, "Dirty bomb terror threat breakthrough: British scientists build machine to detect smuggling of nuclear materials," *The Independent*, 2 November 2012.

103. A.J. Gilbert, B.S. McDonald, S.M. Robinson, K.D. Jarman, T.A. White and M.R. Deinert, "Non-invasive material discrimination using spectral X-ray radiography," *Journal of Applied Physics* 115:2 (April 2014).

104. Afghanistan, Algeria, Armenia, Azerbaijan, Bulgaria, Democratic Republic of the Congo, Georgia, Kazakhstan, Kyrgyz Republic, Lithuania, Moldova, Saudi Arabia, Slovakia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan; http://www.nsoi-state.net/bilateralpartnersengaged/.

105. "Russian-US Expert Meeting on Combating Smuggling of Nuclear Material," 2 December 2011, http://www.mid.ru/brp_4.nsf/0/51790ADC3D6384F94425795D003B2002.

Similar cooperation between the USA and China was established in January 2011.[106] In support of the 2012 NSS, INTERPOL initiated Operation Fail Safe, an information-sharing tool that supports the international law enforcement community in tracking the transnational movement of individuals involved in the illicit trafficking of radioactive or nuclear materials. Efforts to cooperate in countering nuclear smuggling include technical workshops that feature hands-on demonstrations and exercises in nuclear material detection, law enforcement investigations, and nuclear forensics.[107]

§3.6. National Nuclear Security Regulations

3.120 Several countries have strengthened their national regulatory framework and capacity as part of the global efforts to improve nuclear security, from stringent export control laws that incorporate international best practices (for example Armenia in 2009 and Malaysia in 2010), to regulating nuclear and radiological activities in conformity with regional and global norms and treaties (for example Egypt in 2010). Of course, there is a difference between creating the legal framework and implementation in actual practice.

3.121 For example in 2012, on the eve of the Seoul NSS, China released a report listing several points that were implemented since the 2010 NSS in order to enhance nuclear security in the country.[108] The report said that authorities had already finished assessing security systems at operational nuclear power plants all over the country. Since September 2010, China and the United States had worked together to convert Chinese miniature research reactors, allowing them to substitute HEU with LEU fuel. The two countries were about to establish a radiation detection training centre for Chinese and other Asia Pacific customs officers in accordance with the January 2011 agreement. They had also jointly implemented a pilot program in Shanghai under the Megaports Initiative. Beijing claimed that it had created several laws and regulations to enhance security for radioactive storage facilities; upgraded security facilities for regional radioactive storage centres and centralized the storage of several dozen hazardous radioactive sources; and developed new high-tech devices to detect explosives and radioactive substances inside vehicles, that had already been deployed at major international events, including the Shanghai World Expo and the Guangzhou Asian Games in 2010.

3.122 A number of similar initiatives are occurring elsewhere, although, again, it is difficult to distinguish between aspirations and concrete achievements. For instance, at the 2012 NSS, Indonesia announced plans to install, with IAEA help, new mobile radiation portal monitors to increase nuclear and radioactive material detection capabilities at the country's major seaports. One was subsequently installed at Belawan Seaport in July 2012,[109] but it is unclear how much progress has been made since then. Indonesia's

106. "USA and China Cooperate on Nuclear Security," *World Nuclear News*, 20 January 2011.

107. https://www.nss2014.com/sites/default/files/documents/gift_basket_counter_nuclear_smuggling.pdf.

108. "China makes progress on nuclear security: report," *China Daily*, 27 March 2012, http://www.chinadaily.com.cn/china/2012-03/27/content_14922661.htm.

109. Bagus B.T. Saragih, "Govt expands nuclear monitoring at major ports," *Jakarta Post*, 3 April 2012, http://www2.thejakartapost.com/news/2012/04/03/govt-expands-nuclear-monitoring-major-ports.html.

statement at the 2014 NSS notes the country's plan to expand the use of these monitors, but no details were provided.[110]

3.123 UNSCR 1540 has created a legal obligation for states to implement measures related to nuclear security and to report on the measures they have taken to the 1540 Committee. The most recent report on implementation of the resolution, published on the 1540 Committee website in September 2011 (another is expected before the end of December 2016), revealed that since the adoption of the resolution in 2004, 168 states had submitted national reports on the steps they have taken or intend to take to implement 1540.[111] Of these, 105 states had submitted additional information at the request of the 1540 Committee, and at least 140 states had adopted legislative measures to prohibit proliferation of nuclear, chemical and biological weapons (as compared to 65 states in 2006). But the report also revealed significant gaps. For example, more states had measures in place prohibiting chemical weapons than nuclear or biological weapons. At the 2014 NSS, 32 states supported a joint statement on the full and universal implementation of Resolution 1540.[112] In 2014, the 1540 Committee's international outreach activities focused on encouraging states to submit National Actions Plans. By December 2014, only 14 states had done so. States should submit these as soon as possible. Guidance on how to draft the plans is available from the 1540 experts.

§3.7. Sensitive Nuclear Materials: Civilian and Military

3.124 "Sensitive nuclear materials" are HEU and separated plutonium. The bulk of HEU in the world is used for military purposes, but significant amounts are also used in civilian programs and the same is true for separated plutonium. HEU has a threefold attraction for terrorists: it can be used in the simple "gun-type" fission weapon with no need for sophisticated detonation equipment; it is smuggler-friendly because it emits only faint radiation signals that make it hard to detect; and, being less radiotoxic than plutonium, it is safer to handle. HEU remains "the most accessible fissile material for a terrorist nuclear device."[113] Making a successful explosive device from plutonium would present greater challenges for terrorists, compared with using HEU, but the risk is real, especially given the possibility that terrorists might succeed in recruiting one or more experts from a national nuclear weapon program.

3.125 About 1,730 tonnes of weapon-grade nuclear materials in the world – enough for another 100,000+ bombs compared to the present stockpiles of about 16,400 – are stored in hundreds of sites in 32 countries.[114] This is in addition to an estimated 111 sites spread across 14 countries in which nuclear weapons are stored.[115] While some of the

110. https://www.nss2014.com/sites/default/files/documents/indonesia.pdf.

111. 1540 Committee Report, S/2011/579.

112. Argentina, Armenia, Australia, Canada, Chile, Czech Republic, France, Georgia, Germany, Hungary, Italy, Japan, Jordan, Kazakhstan, Lithuania, Mexico, Morocco, the Netherlands, New Zealand, Norway, the Philippines, Poland, the Republic of Korea, Romania, Singapore, Spain, Sweden, Turkey, Ukraine, the UAE, the UK, and the US.

113. FMWG, *Preventing Nuclear Terror in the 21st Century*, p. 6.

114. http://www.knowledgesummit.org/wp-content/uploads/2013/05/R.-Rajaraman-.pdf.

115. Belfer Center, *Nuclear Terrorism Fact Sheet*.

sites are well-secured, many are not.[116] Hence the risk of sabotage and theft by or illicit sales to terrorists, criminals and others.[117] Materials used in the nuclear fuel cycle can be lost, abandoned or removed from decommissioned and inactivated facilities without proper authorization. The risks are multiplied in conditions of fragile and failing states, of fragmented authority structures, of a pervasive culture of corruption among public officials, or when widespread unemployment, underemployment and poverty can weaken resistance to inducements offered by various groups. There are no precise and reliable figures on how much HEU or separated plutonium is missing.

Table 3.3: Fissile Material Stocks, Military and Civil (tonnes) (as at 31 December 2013 unless indicated otherwise)

	Unirradiated HEU		Separated plutonium		Total
	Military	Civil	Military	Civil	
Russia	636.0	20.0	128.0[a]	51.9	835.9
USA	475.0[b]	20.0	87.0[c]	4.6	586.6
UK	19.8	1.4	3.2	123.0[d]	147.4
France	26.0	1.3	6.0	78.1[e]	111.4
China	16.0		1.8		17.8
Pakistan	3.0		0.15		3.15
India	2.4[f]		0.54	4.94[g]	7.88
Israel	0.3		0.84		1.14
North Korea			0.03		0.03
Japan		0.2		10.8[h]	11.0
Germany				3.0[i]	3.0
Others		5.0			5.0
Total (rounded)	**1,178.5**	**47.9**	**227.6**	**276.3**	**1,730.3**

Notes:

a. Includes 34 t declared excess
b. Includes 63 t declared excess
c. Includes 44.4 t declared excess
d. Includes 23.4 t held for other countries
e. Includes 17.9 t held for other countries
f. 0.8 t of 90% HEU equivalent
g. Includes 4.7 t "strategic reserve" outside safeguards
h. A further 36.3 t of Japanese Pu are held in other countries
i. A further 3.8 t of German Pu are held in other countries

Irradiated HEU, in the form of naval fuel, is not included, and is estimated to be approximately 110 tonnes.

There has been a major international effort to eliminate holdings of fissile materials. As at January 2014 26 countries, plus Taiwan, had eliminated all or most of their holdings of these materials.

Source: Various figures available on International Panel on Fissile Materials (IPFM) website. A number of the figures are IPFM estimates, with varying degrees of uncertainty. http://www.fissilematerials.org.

116. Sometimes even a well-secured facility is vulnerable; for an account of what may have been "the biggest security breach in the history of the nation's atomic complex," see William J. Broad, "The nun who broke into the nuclear sanctum," *New York Times*, 10 August 2012, http://www.nytimes.com/2012/08/11/science/behind-nuclear-breach-a-nuns-bold-fervor.html?pagewanted=all&_r=0.

117. For an indication of the scale of damage that can be caused by such an eventuality, see http://www-pub.iaea.org/MTCD/publications/PDF/Pub815_web.pdf, regarding what happened in Goiania, Brazil.

3.126 The elements of a perfect nuclear security storm are the abundant supply of weapon-useable nuclear materials, all of which must be secured to ensure non-availability to unauthorized individuals or groups; the explosion of knowledge and technical expertise, much of it relatively easily accessed through the Internet; the determination of terrorists to get it; and the known ruthlessness of terrorists to use it. For all these reasons, effective nuclear security demands that weapon-useable HEU and plutonium stocks should be eliminated where feasible, and where this is not feasible, they should be minimized and consolidated into fewer sites.

3.127 In order to limit opportunities for theft and sabotage, states must limit access to nuclear material and facilities only to authorized personnel, and to the minimum number of personnel consistent with safe operational requirements; keep material that is not in use in secure vaults; and monitor all storage of and access to materials. Physical protection systems should be subject to periodic inspection and testing. Accountability mechanisms should include an appropriate legislative and regulatory framework, a competent and independent oversight authority or nuclear regulator, and a clear assignment of responsibilities for nuclear security as well as nuclear safety.

3.128 **Sensitive Nuclear Materials for Civilian Use.** Progress has been made in global efforts to shift from the use of HEU to LEU fuel and targets in civil nuclear research reactors and isotope production facilities. These conversion efforts were first started under the Department of Energy's Reduced Enrichment for Research and Test Reactors program, which was launched in 1978. Today, the GTRI's Convert program continues this work.[118] Together, these programs have converted or verified the shutdown of 88 HEU research reactors and isotope production facilities worldwide.[119] The success of the GTRI Convert and predecessor programs has relied on growing international awareness of the security risks posed by HEU, and on the political will of states to reduce these risks. Progress has been very visible since the start of the NSS process in 2010. Between 1992 and 2009, 14 countries rid themselves of weapon-usable nuclear materials; since the launch of the NSS process, 13 more countries have done the same, representing a remarkable rate of acceleration.[120]

3.129 However, states have been reluctant to go a significant step further and actually *ban* HEU use in civilian applications. Hinderstein, Newman and Reistad have argued that the time has come to move from HEU minimization to elimination.[121] As part of this, they call for a new global norm that requires LEU to be used in any new facility, process or vessel under development, design or construction, an end to subsidies for HEU production that prices LEU alternatives out of the market, voluntary declarations of HEU holdings, and an assessment of the inventory needs for HEU use in military vessels. More ambitious steps, including fissile-material-free zones, could follow. At the 2014 NSS, 12 countries marked the elimination of HEU from within their borders: Chile, Czech Republic, Denmark, Georgia, Hungary, Mexico, Republic of Korea, Romania, Sweden, Turkey, Ukraine, and Vietnam.

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118. http://www.nnsa.energy.gov/aboutus/ourprograms/dnn/gtri/convert.

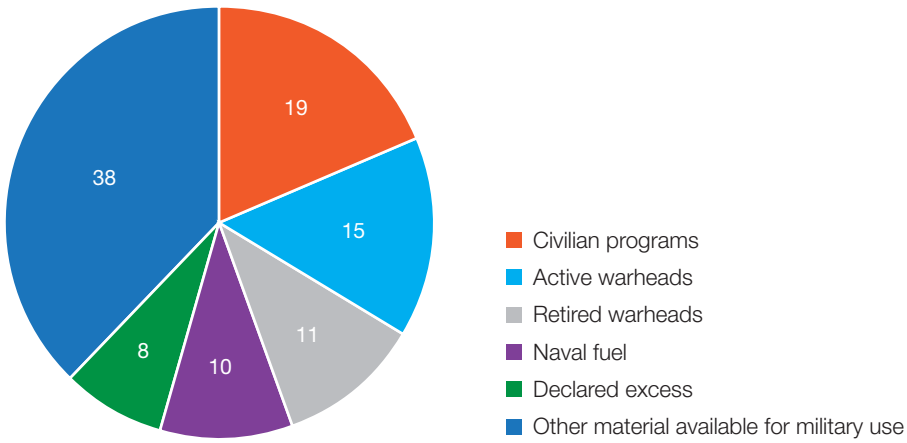
119. NNSA, "GTRI's Convert Program: Minimizing the Use of Highly Enriched Uranium," *NNSA Fact Sheet*, 29 May 2014, https://nnsa.energy.gov/mediaroom/factsheets/gtri-convert.

120. Deepti Choubey, "From Sprint to Marathon: The 2014 Nuclear Security Summit and the Path Ahead," *Arms Control Today*, May 2014, p. 3.

121. Corey Hinderstein, Andrew Newman and Ole Reistad, "From HEU minimization to elimination: time to change the vocabulary," *Bulletin of the Atomic Scientists* 68:4 (2012), pp. 83–95.

3.130 New technologies have enabled the production of reactor fuel and medical isotopes using LEU fuel. More than 700 kg of HEU – or about half the world's consumption – is used in civilian research reactors annually, of which 40-50 kg is used for civilian isotope production. Just five countries – Belgium, Canada, France, the Netherlands, and South Africa – produce most of the world's radioactive isotope molybdenum 99 that is the source for more than 20 million diagnostic imaging procedures globally. These countries are committed to reducing the nuclear security risks involved in its production. In December 2010, South Africa switched to LEU-sourced molybdenum 99.[122] Canada has announced its intention to cease the production of Mo-99 from its Chalk River National Research Universal reactor in 2016, thereby eliminating HEU-based isotope production domestically.[123] Progress has been slower in Europe, where the pace is being determined by technological and economic considerations. Belgium, France and the Netherlands have all announced that they plan to convert their high performance reactors to LEU, but while Belgium claims that its plans are on schedule, France has stated that "efforts remain to be accomplished to develop an economically and technically viable technology."[124]

Figure 3.3: Categories of Weapon-Useable Nuclear Materials Globally (percentages, 2014*)



* The figures for active (15%) and retired (11%) warheads are for 2011, as the information is not available for 2014.
The chart excludes irradiated naval fuel since that requires reprocessing and possibly re-enrichment before it can be made weapon-usable.

Source: Based on information from the International Panel on Fissile Materials (IPFM).

3.131 The GTRI's Molybdenum-99 Program has been assisting global producers in converting their Mo-99 production facilities from the use of HEU targets to LEU targets, and works with existing commercial entities to accelerate the establishment of non-HEU-based Mo-99 production. The program has also verified the cessation of the use of HEU targets for isotope production in Indonesia, and in June 2010, supported

122. Hinderstein, Newman and Reistad, "From HEU minimization to elimination," pp. 85-87.
123. National Progress Report of Canada, Nuclear Security Summit 2014.
124. National Progress Reports of Belgium France, and the Netherlands, Nuclear Security Summit 2014, available at http://nuclearsecuritymatters.belfercenter.org/2014-hague-summit.

South Africa's first large scale production of Mo-99 using LEU targets.[125] Its efforts have been backed by statements and commitments at the 2012 Seoul[126] and 2014 Hague[127] NSS.

3.132 In addition to encouraging states to minimize their stocks of HEU, the 2014 Hague Summit Communiqué called for stockpiles of separated plutonium to be kept to a minimum level. Weapon-grade plutonium, unlike weapon-grade uranium, cannot be blended with other materials to make it unusable in weapons. However, it can be fabricated into mixed oxide uranium-plutonium (MOX) fuel and irradiated in civil nuclear power reactors to produce electricity. This irradiation results in spent fuel – a form that is not usable for weapons or other military purposes. According to the Plutonium Management and Disposition Agreement (PMDA), which entered into force in July 2011, the US and Russia have agreed to eliminate their excess weapon-grade plutonium using this process.[128] Disposition is tentatively scheduled to begin in 2018 under IAEA verification. The agreement prohibits spent fuel from being changed in the future unless it is subject to agreed international monitoring measures and is used only for civilian purposes. This sets the stage for the elimination by each country of 34 tonnes of excess weapon-grade plutonium, enough for 17,000 nuclear weapons. Both Russia and the United States plan to begin disposition activities by 2018.

3.133 At the 2014 NSS Japan pledged to remove all HEU and separated plutonium from the Fast Critical Assembly at the Japan Atomic Energy Agency. This material, which was supplied to Japan in the 1960s by the US and UK, includes 331 kg of weapon-grade plutonium and 200 kg of weapon-grade HEU – enough to produce about 60 nuclear weapons.[129] Under the plan, the United States will convert the material to less sensitive forms: the plutonium will be disposed of and the HEU down-blended. In 2014, Belgium transferred to the United States significant quantities of excess HEU and separated plutonium, for which use was no longer foreseen, in collaboration with the US.[130]

3.134 Reactors that are yet to be converted may pose significant challenges. Russia has devoted more effort and resources to converting and shutting down the facilities of others than its own, on the argument that its stockpiles are well secured. Indeed, despite having the largest number of HEU fuelled research reactors and the second largest stock of civilian HEU (after the US),[131] and despite supporting two NSS communiqués, Russia still lacks a domestic conversion program, is preparing new HEU production activities at its electrochemical plant in Zelenogorsk, and is scaling up the production of HEU-based medical isotopes.[132] In 2013, Russia also declared it would sell HEU to France. Thus, Russia "remains torn between the commercial benefits of HEU and its political and security costs."[133]

125. https://nnsa.energy.gov/mediaroom/factsheets/gtri-convert.

126. http://www.whitehouse.gov/the-press-office/2012/03/26/joint-statement-quadrilateral-cooperation-high-density-low-enriched-uran.

127. http://www.whitehouse.gov/the-press-office/2014/03/25/joint-statement-multinational-cooperation-high-density-low-enriched-uran.

128. http://dtirp. dtra.mil/tic/synopses/pmda.aspx.

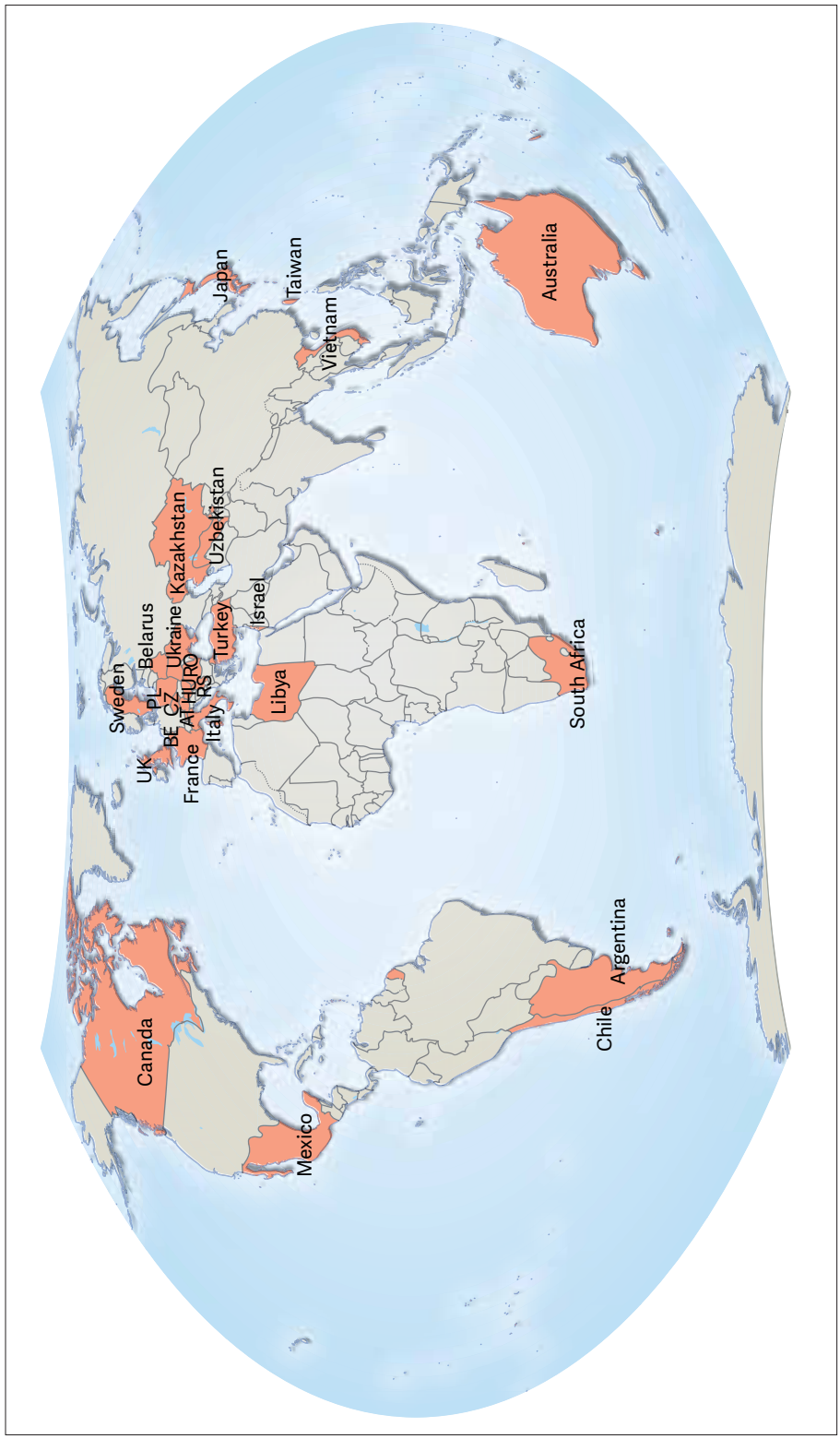
129. John Carlson, "Japan transfers weapons grade plutonium and highly enriched uranium to US," *The Interpreter*, 25 March 2014, http://www.lowyinterpreter.org/category/Nuclear-energy.aspx.

130. Belgium's National Progress Report, Nuclear Security Summit 2014.

131. Anatoli S. Diakov, "On Conversion of Research Reactors in Russia," 23 August 2013, available at http://www.armscontrol.ru/.

132. Pavel Podvig, "Russia is set to produce new highly-enriched uranium," IPFM Blog, 1 June 2012, http://fissilematerials.org/blog/2012/06/russia_to_resume_producti.html.

133. http://www.nti.org/analysis/articles/civilian-heu-russia/.



Map 3.1: Removal of HEU or Plutonium by GTRI (2009–14)

3.135 The 2014 NTI Index reports that Japan and the UK have also increased quantities of weapon-usable nuclear materials in their civilian sectors; India and Pakistan have increased quantities for both civilian and military purposes; and North Korea has taken new steps necessary to produce new weapon-usable nuclear materials, which may increase its quantities in future editions of the NTI Index.[134]

3.136 The United States ended HEU production in 1992 but continues to use HEU for military and civilian purposes, and to engage in HEU commerce. The International Panel on Fissile Materials (IPFM) estimated the total US HEU stockpile (military and civilian) to be 595 tonnes as of the end of 2012.[135] The IPFM figures, which include US–origin HEU that was repatriated from third countries as part of threat reduction efforts, estimate that 260 tonnes of HEU is marked for weapons use; 252 tonnes for naval reactor fuel (including spent fuel); 20 tonnes is in civilian use; and 63 tonnes is declared excess and set aside for blend-down or disposal.

3.137 Although the US and the UK are the only two nuclear-armed states that have declared their total stockpile, the US does not voluntarily declare its HEU holdings to the IAEA as part of its annual declaration of plutonium stocks, and as a result, its civilian holdings are less transparent than those of France, Germany and the United Kingdom. However, the United States has recently increased transparency regarding its HEU exports. The US Nuclear Regulatory Commission is now required by law to report to Congress on HEU exports used as fuel or targets in nuclear research or test reactors. On 9 January 2014, the first report was submitted, revealing that since 1957, the US has exported approximately 22,600 kg of HEU to 35 countries for such uses.[136] Of this, about 6,100 kg remains in storage and/or in use at approximately 40 locations in 20 countries (the countries are identified in a classified annex to the report).

3.138 Lack of transparency is undermining international confidence in the domestic HEU minimization efforts of some countries. India's 2014 NSS national progress report is typically cryptic, stating that: "With regard to minimization of use of civilian HEU, the enriched uranium based fuel in the APSARA reactor was placed in a safeguarded facility in December 2010. APSARA will use indigenous fuel which is not high enriched uranium. However, there is a growing demand for large-scale production of isotopes for a range of applications in healthcare, industry, food and agriculture."[137]

3.139 The release of the 2014 NTI Index, which placed India's nuclear security rating at number 23 out of 25 states with weapon-usable nuclear materials (below that of Pakistan), caused consternation among Indian experts and officials. India's lack of transparency, and decision to store HEU in domestic facilities rather than repatriate it, were cited by the NTI Index as two of the reasons India's score was so low. Senior Indian officials responded that they did not think it was wise to "put all information about how India guards its nuclear establishments in the public domain" and believed the NTI's

134. *NTI Nuclear Materials Security Index*, Second Edition, p. 11.

135. IPFM, *Global Fissile Material Report 2013*, p. 11.

136. United States Nuclear Regulatory Commission Report to Congress on the Current Disposition of Highly Enriched Uranium Exports Used as Fuel or Targets in Nuclear Research or Test Reactors, January 2014, http://fissilematerials.org/library/2014/01/report_to_congress_on_the_curr.html.

137. *National Progress Report of India*, 2014 Nuclear Security Summit.

quest for inside information on such sensitive issues to be a "fishing expedition for information."[138] NTI's response was to highlight the importance of confidence-building through transparency and international peer review.[139] NTI explained that the vast majority of the countries surveyed, including six nuclear-armed states, had participated in some sort of international peer review, but not India, which, with no independent regulatory agency, has "few 'checks and balances'."

3.140 **Sensitive Nuclear Materials for Military Use.** The progress made in reducing the availability of sensitive nuclear materials, and HEU in particular, for civilian use, has not been matched in relation to stocks held for non-civilian purposes. The IAEA safeguards agreements require each state to create a national system for accounting for and control of nuclear material. But most of the world's weapon-useable nuclear material is in nuclear-armed states. Consequently, only a small fraction of the world's HEU and less than half of the world's separated plutonium, is subject to international discipline with respect to nuclear material accountancy. More than 95 per cent of the world's HEU and separated plutonium stock is held by the five NWS, while India and Pakistan (and possibly North Korea) are continuing to produce HEU and plutonium for weapons purposes.[140] Israel is also believed to be producing plutonium for military uses.[141] The minimization by non-NWS of the use of HEU, including through the conversion of reactors from HEU to low enriched fuel, is therefore not enough to solve the fissile material security problem.

3.141 In order for the international community to have confidence in it, an effective nuclear security regime must be comprehensive. That is, it must cover all weapon-useable nuclear material in use and in storage. Significant reductions in non-civilian HEU stocks has occurred under the Russia–US Megatons-to-Megawatts agreement (further addressed below), but the vast majority of weapons-useable material is still not subject to international standards, guidelines, best practices, or mechanisms for international assurance.[142] Matthew Bunn points out that between them, Russia and the United States possess over 90 per cent of the world's HEU stockpile, operate more than half the world's HEU-fuelled research reactors and about two-thirds of the reactors with the most dangerous material, and provide most of the HEU-fuelled reactors and the HEU fuel for them to the rest of the world.[143]

3.142 A comprehensive, universal and enforceable nuclear materials control system would be invaluable. The national commitments made by states at the NSS are minimal, not ambitious, and there is no common rigorous methodology to assess progress against agreed benchmarks. States provide confidential reporting on HEU stocks under IAEA safeguards agreements, but there is no binding transparency regime for non-civilian nuclear materials. Under the terms of the 2010 Action Plan on Nuclear Disarmament, the NWS agreed to report to the 2014 NPT Preparatory Committee on the steps that they

138. Sandeep Dikshit, "Tansparency No Index of Nuclear Security Says India," *Hindu*, 12 January 2014.
139. NTI, "Letter to The Hindu," 15 January 2014, http://ntiindex.org/news-items/letter-to-the-hindu/.
140. IPFM, *Global Fissile Material Report 2013*, pp. 8–10.
141. IPFM, *Global Fissile Material Report 2013*, p. 3.
142. "Options for Strengthening the Global Nuclear Security System," p. 9.
143. Matthew Bunn, "HEU Consolidation: The U.S. and Russian Pictures," unpublished conference paper, 24 January 2012, https://www.nti.org/media/pdfs/Bunn_-_HEU_Symposium_-_Vienna_24_jan_2012.pdf?_=1328045409.

have undertaken to uphold their disarmament commitments. However, their pledge did not lead to greater transparency on domestic non-civilian nuclear materials stockpiles. The reports of China, France, and the UK contain no such details, and Russia's report only includes quantities of fresh and spent HEU fuel returned to Russia from third countries.[144] Only the US report provides details of the US domestic inventory of nuclear materials produced for military or non-military use, all of which was already in the public domain.[145] As a result, there is a significant imbalance in knowledge in this area, as the IPFM Global Fissile Material Report 2013 reveals, and as reflected in Figure 3.3.

3.143 The challenge is to devise systems and procedures that secure non-civilian nuclear materials and facilities to international standards and best practices while maintaining the necessary confidentiality for commercial or national security reasons. In the global stockpile of weapon-useable HEU (1,226 tonnes) and separated plutonium (504 tonnes), almost all HEU and about half of the plutonium remain outside civilian programs.[146] A particular challenge is HEU-fuel use for powering submarines and aircraft carriers. France finished converting its small submarine fleet to LEU in 2008, but naval giants Russia and the US have declined to publicly assess the feasibility of conversion to LEU-fuelled naval reactors for their fleets and they require about one and two tonnes respectively of HEU each year for this purpose.[147] No nuclear security system will be effective unless all weapon-usable materials are under effective security.[148] A modest and cautious start could be made by voluntarily bringing some of the non-civilian nuclear material that is not being used in nuclear weapons under international standards and best practices, for example:[149]

- Through declaring and placing under IAEA safeguards all plutonium and HEU in civilian use; all plutonium and HEU recovered from excess weapons, nuclear weapons complexes, and declared excess for weapon purposes; and all plutonium and HEU going to waste disposal sites;
- Through agreeing to prepare national records that would allow them to declare fissile material production facilities, the state of shutdown, and decommissioning or conversion plans, and HEU and plutonium production and related waste production and disposal records;
- Through agreeing to pursue cooperative projects to permit verification of declarations of historical fissile material production.

3.144 It could be argued that military-relevant material, like nuclear weapons themselves, already has a much higher level of protection. But while non-civilian nuclear material under military protection is generally better protected than civilian material, not all material – even weapons themselves – and facilities under military protection can be

144. The national reports submitted by the NWS at the 2014 PrepCom can be found at: http://www.reachingcriticalwill.org/disarmament-fora/npt/2014/national-reports.

145. US Department of State, *Transparency in the U.S. Nuclear Weapons Stockpile: Fact Sheet*, 29 April 2014, http://www.reachingcriticalwill.org/disarmament-fora/npt/2014/national-reports.

146. IPFM, *Global Fissile Material Report 2013*, p. 3.

147. The UK and India also produce HEU for naval fuel, but in much smaller quantities (especially in India's case). See Hinderstein, Newman and Reistad, "From HEU minimization to elimination," p. 89; Zia Mian, Frank von Hippel, Alexander Glaser, "A Fissile Material Approach to Nuclear Disarmament and Nonproliferation," Rio de Janeiro, 21 March 2014.

148. "Options for Strengthening the Global Nuclear Security System," p. 10.

149. These recommendations and others are outlined in the IPFM, *Global Fissile Material Report 2013*, pp. 3–5.

assumed to be totally safe, as exemplified in: the unauthorized transfer of six nuclear weapons across the United States in 2007; revelations about security vulnerabilities on L'Ile Longue (which hosts France's four ballistic missile submarines); and concerns regarding competent personnel and strategic organizational change affecting the UK's Trident warheads and nuclear submarines.[150]

3.145 Moreover, not all nuclear material for non-civilian use is under military protection. Warhead components, warheads undergoing maintenance, warheads awaiting dismantlement, and the large stockpiles of US legacy materials, for example, are in the custody of the DOE and under the protection of civilian contractors. On 28 July 2012 three activists – including an 82-year old nun – breached for a few minutes a heavily guarded section of the Y-12 National Security Complex in Oak Ridge, Tennessee, which houses several hundred tonnes of weapon-grade HEU and had been assumed to be secure against armed terrorists. This is a government but not a military facility.[151]

3.146 Although achieving international cooperation aimed at securing military-relevant materials is challenging, significant strides have been made in the past and it is critical that similar initiatives are not prevented from occurring in future. The bilateral 1993 HEU purchase agreement between the United States and Russian governments, known informally as the Megatons-to-Megawatts program, eliminated 500 tonnes of surplus weapon-grade uranium from Russian military stockpiles from 1993–2013: a historic achievement that over 20 years eliminated more than a quarter of the planet's fissile material for non-civilian use. Trilateral US–Russia–Kazakhstan cooperation to secure residual, unguarded plutonium at Semipalatinsk (a former Soviet nuclear-weapon test site in Kazakhstan), was also ground breaking. This cooperation ran from 1993–2012, was initiated without a formal negotiated agreement and was driven by direct engagement among US, Russian and Kazakh scientists.[152] The two initiatives provide models for future international cooperation on threat reduction, demonstrating that collaborative work involving military-relevant nuclear materials can be undertaken without threatening national security or requiring countries to disclose sensitive information.

3.147 This issue of military and other non-civilian stocks is destined to become more central to nuclear security debates in the lead-up to the 2016 NSS. At the end of The Hague summit, President Obama included military materials in his outline of the forthcoming agenda, and the US national progress report provided information about the measures in place around US military materials. It also made a new commitment to use Security Council Resolution 1540 to report on the security of these materials.[153] This pledge was upheld in September 2014, when the US submitted an updated 1540 report to the Security Council, which included information about the nuclear security measures it has in place to protect nuclear weapons and related materials.[154] US leadership also extends to the NGO community, and in particular to a new NTI project bringing together

150. Patricia Lewis, Heather Williams, Benoit Pelopidas, and Susan Aghlani, *Too Close for Comfort: Cases of Nuclear Nuclear Use and Options for Policy* (London: Royal Institute of International Affairs, 2014), p. 1.

151. "Options for Strengthening the Global Nuclear Security System," p. 10.

152. Cann et al, *The Nuclear Security Summit* (2014), p. 19.

153. *National Progress Report of the United States of America*, 2014 Nuclear Security Summit.

154. National Submission of the United States of America to the 1540 Committee, 29 September 2014. See pages 4–8, which cover the security of nuclear weapons and nuclear weapons materials.

prominent leaders from the military, political and technical sectors from key nuclear-armed states to discuss the security of a diverse range of military-relevant materials. The NTI website states that the group will "develop specific recommendations for release in 2015 to tighten control of military and non-civilian materials and build international confidence in the effectiveness of their security, while still protecting sensitive information."[155]

§3.8. Nuclear Forensics

3.148 Nuclear forensic analysis is a key technical capability that utilizes signatures inherent to nuclear or other radioactive material to provide information on its source, production and history. It can be useful before and after a nuclear security event, and in tracing breaches of the non-proliferation regime. As one would expect, the technical capability to detect current and past suspect activity is becoming more sophisticated.

3.149 When nuclear or radioactive material is found outside of regulatory control, nuclear forensics becomes relevant. The first task for nuclear forensic experts is to determine the location of the material and make sure that it is secured against loss or theft. Subsequent but just as vital requirements are to identify the source and place of origin of the material, plug the vulnerabilities that allowed it to escape regulatory control, and assist the lax or negligent authorities to enact and enforce laws to prevent recurrence of such incidents.

3.150 Forensic experts trace the "signatures" of each of the production processes in the manufacture of the nuclear material by examining the isotope content, chemical constituents and physical shape to determine the geological features of the place from which the uranium ore might have been extracted, or the process by which the ore was concentrated into yellowcake, made into nuclear fuel pellets and burned in a reactor. With the help of such specialized forensic techniques, the investigators can usually tell the story of where the material came from, or at least narrow it down to a few places, and retrace its manufacture and use.

3.151 The nuclear forensic analysis of signatures introduced into the material by specific production processes can in some cases determine if the material has been removed from sites or facilities previously deemed secure. By doing so, nuclear forensics can help identify previously unknown nuclear security gaps, deficiencies in materials accounting, control and physical protection systems, at the level of individual facilities as well as states. By determining that an intercepted material originates from a particular state, nuclear forensics can help to highlight the need to improve the nuclear security regime in that state. Identification of a particular facility or state being the source of material in multiple illicit trafficking cases would emphasize issues with existing nuclear security even more.

3.152 Nuclear forensics can also be used before a nuclear security event has taken place, to help prevent unauthorized removal of nuclear or other radioactive material. It can exercise a deterrent function on states as well as individuals. At the state level, the credible attribution potential of nuclear forensics combined with credible assurance

155. NTI, "Military Materials Study Group," http://www.nti.org/about/projects/military-materials-security-study-group/.

of measured response can deter national authorities from actively supporting or contributing in any way to illicit trafficking. The same combination of factors is also likely to encourage governments to introduce improvements into the existing nuclear security regime in their own states, as well as to contribute better to international regulatory and policy measures aimed at advancing nuclear security. Individuals with access to nuclear or other radioactive material may be dissuaded from diverting it if they are made aware that the likelihood of attribution and prosecution is increased by an advanced nuclear forensics capability.

3.153 In order to function as a deterrent for states or individuals, the discipline of nuclear forensic analysis, working in concert with other means of investigation, has to demonstrate the potential to attribute material outside regulatory control to the specific source, and possibly to collect information on a history of unauthorized removal. The success of the deterrent function will depend on credibility and speed of attribution process, as well as the degree of certainty of the threatened response measures. Since the nuclear forensic evidence might be less than unequivocal, the investigation process must be at least as accurate, reliable and transparent as deemed acceptable by involved states or stakeholders to justify an appropriate response. The current lack of pre-established clarity concerning certainty and form of response may undermine international and local cooperation required for successful attribution. A number of unresolved technical, legal and policy issues in this area are addressed by international mechanisms such as the Global Initiative to Combat Nuclear Terrorism and the Nuclear Forensics International Technical Working Group; as well as by activities within the NSS framework.

3.154 An IAEA Nuclear Security Series publication on nuclear forensics in 2006 brought together for the first time a concise but comprehensive description of the various tools and procedures of nuclear forensics investigations from the existing scientific literature. It also incorporated the experience accumulated over the preceding decade by law enforcement agencies and nuclear forensics laboratories confronted with cases of illicit events involving nuclear or other radioactive materials.[156] In addition, the IAEA helps to build capacity in member states by coordinating research and development, training experts in nuclear forensic methodologies, and providing guidance on the design of a nuclear forensic library.

3.155 The importance of forensic investigations in the event of a nuclear security incident – and the need for states to work with each other and with the IAEA on this issue – was stressed at the 2010 and 2012 NSS and led to a joint statement at The Hague NSS in 2014. Supported by 24 states and Interpol,[157] the joint statement encourages states to undertake nuclear forensics research and share information and best practices.[158] Much of this work is currently underway, with many of the joint statement signatories leading international efforts.

156. IAEA, *Nuclear Forensics Support* (Vienna: Nuclear Security Series No. 2, 2006), http://www-pub.iaea.org/books/iaeabooks/7401/Nuclear-Forensics-Support.

157. Algeria, Australia, Canada, Chile, Czech Republic, Finland, France, Georgia, Hungary, Indonesia, Italy, Japan, Kazakhstan, Malaysia, Morocco, the Netherlands, Republic of Korea, Romania, Spain, Sweden, Switzerland, Turkey, UK, and US.

158. *Joint Statement on Forensics in Nuclear Security*, Nuclear Security Summit, The Hague, March 2014.

§3.9. Role of Nuclear Industry

3.156 As with global governance in general, global nuclear governance is being increasingly shared between state, intergovernmental (for example the IAEA) and non-state (for example WANO and WINS, already mentioned earlier in this chapter) actors. This is especially true of the nuclear industry, where there exists significant public–private cross-ownership, not just partnership. Commercial, non-proliferation and nuclear security interests can overlap or collide between industry and government stakeholders and accountabilities in managing nuclear risks have to be shared between parliaments and boardrooms. Just as nuclear security events will add to the financial and commercial costs of the nuclear industry, so industry can help governments to raise the costs of proliferation.

3.157 Providing nuclear security must be a shared responsibility between state authorities and the nuclear industry. Industry's "comparative advantage includes its knowledge of increasingly complex supply chains for hardware and technology exports and its ability to deploy such knowledge to prevent proliferation."[159] In the changing global nuclear energy landscape, the integrated nature of the nuclear industry both vertically (across the different levels of the global supply chain) and horizontally (across the different political jurisdictions) puts a premium on active government–industry collaboration to manage the risks and dangers of the three nuclear "Ss" of safety, safeguards and security.

3.158 The cooperation between state authorities and the operators is probably the main determining factor in the effectiveness of a nuclear security system, because legislation and regulations cannot compensate if industry fails to implement the necessary measures. While the state authorities can identify current and anticipated threats, it is the industry that must translate those assessments into practical measures at facility level. The operator understands the vulnerabilities of a facility, knows the vital areas that need to be protected and probably owns the equipment and employs the manpower needed to perform security tasks. If an incident does occur, it will first and foremost be the operators in charge of nuclear facilities who will have to deal with nuclear and radiological risks associated with it. This was the case, for example, with the Tokyo Electric Power Company (TEPCO) in Fukushima in March 2011. At the same time, confidentiality must be maintained of any information that is sensitive from a commercial competition point of view, or the industry sector will withhold cooperation.

3.159 Some survey work was done by the Lowy Institute in Sydney on behalf of ICNND. Overall, the nuclear industry took the view that nuclear non-proliferation and security were primarily the responsibility of governments and not of the nuclear energy industry. That said, they subscribed to the same broad goals, believed it to be part of their social responsibility and were prepared to work with governments to prevent, limit or place conditions on the spread of developing dual-use technology to stop it from being abused by rogue regimes and associated networks. While only governments can put in place regulatory regimes, industry can play a critical role in reporting suspicious activities or

159. Martine Letts, "Nuclear security: Partner with industry," *The Interpreter* (Sydney: Lowy Institute, 28 March 2012), http://www.lowyinterpreter.org/post/2012/03/28/Nuclear-security-The-case-for-a-PPP.aspx.

patterns. But there is some industry scepticism on the value of more restrictive measures.[160] Sharing information on best practice among industry can be done while respecting the confidentiality surrounding the specific aspects of security measures at facility level.

3.160 The importance of the industry sector has been recognized in the NSS, where dedicated industry events and sessions have been devoted to exploring how state authorities and industry can work together more effectively to promote a strong nuclear security culture and foster the development of LEU. However, the issue of civilian plutonium has not been sufficiently addressed in the NSS industry events "because entities that are state owned or state reliant have blocked discussions."[161] The 2016 NSS should close this gap and ensure that discussions take place on the need to minimize the civilian use of plutonium.

§3.10. Nuclear Security and Safety Interface

3.161 Both nuclear safety and security are concerned with public safety and health, but they differ with respect to the events that are to be prevented. Nuclear safety covers unintended events, such as natural disasters, human mistakes or interruptions, while nuclear security deals with intended malicious acts. The IAEA defines nuclear safety as "The achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation hazards."[162]

3.162 Useful progress has now been made in recognizing the synergy between the two concepts. Meeting shortly after the anniversary of the nuclear meltdown in Fukushima, the 2012 NSS highlighted "the nexus between nuclear security and nuclear safety," and it did so with a starkness that was absent in Washington:

> 7. Acknowledging that safety measures and security measures have in common the aim of protecting human life and health and the environment, we affirm that nuclear security and nuclear safety measures should be designed, implemented and managed in nuclear facilities in a coherent and synergistic manner. We also affirm the need to maintain effective emergency preparedness, response and mitigation capabilities in a manner that addresses both nuclear security and nuclear safety. In this regard, we welcome the efforts of the IAEA to organize meetings to provide relevant recommendations on the interface between nuclear security and nuclear safety so that neither security nor safety is compromised.[163]

3.163 The common goal of the interface between nuclear safety and security is the protection of people, society and the environment by preventing any large release of

160. Martine Letts, "Companies ponder their role in non-proliferation and nuclear safety," *Australian Uranium: A Quarterly Bulletin from the Australian Uranium Association* 12 (2010), pp. 5–6, http://lowyinstitute.cachefly.net/files/pubfiles/Letts%2C_Companies_ponder_their_role.pdf.

161. Choubey, "From Sprint to Marathon," p. 6.

162. IAEA, "The Interface Between Safety and Security at Nuclear Power Plants," INSAG-24. A report by the International Nuclear Safety Group (Vienna: IAEA, 2010), p. 3, paragraph 7; http://www-pub.iaea.org/books/iaeabooks/8457/The-Interface-Between-Safety-and-Security-at-Nuclear-Power-Plants.

163. 2012 Seoul Nuclear Security Summit, "Seoul Communiqué," http://www.thenuclearsecuritysummit.org/userfiles/Seoul%20Communique_FINAL.pdf.

radioactive material.[164] The threshold of unacceptable risk may be presumed to be the same for both and both adopt the strategy of defence in depth based on layers of protection that begin with prevention and move to detection and response. Accordingly, many elements and actions enhance both security and safety simultaneously. For example, the containment structure at a nuclear power plant not only prevents the significant release of nuclear material in case of an accident, but also provides a robust shield in the event of a terrorist attack.[165]

3.164 It appears to be generally recognized now that safety-security overlaps are to be found in:

- *Regulation.* It is a good idea to have a single site licence that incorporates safety and security issues rather than two separate licensing systems, one each for safety and security.
- *Design*. The planning of a nuclear facility should be done with both safety and security as integral elements, rather than a focus on the safety aspect with security "bolted on" later.
- *Risk assessment.* It is better to have an integrated approach to risk assessment, rather than two separate assessments, one for safety and one for security.
- *Training.* Personnel should be sensitized to both safety and security issues as part of their training.

§3.11. Nuclear Security Culture

3.165 There are six groups of actors responsible for the proper development of security culture. States, organizations, managers in organizations, personnel, public and the international community fulfil the different tasks relevant for the realization of nuclear security culture through dialogue and coordination.[166] The role played by WINS, as already mentioned earlier in this chapter, is especially important in this regard. There are also additional bilateral and other collaborative arrangements and practices, including the International Network for Nuclear Security Training and Support Centres, which has been set up to improve training, national capacity and information sharing. This network, which is coordinated by the IAEA, runs working groups on Coordination and Collaboration, Best Practices, and Information Management and Other Emerging Issues, and has helped establish several national nuclear security centres of excellence. The initiative has been driven by the NSS process. Centres of excellence are already operating in several key countries like China, India, Japan and South Korea. Several more training centres are in various stages development in Chile, Colombia, Cuba, Ghana, Jordan, Kazakhstan, Malaysia, Morocco, the Philippines, South Africa, Tanzania, and Turkey.

3.166 Nuclear security culture is discussed in the IAEA Nuclear Security Series No. 7 Implementing Guide, and described there as the "assembly of characteristics, attitudes and behaviour of individuals, organizations and institutions which serves as a means to

164. IAEA, "Interface Between Safety and Security at Nuclear Power Plants," p. 3, paragraph 9.
165. IAEA, "Interface Between Safety and Security at Nuclear Power Plants," p. 1, paragraph 3.
166. IAEA, *Nuclear Security Culture*, IAEA Nuclear Security Series No. 7, Implementing Guide (Vienna: IAEA, 2008), p. 3, http://www-pub.iaea.org/MTCD/publications/PDF/Pub1347_web.pdf, p. 7.

support and enhance nuclear security."[167] Each characteristic is made up of various components, including beliefs and management systems, which together contribute to greater nuclear security. The publication consists of four main chapters: an introduction to the topic, nuclear security and nuclear security culture, roles and responsibilities of institutions and individuals, and characteristics of the nuclear security culture.

3.167 The IAEA organizes a variety of training activities and workshops that are based on findings from the work of advisory missions. One of the IAEA programs relevant to security culture is IPPAS, whose objective is to support states to develop and improve their national nuclear security. Sixteen countries – Armenia, Australia, Belgium, Cuba, Finland, France, Indonesia, Hungary, Kazakhstan, Netherlands, Republic of Korea, Romania, Slovenia, Sweden, the United Kingdom and the United States – have received an IAEA IPPAS review mission since the Washington Summit.

3.168 "International assurances" refer to activities undertaken, information shared, or measures implemented voluntarily by one party to provide confidence to others of the effectiveness of nuclear security within the jurisdiction of the first party.[168] They can include "conformity assessments," as used for example by the International Organization for Standardization (ISO) to show that a product, service or system meets the requirements specified in an ISO standard; information sharing and annual reports on nuclear security regulations and issues; physical protection assessments; certification of nuclear security personnel to agreed baseline qualifications and training; bilateral cooperation programs; and peer review mechanisms.

3.169 IAEA IPPAS missions offer one example of a peer review mechanism that helps to provide international assurance. Since the first such mission in 1996, 65 IPPAS missions in 41 countries have been performed.[169] The IAEA IPPAS checks if a country's laws and regulations conform to IAEA guidance, but not the effectiveness of the implementation of the guidelines. Others gain confidence from the very fact that a state agrees to host an IPPAS mission, because it indicates a national commitment to evaluate and strengthen nuclear security. But the state has no obligation to implement the recommendations and report on them. According to the NTI Nuclear Materials Security Index, "Only 11 of 25 states with weapon-usable nuclear materials now publish both their nuclear security regulations and an annual report."[170]

3.170 In addition to acknowledging the nuclear security and safety interface, it is worth noting also that there is a close relationship between nuclear non-proliferation and nuclear security. While the non-proliferation regime was designed to defend against state level proliferation it also provides an important, if by itself insufficient, line of defence against terrorists acquiring nuclear materials, equipment and technologies. Application of safeguards [particularly an effective state system of accounting for and control of nuclear material (SSAC)], export controls and the like are all fundamental to the security of nuclear material, technology and equipment and to preventing illicit trafficking. Similarly,

167. IAEA, *Nuclear Security Culture*.
168. Adapted from "Options for Strengthening the Global Nuclear Security System," p. 6.
169. http://www-pub.iaea.org/MTCD/publications/PDF/IAEA-SVS-29_web.pdf.
170. *NTI Nuclear Materials Security Index* (2014), p. 50.

agreement on measures to limit the spread of uranium enrichment and reprocessing would reduce the risk of both state and non-state misuse of these materials. All of this also can be described as developing a robust nuclear security culture.

3.171 If a robust nuclear security culture is to be created, some gaps will have to be filled. The catalogue of incidents listed in Box 3.1 is suggestive of gaps in the existing national and multilateral machinery of nuclear security. These include lack of universality, binding standards, transparency and accountability mechanisms, compulsory IAEA oversight, and insufficient attention to nuclear weapons. The measures adopted by the NSS suffer from three serious flaws: they are recommendations for voluntary action by states; they are uneven and inconsistent between different states; and they lack built-in accountability requirements and mechanisms. Given the gravity of the threat, a credible and effective nuclear security regime requires the opposite three attributes: mandatory, legally binding, and globally uniform standards and monitoring-cum-verification systems. It is not enough to "encourage" states to share best practices and to cooperate with the IAEA in securing and disposing of surplus nuclear material. A nuclear terrorist attack would unleash profound security, political, economic and social consequences.

3.172 That said, the international community must weigh in the balance whether an instrument capable of attracting strong political support like the Code of Conduct on Radioactive Sources is, for the present, a better outcome than a poorly supported legally binding instrument. David Santoro recommends the cultivation of "national security champions" with in-depth understandings of the political, legal, economic, social and technological aspects of the subject as an effective means of fostering a culture of nuclear security at the state level.[171] This would add to the current efforts, for example of the IAEA with its International Nuclear Security Education Network,[172] and of the MacArthur Foundation's initiative on support for graduate and post-doctoral interdisciplinary training in nuclear security.[173]

171. David Santoro, "Championing Nuclear Security," Carnegie Endowment for International Peace, 10 September 2012, http://carnegieendowment.org/2012/09/10/championing-nuclear-security/dsz1.

172. http://www-ns.iaea.org/security/workshops/insen-wshop. asp.

173. http://www.macfound.org/info-grantseekers/grantmaking-guidelines/ips-grant-guidelines/.

4. PEACEFUL USES OF NUCLEAR ENERGY

§4.1 Overview
§4.2 Objectives and General Strategy
§4.3 Nuclear Cooperation
§4.4 Mitigating Proliferation Risks
§4.5 Nuclear Safety and Security Commitments

§4.1 Overview

4.1 The overarching international objective in relation to peaceful uses of nuclear energy is to ensure that the benefits of nuclear energy are available to all states that choose to use it, on equitable terms and through international cooperation, while also ensuring that the use of nuclear energy does not lead to the proliferation of nuclear weapons and does not endanger human and environmental health and safety.

4.2 The use of nuclear energy for peaceful purposes is one of the three fundamental pillars of the NPT, along with nuclear disarmament and non-proliferation. The treaty sets out general rights and obligations with respect to peaceful uses but does not detail approaches for determining compliance with these, other than through the application of International Atomic Energy Agency (IAEA) safeguards. This has resulted in a longstanding debate over the extent of the Nuclear Non-Proliferation Treaty (NPT) rights and obligations. In recent years, a focus of this debate has been the intersection of national and international interests regarding development and use of proliferation-sensitive nuclear technologies and materials – enrichment and reprocessing, and highly enriched uranium (HEU) and separated plutonium.

4.3 The renewed interest in nuclear power, together with an associated interest by a number of countries in developing sensitive aspects of the fuel cycle (enrichment, reprocessing and plutonium fuels), underscores the importance of timely resolution of differences within the international community on peaceful uses of nuclear energy issues. Politicization of peaceful uses issues, to the extent that it exists, is against the interests of the vast majority of states, be they holders of advanced nuclear technology, countries that aspire to a peaceful nuclear power program or countries unlikely ever to want to develop nuclear power.

4.4 **Nuclear Cooperation.** NPT states parties at successive treaty review conferences have elaborated the basic NPT peaceful use provisions with respect to nuclear cooperation. For example, Action 51 from the 2010 NPT Review Conference called upon

states parties to "Facilitate transfers of nuclear technology and international cooperation among States Parties in conformity with articles I, II, III, and IV of the Treaty, and eliminate in this regard any undue constraints inconsistent with the Treaty."

4.5 The wide uptake of nuclear power and nuclear applications, and the fact that many developing countries have been able to conclude nuclear supply agreements with supplier countries, suggest that national status and supplier non-proliferation practices are not a practical impediment to legitimate nuclear trade and cooperation. Of the 30 states, plus Taiwan, operating nuclear power programs, almost 40 per cent are developing countries. The majority of the 29 states planning or proposing nuclear power programs are developing countries, and of the seven of those states most likely to proceed with nuclear power in the near term, six are developing countries. Looking ahead, the lower capital costs and simplified operational requirements of the innovative small power reactor designs currently being developed could make nuclear power more accessible to additional developing countries.

4.6 Non-power applications of nuclear technology are also spread widely. Of the 55 states (plus Taiwan) operating research reactors, well over half are developing countries. In terms of the IAEA's Technical Cooperation Programme, which covers nuclear power-related and non-power applications, projects are being undertaken in 124 states and territories, the great majority of which are developing countries. Funding available for this program has increased over the years but debate on its adequacy continues, including the degree of reliance on extra-budgetary and in-kind contributions. This debate should continue within the discussion of the IAEA's system-wide budgetary difficulties.

> *Overall Evaluation of Nuclear Cooperation:* **Significant Progress.** NPT 2010 commitments and ICNND 2009 recommendations are generally being met. There are grounds for criticism that technical cooperation assessed funding has not increased more – though it has increased substantially over the years – but the additional funding provided by a number of states is consistent with the increase called for in the NPT 2010 Action Plan.

4.7 **Mitigating Proliferation Risks.** The nuclear non-proliferation, disarmament and peaceful use pillars of the NPT are closely related and mutually reinforcing. Effective nuclear non-proliferation measures provide confidence that peaceful nuclear trade and cooperation can proceed without contributing to nuclear weapons proliferation. Also vital is confidence that effective nuclear safety and security measures will apply.

4.8 National export controls coordinated by the Nuclear Suppliers Group (NSG) are the principal means by which nuclear suppliers give effect to the requirement that exports be consistent with their non-proliferation obligations (see Chapter 2 for detailed discussion). With export controls against the proliferation of weapons of mass destruction (WMD) now established as an international norm, including through UN Security Council Resolution 1540, the NSG and its members have an important contribution to make through assisting non-members develop and apply effective nuclear export controls.

4.9 However, little progress has been made in a number of areas with important implications for peaceful nuclear cooperation. An inclusive approach which respects state sovereignty and rights to development is critical. The international community is broadly agreed that limiting the spread of sensitive nuclear technology is in the interests of all states and making this choice will involve substantial practical benefits to countries looking to develop peaceful nuclear energy programs. But the need remains to reach a shared understanding on how to translate this general principle into practical steps and concrete actions.

4.10 There has been no progress on addressing the potential problems of national enrichment and reprocessing capabilities in non-nuclear-weapon states. These capacities inadvertently or deliberately provide such states with the technical capacity to produce nuclear weapons in a relatively short time. Likewise, the prospective spread of fast breeder reactors and plutonium fuels in the future will present serious challenges unless addressed. Highly enriched uranium (HEU) minimization is proceeding, though large quantities of HEU remain in the civil cycle. Currently there is no corresponding effort to minimize the stockpiling and use of separated plutonium in the civil nuclear power sector (as mixed oxide – MOX – fuel).

> *Overall Evaluation of Mitigating Proliferation Risks:* **Some Progress.** Most states are meeting their NPT peaceful use commitments, but non-compliance cases – especially Iran and North Korea – are cause for concern. Issues of nuclear latency and hedging are not being addressed. The spread of sensitive nuclear technology and the prospective spread of fast reactors and plutonium fuels in the future will present serious challenges unless addressed. HEU minimization is proceeding, though large quantities of HEU remain in the civil cycle; but no effort has been made to minimize plutonium (as MOX). The establishment of two fuel banks and the work of the International Framework for Nuclear Energy Cooperation (IFNEC) are positive developments, but further elaboration, and acceptance, of multilateral approaches have a long way to go.

4.11 **Safety and Security Commitments.** Nuclear safety and security have global ramifications for peaceful nuclear use but continue to be seen mainly as national concerns. A more appropriate balance is needed between national and international interests and responsibilities. This should include increased focus on the development of and adherence to international standards, as well as greater transparency and accountability.

4.12 Participation rates in existing nuclear safety and security treaties and other instruments remain inconsistent with the consequences significant nuclear safety or security incidents have for global confidence in peaceful nuclear energy. One state, Iran, operating a nuclear power reactor, is yet to join the principal treaty on nuclear safety – the Convention on Nuclear Safety (CNS). A number of states operating power reactors are yet to join the 1997 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

4.13 Treaty participation in the area of nuclear security is similarly inadequate. The principal convention on nuclear security, the 1980 Convention on the Physical Protection of Nuclear Material (CPPNM) has 151 parties, well short of universality. Nine years after the 2005 Amendment extending application of the CPPNM was opened for signature, a little over three quarters of the ratifications required for its entry into force have been obtained – a gradual improvement but still insufficient.

4.14 At present the only multilateral treaties dealing with attacks on nuclear facilities are the 1977 Additional Protocols to the Geneva Conventions and the 1996 Pelindaba Treaty (which is limited to the African nuclear-weapon-free zone). Work in the Conference on Disarmament (CD) in the 1980s to develop a more comprehensive multilateral treaty dealing with this subject was never taken further. Action 64 from the 2010 NPT Review Conference called on all states to abide by the 2009 decision of the IAEA General Conference, that "any armed attack on and threat against nuclear facilities devoted to peaceful purposes constitutes a violation of the principles of the United Nations Charter, international law and the Statute of the Agency."

> *Overall Evaluation of Safety and Security Commitments:* **Some Progress.** Overall, international standards, transparency and accountability are lacking. Not all states with significant nuclear activities have joined the Convention on Nuclear Safety, and there is a lack of international standards, transparency and accountability. Many states with power reactors remain outside the liability regimes. On nuclear security, many states remain outside the CPPNM, and there are insufficient ratifications/accessions for the CPPNM Amendment to enter into force.

§4.2 Objectives and General Strategy

4.15 The right to the peaceful use of nuclear energy is one of the three pillars of the NPT, the other two being non-proliferation and disarmament. A key objective of the NPT is to ensure that nuclear energy is indeed used only for peaceful purposes and does not contribute to the proliferation of nuclear weapons. Accordingly, Article IV of the NPT affirms the right of states to use nuclear energy for peaceful purposes, provided this is in conformity with the non-proliferation obligations of the treaty and IAEA safeguards are applied to verify fulfilment of these obligations.

4.16 The need for effective control of nuclear energy to ensure that it is used only for peaceful purposes was one of the first issues addressed by the United Nations when it was established in 1946. A number of proposals were examined, including placing all nuclear materials under the control of an international agency, but the United States and the Soviet Union were unable to reach agreement on these.

4.17 Following the Soviet Union's first nuclear test in 1949, attention turned to preventing the further proliferation of nuclear weapons. Recognizing the right of countries to exploit nuclear energy, the United States proposed a policy of cooperation under peaceful use

guarantees in President Dwight Eisenhower's "Atoms for Peace" speech to the UN General Assembly in December 1953. This initiative led to the establishment of the IAEA in 1957, and subsequently to the negotiation of the NPT in 1968 and its entry into force in 1970.

4.18 The NPT does not in fact specifically define *peaceful purposes* and *peaceful uses.* What is encompassed, in effect, is anything not within two other categories of nuclear activity contemplated by the treaty, viz:

- The manufacture or other acquisition of nuclear weapons or other nuclear explosive devices, or control over such weapons or explosive devices, which activities are proscribed for all but the five countries recognized by the NPT as nuclear-weapon states (NWS); and
- Non-peaceful purposes that are not proscribed – that is, non-explosive military purposes such as naval propulsion reactors. It is clear from the wording of Article III and international practice[1] that these activities are not *peaceful purposes.* Accordingly their status is ambiguous in terms of the "inalienable right" referred to in paragraph 1 of Article IV, and they are outside the scope of the cooperation envisaged under paragraph 2 of Article IV.

4.19 The lack of a clear definition of peaceful purposes leaves a grey area with respect to nuclear latency and nuclear hedging, problems which were neither adequately foreseen nor appropriately addressed at the time the NPT was negotiated. These are discussed further in section 4.4.

4.20 For present purposes, the overarching international objective in relation to peaceful uses of nuclear energy may be described as being to ensure that the benefits of nuclear energy are available to all states that choose to use it, on equitable terms and through international cooperation; while also ensuring that the use of nuclear energy does not lead to the proliferation of nuclear weapons and does not endanger human and environmental health and safety. The strategies to advance this objective are discussed in the remainder of this chapter, under three headings as follows:

4.21 **Cooperation in Developing Peaceful Applications.** The main NPT provision is Article IV.2, and the principal 2010 NPT Review Recommendations are Actions 48 to 56. Key questions here include: are states meeting the commitment to cooperate in developing peaceful applications of nuclear energy, and is due consideration being given to the needs of developing countries?

4.22 **Mitigation of Proliferation Risks Associated with Peaceful Purposes.** The main NPT provision is Article II, and the principal 2010 NPT Review Conference recommendation is Action 61 on minimization of the use of highly enriched uranium (HEU). ICNND recommendations 34 to 38 are more specific. Key questions here include: do IAEA safeguards provide sufficient assurance against possible misuse of nuclear programs for non-peaceful purposes, are further institutional and technical measures needed to mitigate proliferation risk, and can states exercise effectively the right to use nuclear energy for peaceful purposes without needing to develop proliferation-sensitive stages of the fuel cycle? Proliferation risk issues are addressed in more detail in Chapter 2.

1. As reflected for example in paragraph 14 of the IAEA model NPT safeguards agreement, INFCIRC/153.

4.23 **Ensuring Peaceful Nuclear Programs are Conducted Safely and Securely.** Safety and security are not specifically referred to in the NPT, but they are covered by other treaties and in Actions 57, 59, 60, 62 and 63 of the 2010 NPT Review Conference. The key question here is: are states, in conducting their nuclear programs, applying standards of nuclear safety and security sufficient to ensure protection of other states from the consequences of nuclear accidents or terrorist acts? Nuclear security issues are discussed in more detail in Chapter 3.

§4.3 Nuclear Cooperation

4.3.1 Among States

4.24 An essential aspect of peaceful uses of nuclear energy under the NPT is the commitment to international cooperation, set out in Article IV.2. Prior to the treaty, nuclear cooperation, including supply of nuclear facilities, equipment and nuclear materials, took place under bilateral agreements between supplier and recipient states. In economic terms bilateral cooperation remains the most substantial form of nuclear cooperation, through supply of reactors, nuclear fuel and nuclear services. At the multilateral level, the main vehicle for nuclear cooperation is the IAEA and its Technical Cooperation Programme, discussed in the next section.

4.25 **Nuclear Power.** The NPT established a much broader basis for peaceful use commitments and verification, extending beyond supplied items and materials to all of the nuclear material and activities in a state. In so doing, the NPT has established the conditions under which nuclear trade has been able to grow to its current global scale. The NPT and the IAEA safeguards system have provided confidence to states that they are able to cooperate in the peaceful use of nuclear energy without contributing to the proliferation of nuclear weapons.

4.26 Nuclear energy currently provides less than 11 per cent of global electricity.[2] There are 30 states, plus Taiwan, operating nuclear power programs (Table 4.1). Almost 40 per cent of these (12 out of 31) are developing countries.[3] Of the 71 power reactors currently under construction, 60 per cent are in developing countries. The IAEA reports that there are 33 states interested in introducing nuclear power. The IAEA does not identify these but indicates that most are developing countries.[4] Using a conservative figure of seven for those states most likely to proceed with nuclear power in the near term,[5] six of these are developing countries.

2. IAEA, *International Status and Prospects for Nuclear Power* 2014, http://www.iaea.org/About/Policy/GC/GC58/GC58InfDocuments/English/gc58inf-6_en.pdf.

3. States with nuclear power that are defined by the World Bank (2012) as "developing countries" (http://data.worldbank.org/about/country-classifications/country-and-lending-groups) are: Argentina, Armenia, Brazil, Bulgaria, China, India, Iran, Mexico, Pakistan, Romania, South Africa and Ukraine. The World Bank definition also includes Russia, but Russia is not counted as a developing country in this report on the basis that it is a leading nuclear power.

4. IAEA, *International Status and Prospects for Nuclear Power* 2014.

5. The seven are Bangladesh, Belarus, Lithuania, Poland, Turkey, UAE and Vietnam. All but Poland are categorized as developing countries by the World Bank.

Table 4.1: World Nuclear Energy (December 2014)

	Operating		Under Construction		Planned	
Power Reactors	Number	Total Capacity GW(e)	Number	Total Capacity GW(e)	Number	Total Capacity GW(e)
Argentina	3	1.6	1	0.02		
Armenia	1	0.4			1	1.0
Bangladesh					2	2.4
Belarus			2	2.2		
Belgium	7	5.9				
Brazil	2	1.9	1	1.2		
Bulgaria	2	1.9			1	1.0
Canada	19	13.5			2	1.5
China	23	19.0	26	25.8	60	66.2
Czech Republic	6	3.9			2	2.4
Egypt					1	1.0
Finland	4	2.8	1	1.6	1	1.2
Finland	4	2.8	1	1.6	1	1.2
France	58	63.1	1	1.6	1	1.7
Germany	9	12.1				
Hungary	4	1.9			2	2.4
India	21	5.3	6	3.9	22	21.3
Iran	1	0.9			2	2.0
Japan			2	1.3	9	12.9
Jordan					2	2.0
Kazakhstan					2	0.6
Korea, Republic of	23	20.8	5	6.4	8	11.6
Lithuania					1	1.3
Mexico	2	1.3				
Netherlands	1	0.5				
Pakistan	3	0.7	2	0.6		
Poland					6	6.0
Romania	2	1.3			2	1.4
Russia	33	23.6	10	8.4	31	32.8
Slovak Republic	4	1.8	2	0.9		
Slovenia	1	0.7				
South Africa	2	1.8				
Spain	7	7.1				
Sweden	10	9.5				
Switzerland	5	3.3				
Taiwan, China	6	5.0	2	2.6		
Turkey					4	4.8

Power Reactors	Operating		Under Construction		Planned	
	Number	Total Capacity GW(e)	Number	Total Capacity GW(e)	Number	Total Capacity GW(e)
Ukraine	15	13.1	2	1.9	2	1.9
UAE			3	4.0	1	1.4
United Kingdom	16	9.2			4	6.7
United States	100	99.1	5	5.6	5	6.1
Vietnam					4	4.8
WORLD	**390**	**337.1**	**71**	**68.1**	**178**	**198.6**
Japan – Shutdown reactors	48	42.4				

Sources: Reactors operating and under construction in December 2014: IAEA, www.iaea.org/PRIS/WorldStatistics/OperationalReactorsByCountry.aspx; www.iaea.org/PRIS/WorldStatistics/UnderConstructionReactorsByCountry.aspx;

Planned reactors as of December 2014: WNA, www.world-nuclear.org/info/Facts-and-Figures/World-Nuclear-Power-Reactors-and-Uranium-Requirements.

4.27 The long-term impact of the Fukushima accident on planned nuclear programs is not yet clear. The accident is likely to make nuclear power more expensive through higher capital costs, due to more rigorous safety requirements, and higher finance costs, reflecting lenders' reappraisal of commercial risk. In 2012 the World Energy Council reported that the Fukushima accident had not led to a significant retraction in nuclear power programs outside Europe, except in Japan.[6] More recently, the Council reported that uncertainty on the nuclear outlook has come down but, with increasing safety costs and low gas prices (in North America), nuclear is more exposed than ever to the potential effects of a world in which governments pick technologies rather than markets.[7]

4.28 Post-Fukushima the German and Japanese governments announced the phase-out of nuclear power, but the current Japanese government is looking at a strategy of decommissioning reactors 40 years or older and restarting the rest, maybe 38 out of Japan's current 48 fleet. The Chinese government cancelled planned Generation II reactors in favour of Generation III models, a move that will bring safety benefits but will increase costs and slow down China's nuclear expansion in the near term. Also in the Asian region, India has affirmed its plans to boost its nuclear capacity up to fifteen-fold by 2032, and Taiwan, South Korea and Vietnam are proceeding with announced plans, although Vietnam has delayed start of construction. Indonesia and Thailand have delayed nuclear power until after 2020. However Malaysia announced *after* Fukushima that it is considering the option of nuclear power.

4.29 Of the 55 states (plus Taiwan) currently operating research reactors, well over half (32) are developing countries.[8] Apart from research reactors, statistics are not readily available on the number of states in which non-power nuclear applications are used, but this would include most if not all the world's states. In terms of the IAEA's Technical

6. World Energy Council, *Nuclear Energy One Year After Fukushima*, 2012, http://www.worldenergy.org/documents/world_energy_perspective__nuclear_energy_one_year_after_fukushima_world_energy_council_march_2012_1.pdf.
7. http://www.worldenergy.org/publications/2014/world-energy-issues-monitor-2014, page 15.
8. IAEA, Research Reactor Database, 2014 http://nucleus.iaea.org/RRDB/RR/ReactorSearch.aspx?rf=1.

Cooperation Programme, which covers nuclear power-related and non-power applications, projects are being undertaken in 124 states and territories,[9] the great majority of which are developing countries.

4.30 The Action Plan from the 2010 NPT Review Conference elaborated on the implementation of nuclear cooperation, inter alia calling on parties to give preferential treatment to the non-NWS, particularly taking into account the needs of developing countries, and to facilitate transfers of nuclear technology and cooperation among states parties, eliminating any undue constraints inconsistent with the treaty.[10]

4.31 The figures cited above demonstrate that nuclear energy has brought benefits to a great many states, including many developing countries. The fact that the uptake of nuclear power by developing countries has not been greater reflects practical constraints, such as the high capital costs of power reactors, human and technical infrastructure requirements, and electricity grid capacity. In the near term, the main growth in nuclear power in developing countries will be where the technology is already well established – particularly China and India. Looking ahead, a number of innovative small power reactor designs[11] are under development, with features more suited to conditions in developing countries, including lower power levels, life-time or long-life fuel cores and modular construction and operation. The lower capital costs and simplified operational requirements of these reactors could make nuclear power more accessible to a number of developing countries.

4.32 Few states have developed indigenous nuclear technology and few produce nuclear materials. The uptake of nuclear power and other nuclear applications has been enabled by nuclear cooperation among states. Today no state has a wholly self-reliant nuclear energy program; there is a global market in nuclear equipment, technology, materials and services. The nuclear market operates on a commercial basis – there is no known case of a state being excluded, other than on grounds of proliferation concern.

4.33 The commitment to cooperate applies only to peaceful uses, and is subject to the other provisions of the NPT, for example Article IV.1 (which in turn refers to Articles I and II) and Article III. This is reflected in the wording of Action 51 from the 2010 NPT Review Conference. A state party considering cooperation, or asked for cooperation, may take into account the other party's performance with respect to NPT obligations, for example whether there have been safeguards violations (Article III) or whether there are grounds for concern regarding Article II (the commitment not to seek nuclear weapons). These considerations are reflected in national export controls (discussed in more detail in Chapter 2).

4.34 National export controls on nuclear equipment, nuclear-related materials and technology, and specified *dual-use* items are coordinated by the Nuclear Suppliers Group (NSG). These controls are fully consistent with the NPT, giving effect to the requirements of Articles I and II of the treaty. The NSG membership includes several major developing countries, for example Argentina, Brazil, China, Kazakhstan, Mexico, South Africa and

9. IAEA, *Annual Report 2013* (Vienna: IAEA, 2014), http://www.iaea.org/Publications/Reports/Anrep2011/index.html.
10. Actions 50 and 51 respectively – see section 4.3.1 below.
11. Small reactors are defined by the IAEA as less than 300 MWe.

Turkey.[12] Apart from export controls applied by states, the technology holders (for example URENCO, TENEX, BNFL (British Nuclear Fuels Limited) and AREVA) themselves are very cautious about the states to whom they supply. In enrichment, URENCO and TENEX supply only on a black box basis, so that technology is not transferred. These issues are discussed further in section 4.4.

4.35 The fact that non-proliferation practices have not been a practical impediment to legitimate nuclear trade is demonstrated by the uptake of nuclear power and nuclear applications, discussed above, and by the many developing countries that have been able to conclude nuclear cooperation agreements with supplier countries. For example, states with nuclear supply agreements with the United States include Argentina, Bangladesh, Brazil, Colombia, Egypt, India, Indonesia, Kazakhstan, Morocco, South Africa, Thailand, the United Arab Emirates (UAE) and Vietnam. Currently, the US is negotiating an agreement with Jordan.

4.36 **Other Forms of Nuclear Cooperation.** While nuclear energy is usually thought of in terms of nuclear power, non-power nuclear applications are also very important. These include the use of nuclear techniques in areas such as human health, food and agriculture, and physical and chemical sciences. Developing countries have benefited particularly in these areas. Nuclear cooperation among states is not limited to nuclear trade, but includes non-power nuclear applications and also training, capacity-building, sharing of experience and the like, in areas including facility operations and the "3 Ss" – safeguards, safety and security.

4.37 Statistics are not readily available on the number of states in which non-power nuclear applications are used, but this would include most if not all the world's states. Mostly cooperation in non-power applications is provided through the IAEA. Under the IAEA's Technical Cooperation Programme, which covers nuclear power-related and as well as non-power applications, projects are being undertaken in 124 states and territories,[13] the great majority of which are developing countries, including 30 Least Developed Countries. The IAEA's program is discussed further in section 4.3.2.

4.38 In addition to cooperation provided through the IAEA, there are many bilateral and regional projects and programs. There are too many examples to list here, but mention can be made of a few: IAEA Regional Cooperative Agreements – in Africa, Asia Pacific, Arab states, and Latin America; the International Framework for Nuclear Energy Cooperation (IFNEC – see further below); global and regional cooperation and assistance programs operated by the European Union (EU) and many governments, particularly (because of its scale) the United States; establishment of regional training centres and centres of excellence on nuclear safeguards and nuclear security, for example by China, India, Japan and South Korea; the Asian Nuclear Safety Network (ANSN); and the Asia–Pacific Safeguards Network (APSN). A recent initiative is the Gulf Nuclear Energy Infrastructure Institute, opened in Abu Dhabi in 2011: this is a joint US/UAE venture aimed at strengthening nuclear energy security, safeguards and safety infrastructure

12. Other NSG members categorized by the World Bank as developing countries are Bulgaria, Latvia, Lithuania, Romania and Ukraine.

13. IAEA, *Technical Cooperation Report 2013*, p. ix.

development throughout the Gulf region. There are also the industry-based World Association of Nuclear Operators (WANO), dealing with nuclear safety, and the World Institute for Nuclear Security (WINS).

4.3.2 Role of the IAEA in Nuclear Cooperation

4.39 All of the IAEA's program areas (safeguards, nuclear safety, nuclear security, nuclear energy, and nuclear sciences and applications), include elements of cooperation, training and capacity-building for IAEA member states. The IAEA's main vehicle for nuclear cooperation, however, is the Technical Cooperation Programme. While all IAEA member states are eligible for technical support, "in practice technical cooperation activities tend to focus on the needs and priorities of less developed countries."[14]

4.40 Because the IAEA's statute does not expressly refer to a Technical Cooperation Programme, this program is not funded as part of the agency's regular budget, but primarily through voluntary contributions from member states to the Technical Cooperation Fund (TCF). Contributions are based on an assessed share of a target amount set by the member states in consultation with the IAEA secretariat. These extra-budgetary funds are supplemented by other resources and in-kind contributions provided by a number of states.

4.41 Action 55 from the 2010 NPT Review Conference encouraged all states to make additional contributions to an initiative designed to raise US $100 million over five years as extra-budgetary contributions to IAEA activities in support of promoting peaceful uses of nuclear energy. As a consequence, in 2010 the IAEA established the Peaceful Uses Initiative. To date eighteen member states and the European Commission have contributed around US $66 million to the initiative as additional extra-budgetary contributions.

4.42 Reflecting the original assumption behind the NPT, at the 2014 IAEA General Conference Director General Yukiya Amano emphasized the vital importance of nuclear science and technology for sustainable development and achievement of development goals in areas such as human health, agriculture, water management and industrial applications, and noted the key role of the Technical Cooperation Programme in ensuring that developing countries gain access to nuclear science and technology. Details of the IAEA's activities in these areas are set out in the Technical Cooperation report for 2013.[15] The 2013 TCF expenditures by technical field are set out in Table 4.2.

4.43 The IAEA provides the foundation for international cooperation on nuclear energy infrastructure, offering a wide range of services, publications and meetings to assist member states intending to develop nuclear power. In 2009, the IAEA began providing Integrated Nuclear Infrastructure Review missions to member states. These cover the comprehensive infrastructure required for building a nuclear power program including safeguards, security and safety. The missions have been carried out in ten states – Bangladesh, Belarus, Indonesia, Jordan, Poland, South Africa, Thailand, Turkey, UAE and Vietnam – and missions are planned for Morocco and Nigeria.

14. IAEA, Our Work, Technical Cooperation, http://www.iaea.org/technicalcooperation/programme/index.html.
15. http://www.iaea.org/About/Policy/GC/GC58/GC58InfDocuments/English/gc58inf-5_en.pdf.

Table 4.2: IAEA Technical Cooperation Fund Expenditure by Technical Field (2013)

Technical Field	Expenditure €million	Per Cent of Total
Health and Nutrition	22.366	28.6
Safety and Security	17.848	22.8
Food and Agriculture	12.748	16.3
Nuclear knowledge development and management	8.924	11.4
Energy	6.049	7.7
Industrial Applications/Radiation Technology	5.953	7.6
Water and the Environment	4.379	5.6

Source: IAEA Technical Cooperation Report for 2013, Supplement, pp. 34, 35.

4.44 The IAEA also offers the Integrated Regulatory Review Service, designed to enhance the effectiveness of the regulatory infrastructure of states for nuclear, radiation, radioactive waste and transport, safety and security of radioactive sources, by reviewing both regulatory technical and policy issues against IAEA safety standards and good practice in other states. The Technical Cooperation Programme also delivers substantial assistance to IAEA member states on developing the infrastructure necessary for a nuclear power program.

4.45 In non-power applications, the IAEA collaborates closely with other relevant international agencies, such as the Food and Agriculture Organization (FAO), the World Health Organization (WHO) and the United Nations Environment Programme (UNEP), to ensure that technical cooperation projects are conducted in priority areas.

4.46 In 2013 member states' contributions to the TCF were €65.7 million. Additional resources – other income, further extra-budgetary and in-kind contributions – amounted to €12.5 million, making an overall total of €78.2 million. Resources available to the TCF in 2013 represented an increase of 18 per cent over the resources available a decade earlier, in 2004 (€66.3 million). Active projects at the end of 2013 totalled 791, with an additional 169 projects in the process of being closed.[16] In addition, the IAEA Peaceful Uses Initiative, launched in 2010, "has become an important vehicle to raise extra-budgetary contributions for IAEA activities in the peaceful uses of nuclear technology."[17]

4.47 There are regular calls for the resources to the TCF to be increased. In this regard, the additional resources of €12.5 million contributed to the TCF in 2013 seem comparatively low in the context of the additional contributions of $100 million over five years called for in NPT 2010 Action 55. But the total additional resources contributed in the four years from 2010 inclusive, €79.8 million,[18] appear consistent with this target. The suggestion that developing countries would benefit by increasing the funding of the TCF needs careful analysis. Typically each year the TCF underspends available funding,

16. IAEA, *Technical Cooperation Report 2013*, p. 25.
17. *Understanding the Peaceful Uses Initiative* (Vienna: IAEA 2012), http://www.iaea.org/newscenter/news/2012/pui.html.
18. IAEA, *Technical Programme Report 2013*, Supplement, Table A.1.

for example for 2013 the IAEA reported that the implementation rate for the TCF was 83.7 per cent. Making better use of the available funds would bring increased benefit without increased funding levels and it is encouraging that the implementation rate is considerably improved over previous years.

4.48 The Technical Cooperation Programme has been criticized on a number of grounds, for example that recipients include a number of relatively high-income states that can well afford to pay for IAEA services,[19] or that there is inadequate review and follow-up of project completion and outcomes.[20] The first point appears to have been addressed: in 2013[21] the Africa region received some 30 per cent of TCF assistance, Asia Pacific 22 per cent, Europe 23 per cent and Latin America 18 per cent. These represent a substantial change from past years. For example in 2011 the respective percentages were 18, 18, 48 and 12. In 2011 more than 31 per cent of TCF expenditure was for projects relating to the nuclear fuel cycle and nuclear power. Owing to changes in the way expenditures are reported, it is not clear how much TCF expenditure was fuel-cycle related in 2013, but it is clearly diminished. Regarding the second point, the IAEA's technical cooperation review processes are undergoing improvement. For further increases to TCF funding to be warranted, it should be demonstrated that the current program is fully efficient, current funding is being fully utilized, planned outcomes are being achieved, including in subsequent years, and that funding is targeted at those in genuine need.

§4.4 Mitigating Proliferation Risks

4.4.1 Safeguards, Technology and National Supply Policies

4.49 Uranium enrichment and reprocessing, the key processes required for producing nuclear fuel at the front end and the back end of the fuel cycle, can also be used for producing fissile material[22] for nuclear weapons – indeed, they were first developed for this purpose. Accordingly, mitigating proliferation risk is largely concerned with ensuring that these technologies are used only for peaceful purposes.

4.50 The international community is broadly agreed that limiting the spread of these sensitive nuclear technologies is in the interests of all states and making this choice will involve substantial practical benefits to countries looking to develop peaceful nuclear energy programs. But an inclusive approach which respects state sovereignty and rights to development is critical. There is a need to reach a shared understanding on how to translate this general principle into practical steps and concrete actions.

4.51 The need for special arrangements for these technologies was recognized at the very beginning of the nuclear era, and proposals were advanced for the internationalization of nuclear programs.[23] Agreement could not be reached, however,

19. Trevor Findlay, *Unleashing the Nuclear Watchdog* (Waterloo, Ontario: Centre for International Governance Innovations, 2012), p. 87.
20. Findlay, *Unleashing the Nuclear Watchdog*, p. 87, citing reviews by the IAEA's Office of Internal Oversight and the US General Accounting Office.
21. http://www.iaea.org/About/Policy/GC/GC58/GC58InfDocuments/English/gc58inf-5-att1_en.pdf.
22. HEU (highly enriched uranium) and separated plutonium.
23. The Acheson–Lilienthal and Baruch plans considered by the UN Atomic Energy Commission in the 1940s.

and nuclear programs have proceeded since on a national basis. Consequently, efforts to mitigate proliferation risk have a major place in the international agenda. There is no magic bullet to eliminate all proliferation risk – no current nuclear fuel cycle is completely proliferation proof. But a combination of institutional and technical measures can give needed robustness to non-proliferation efforts, and also to counter-terrorism efforts.

4.52 Central to these efforts is the NPT. This, however, does not specifically address the use of any particular nuclear technology and requires only that non-NWS conduct nuclear activities solely for peaceful purposes under verification by IAEA safeguards. It has now become apparent that the NPT does not deal adequately with the issue of proliferation-sensitive technology. When the NPT was negotiated it was thought that in practice enrichment and reprocessing programs would be limited to the NWS and a small number of other advanced industrialized states. Today, in addition to the five NWS and the other four nuclear-armed states, there are at least eight states that have demonstrated enrichment capability, and four that have demonstrated reprocessing capability. Some of these non-NWS have both enrichment and reprocessing capabilities (Table 4.3).

Table 4.3: States with Demonstrated Enrichment and/or Reprocessing Capability

NWS	Non-NPT NW Possessing States	Other States		
These states have both enrichment and reprocessing capabilities		**Enrichment capability**	**Reprocessing capability**	**Enrichment and reprocessing capabilities**
United States	India	Argentina	Belgium	Germany
Russia	Pakistan	Australia	Italy	Japan
UK	North Korea	Brazil[1]		
France	Israel[2]	Iran		
China		Netherlands		
		South Africa		

Notes:

1. Brazil also had an R&D program, but not a demonstrated capability, in reprocessing.
2. Israel has neither confirmed nor denied nuclear-armed status.

Source: Centre for Nuclear Non-Proliferation and Disarmament.

4.53 An issue neither clearly foreseen nor adequately addressed in the NPT is the distinction between nuclear latency and nuclear hedging. "Nuclear latency" refers to the situation where a state has established, under an apparently peaceful nuclear program, dual-use capabilities – uranium enrichment and/or reprocessing. Nuclear latency might be considered inadvertent: a state with enrichment or reprocessing capabilities thereby has the basic capability to produce fissile material for nuclear weapons, though it may well have – at least in foreseeable circumstances – no intention of doing so. It is not impossible that even a state as firmly committed to non-proliferation as Japan could change its position in the future. Some commentators refer to such a state as a virtual

NWS. However, as well as weapon-useable fissile material, other capabilities would be required for weaponization, including suitable delivery systems, and Japan does have a longstanding and strongly held commitment against pursuing nuclear weapons. Nonetheless, it does illustrate the problem of enrichment and reprocessing capabilities being in national hands.[24]

4.54 If nuclear latency is supposedly inadvertent, nuclear hedging refers to a deliberate national strategy of establishing the option of relatively rapid acquisition of nuclear weapons, based on an indigenous technical capacity to produce them within a relatively short time frame – ranging from several weeks to a few years.[25] Nuclear hedging could result in virtual arms races, with the risk of degenerating very quickly into real arms races, break-out from the NPT, and even nuclear war. The existence of suspected nuclear hedging programs undermines the confidence and stability that the NPT is intended to promote. There is no doubt that the larger the number of states perceived as virtual nuclear-armed states, the greater the potential destabilizing effect on the non-proliferation regime.

4.55 **Safeguards.** When the NPT was concluded, it was assumed that IAEA comprehensive safeguards would provide timely warning of any misuse of nuclear facilities, giving the international community opportunity to intervene before a proliferator has time to turn diverted nuclear material into nuclear weapons. However, centrifuge enrichment technology presents a serious challenge to this objective – the relative ease of concealing centrifuge plants and the potential speed of break-out mean that in certain circumstances,[26] adequate warning time cannot be guaranteed. Even if removal of enriched uranium from safeguards, or use of a safeguarded facility for high enrichment,[27] is detected immediately, the time required for international deliberations could mean that practical intervention is not possible within the necessary timeframe.

4.56 Similar timeliness issues are raised where stocks of separated plutonium are held. The risks are exacerbated where high-fissile (weapon-grade) plutonium is involved, for example with fast breeder reactors or large "research" reactors.[28] There is a real concern that if plutonium is diverted, and the state has been able to make the necessary preparations in advance, the plutonium could be turned into nuclear weapons before effective intervention is possible.

4.57 Where proliferation-sensitive facilities and materials are involved, it is essential to have the most effective form of safeguards. Today this includes measures under the IAEA's Additional Protocol (AP), together with the most advanced safeguards technologies – remote monitoring, a "safeguards by design" approach for facilities, and so on. Although the number of states that have concluded APs continues to grow – by

24. This concern is reinforced by the occasional comments by some Japanese political figures about the need to maintain fuel cycle capabilities in order to ensure a nuclear weapon option, or "strategic deterrence."

25. Ariel E. Levite, "Never Say Never Again: Nuclear Reversal Revisited," *International Security* 27:3 (Winter 2002/03), pp. 59–88.

26. For example a state that has an industrial-scale enrichment facility, or the capability to establish undeclared enrichment facilities for upgrading LEU diverted from safeguards.

27. One problem here is that production of HEU is not prohibited – if a state started to do this, vital time could be lost on legalistic arguments.

28. Such as Iran's Arak reactor.

23 since the 2010 NPT Review Conference – several states with sensitive nuclear programs still remain outside this most effective form of safeguards (see Chapter 2). AP universalization is critically important. However, the practical limitations to safeguards outlined here indicate the case against over-reliance on safeguards – non-proliferation is also dependent on other technical counter-measures and on institutional measures, especially establishing multilateral rather than national control of proliferation-sensitive nuclear facilities.

4.58 **Technology.** Technical approaches to mitigating proliferation risk involve avoiding or minimizing the production and use of proliferation-sensitive materials and building proliferation resistance into facilities and technology. While the focus of proliferation resistance is on possible misuse by states, measures taken for proliferation resistance can also contribute to nuclear security through protecting nuclear materials and facilities against access and misuse by non-state actors. For example, avoidance/elimination of weapon-grade materials in civil nuclear programs reduces the risk of terrorists being able to produce a workable nuclear explosive device.

4.59 Technical measures for proliferation resistance include avoiding production of weapon-grade material and introducing technical barriers to producing such material; ensuring nuclear material is difficult to access (for example through high radiation levels) in order to increase the difficulties of diversion by states or theft/seizure by terrorists; and avoiding separation of plutonium from spent fuel, at least as a pure product.

4.60 International efforts to minimize production and use of proliferation-sensitive materials have been focused on highly enriched uranium (HEU). The principal use of HEU in civil programs has been as fuel for research reactors. HEU is also used as an irradiation target material for production of medical isotopes. These efforts have had considerable success: since 1978, 62 HEU-fuelled research reactors have been converted to use low enriched uranium (LEU) fuel and 17 HEU reactors have been shut down in 36 states.[29] In the medical isotope industry, most producers have committed to convert their reactors and targets to use LEU by 2015. However, some 50 tonnes of HEU remain in the civil sector, and it is estimated that 119 HEU-fuelled facilities of all types still remain in operation. [30] Remaining reactor conversions are expected to take another decade or more.

4.61 Similar attention has not been given to use of plutonium fuels. Plutonium obtained through reprocessing spent fuel has been in commercial use as reactor fuel, mainly in the form of MOX – a mix of plutonium and uranium oxides – since the 1980s. Currently MOX is used in over 30 power reactors, mostly in Europe. Stockpiles of plutonium separated by reprocessing continue to grow – currently there are some 276 tonnes of separated plutonium in civil programs.[31] Most of this is held in NWS, including plutonium stored for other states (principally in the United Kingdom and France), but significant

29. NTI, Civilian HEU Reduction and Elimination Resource Collection, http://www.nti.org/analysis/reports/civilian-heu-reduction-and-elimination/.

30. http://www.stanleyfoundation.org/publications/PomperPAB514.pdf.

31. IPFM, *Global Fissile Material Report 2013*, http://fissilematerials.org/library/gfmr13.pdf, and other information on the IPFM site.

quantities are held in non-NWS, especially Japan where the stockpile is growing[32] and will increase further with the operation of the Rokkasho-mura reprocessing plant. At the very least international agreement is needed to keep supply (separation and stockpiling) of plutonium in balance with demand (consumption as fuel).[33]

4.62 The plutonium currently used in MOX fuel is reactor grade, having an isotopic composition well outside the weapon-grade range. It would be difficult for a sub-state group to successfully explode a device made from this material, and the yield would be uncertain. A much higher risk would be presented if MOX was produced from weapon-grade plutonium. From the terrorism as well as the proliferation perspective, production of weapon-grade plutonium in civil programs should be avoided.

4.63 The main risk of weapon-grade plutonium being produced and used in the civil cycle comes from the prospective use of fast breeder reactors. In the established fast breeder reactor design, the reactor core, containing the fuel, is surrounded by a uranium "blanket" in which neutrons are captured to produce further plutonium. A major issue from the non-proliferation perspective, however, is that plutonium produced in fast breeder reactor blankets has a very high proportion of the isotope Pu-239, well within the weapon-grade range. This combination of producing weapon-grade plutonium and reprocessing presents obvious proliferation concerns. Moreover, use of separated weapon-grade plutonium on a commercial scale could present a major terrorism risk.

4.64 This problem is recognized at the technical level and reactor designs are being considered in which plutonium would be produced outside the weapon-grade range. The international programs coordinating research in this area – the IAEA's International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO)[34] and GIF (Generation IV International Forum)[35] – include proliferation-resistance amongst the major development criteria. Of particular importance is the development of advanced spent fuel treatments – such as electro-metallurgical processing (otherwise known as pyro-processing) – which will enable plutonium recycle without separation. Plutonium will not be produced as a purified material, but will remain in a highly radioactive mix with fission products and other spent fuel materials. This highly radioactive mix will be made into new fuel using robotic equipment. In 2010 the United States and South Korea agreed to a joint study of pyro-processing, particularly proliferation resistance aspects.

4.65 Another approach promoted by some is the thorium fuel cycle, which avoids the production of plutonium. India has a long-standing interest in developing the thorium fuel cycle, and more recently China has commenced a substantial research program in this area. The current Indian vision for the thorium fuel cycle, however, raises proliferation and terrorism concerns: use of plutonium "driver fuel" is an essential aspect, and this would be weapon-grade plutonium produced in fast breeder reactors.

32. At the end of 2013 stocks of separated plutonium in Japan were 10.8 tonnes.
33. Balancing supply and demand is set out as a principle in the IAEA's Plutonium Management Guidelines, but these guidelines are not binding.
34. http://www.iaea.org/ INPRO/about.html.
35. GIF is a collaboration among 12 countries and the EU – see www.gen-4.org.

4.66 The chief scientific adviser to the United Kingdom government, Sir John Beddington, conceded in September 2012 that although the benefits of thorium are "often overstated," it does have some "theoretical advantages regarding sustainability, reducing radiotoxicity and reducing proliferation risk."[33] That said, the thorium fuel cycle is not entirely proliferation resistant: uranium (or plutonium) fuels are required for initial reactor fuelling cycles, and possibly thereafter as driver fuel, and uranium-233, which is produced through irradiation of thorium, can be used in nuclear weapons. U-233 is difficult to produce as a pure material (in the reactor it is produced in association with U-232, which makes weapons use impracticable). However, there are certain reactor concepts in which U-233 can be recovered without U-232 – it is essential for proliferation risk analysis to take this into account.

4.67 Progress in the development of technical approaches can be hard to demonstrate, given the long lead times with some of the technologies involved, but adoption of proliferation resistance as an important criterion in INPRO and GIF is encouraging. The non-proliferation regime benefits from the fact that, to date, enrichment and reprocessing – which provide the capabilities to produce the materials required for nuclear weapons – are not more widespread. The regime also benefits from HEU and separated plutonium not being widespread in civil programs. It is essential for the international community to take the steps necessary not only to maintain this situation, but to reduce the availability of proliferation-sensitive technologies and materials.

4.68 **National Supply Policies.** National policies on the supply of nuclear materials, equipment and technology subject to non-proliferation conditions are one of the earliest forms of risk mitigation. Nuclear suppliers reserve the right to decide what they will supply, to whom, and under what terms. Supplier conditions were the basis for the earliest form of safeguards, under which suppliers required the right to verify that supplied items remained in peaceful use. Today supply policies coordinated by the NSG remain an important part of the non-proliferation regime.

4.4.2 Multilateralizing the Nuclear Fuel Cycle

4.69 The needs of states with nuclear power programs, or planning such programs, can be outlined as follows: reliable access to reactors and fuel on secure, non-discriminatory and equitable terms; reliable access, also on such terms, to fuel cycle services, especially for used fuel management; support in establishing regulatory systems; support through training and capacity building; and sharing of expertise in reactor operations, nuclear safety and nuclear security. These needs can, and arguably should, be met through development of a new international framework for the nuclear fuel cycle – a framework based on international cooperation rather than an emphasis on national programs in proliferation-sensitive areas.

4.70 Every state has a legitimate interest in security of energy supply, but it is neither necessary nor cost effective for every state with a nuclear power program to develop uranium enrichment and reprocessing facilities. In principle, national enrichment programs are not viable except for states with large power programs operating twenty or more reactors. Viability is even more difficult in current circumstances where global

enrichment capacity is adequate and increased demand can be readily met by existing enrichers. Most analysts conclude that reprocessing is not economic in current circumstances. Because possession of enrichment and reprocessing capabilities could increase international tensions – potentially leading to "virtual" arms races – and also because of the technical complexity and high costs, most states have not sought to establish these capabilities.

4.71 While energy independence may be cited as justification for a national fuel cycle, few states are in a position to achieve real independence. Apart from technological capabilities, not many states have uranium resources sufficient to maintain a nuclear power program independent of external supply. For most states international cooperation is likely to be a necessity, and for all states such cooperation will offer major advantages. Participation in international fuel cycle arrangements will lead to better outcomes than pursuing national independence.

4.72 Consideration of these issues internationally took a negative turn when the George W. Bush administration proposed that states not currently operating commercial enrichment or reprocessing facilities should permanently renounce these technologies. Many states, particularly in the Non-Aligned Movement (NAM), saw this as an attempt to entrench existing technology holders in a monopoly position. As a consequence, even international fuel bank proposals have been opposed as in some way furthering an agenda of denial. To counter these negative sentiments it will be necessary to demonstrate that alternatives to national fuel cycle programs offer security of supply on non-discriminatory and equitable terms, with advantages through collaborative approaches (for example in used fuel management), as well as the obvious advantages of mitigating proliferation risk.

4.73 **IFNEC and International Fuel Banks.** Much work is underway on proposals for practical and attractive alternatives to national programs in proliferation-sensitive areas. A number of proposals have been made to reflect these ideas. The proposal showing most progress is the International Framework for Nuclear Energy Cooperation (IFNEC), the successor to the Global Nuclear Energy Partnership (GNEP). GNEP started as a US initiative, but IFNEC now has a substantial international character, having grown to 32 participating states – including 17 developing countries – and 31 observer states, many of which can be expected to become full members.[36]

4.74 A key feature of IFNEC is that participating states are not asked to renounce any rights. IFNEC has adopted a pragmatic approach – to set aside unproductive political arguments about national "rights" and instead focus on practical problems and solutions. IFNEC has two working groups, on Infrastructure Development and Reliable Nuclear Fuel Services. IFNEC has made good progress in developing the concept of comprehensive fuel service arrangements, including fuel leasing, to meet the need for reliable fuel supply and to provide used fuel disposition options. The basic idea is that nuclear suppliers would commit to provide nuclear consumers with long-term whole-of-life fuel

36. IFNEC members as of September 2014 were: Argentina, Armenia, Australia, Bahrain, Bulgaria, Canada, China, Estonia, France, Germany, Ghana, Hungary, Italy, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Lithuania, Morocco, Netherlands, Oman, Poland, Romania, Russia, Senegal, Slovenia, South Korea, UAE, Ukraine, United Kingdom, and United States. See www.ifnec.org.

service assurances – suppliers would provide fresh fuel and take back used fuel, or otherwise assist with used fuel management. The practical and economic benefits of this international cooperation would be such that nuclear consumers have no legitimate reason for pursuing national programs in proliferation-sensitive technologies.

4.75 The IFNEC approach of establishing strong practical and economic advantages for states not to pursue sensitive technologies has considerable merit, but in itself it is not sufficient. First, it does not address the problem cases, except indirectly in the longer term. If IFNEC succeeds in establishing an international norm of behaviour against new national enrichment and reprocessing programs, this would be helpful in isolating those who act against this norm, but this is a long way off. The need to deal with Iran, and others that may insist on establishing fuel cycle programs in dubious circumstances, is more immediate (see further the section on Iran in Chapter 2).

4.76 Second, arrangements that are mostly commercial in nature might not offer sufficient assurance to states concerned about long-term security of supply. States are likely to have greater confidence in arrangements where assurances are legally binding in international law, that is, are based on a treaty-level umbrella. It would provide additional confidence if the IAEA were given an oversight role in these arrangements, to ensure that decisions are taken on an objective non-discriminatory basis.

4.77 Third, the IFNEC concept does not address existing enrichment and reprocessing programs. Some of these programs are of potential strategic concern, and all of them provide the operating state with nuclear latency. This is not only a non-proliferation issue, it is also an issue for disarmament. As nuclear disarmament progresses, the potential for rapid break-out from disarmament commitments will be just as great a concern as the potential for break-out from non-proliferation commitments. Furthermore, non-NWS being asked to accept restrictions on national nuclear programs are likely to argue that the new approaches should be non-discriminatory and apply also to the nuclear-armed states. Accordingly, concepts are needed for the transitioning of all nationally controlled enrichment and reprocessing programs to an appropriate alternative model within a realistic timeframe.

4.78 An important complement for international approaches such as those being developed in IFNEC is the establishment of international fuel banks as a fuel provider of last resort in case supply arrangements fail. There are now two such fuel banks – one established by Russia at the International Uranium Enrichment Centre at Angarsk, and one being established in Kazakhstan, under IAEA auspices and with funding assistance by the Nuclear Threat Initiative (NTI) and a number of IAEA member states.

4.79 **Multinational Control.** The most practical alternative to national control of sensitive nuclear programs is some form of multinational control, of the kind referred to in the NSG Guidelines: "If enrichment or reprocessing facilities, equipment or technology are to be transferred, suppliers should encourage recipients to accept, as an alternative to national plants, supplier involvement and/or other appropriate multinational participation in resulting facilities. Suppliers should also promote international (including IAEA) activities concerned with multinational regional fuel cycle centres."[37]

37. NSG Guidelines, INFCIRC/254/Rev.10/Part 1, paragraph 6(e).

4.80 As already noted, international operation of the nuclear fuel cycle was proposed unsuccessfully in the 1940s. This was looked at again by the International Nuclear Fuel Cycle Evaluation (INFCE) in the 1970s[38], and by the IAEA's study of proposals for multilateral approaches in 2005.[39]

4.81 A key objective of the multinational approach is to establish technical and institutional barriers against a state attempting to misuse enrichment and reprocessing capabilities. The less control an individual state has over such capabilities, the harder it will be to misuse them. Of course no barrier can be totally effective – a state can always seize facilities regardless of who owns and operates them – but arrangements such as black box[40] technology can be important in making misuse more difficult, providing more time for international intervention. Multinational approaches will also help ensure best practice standards of nuclear safety and security in the most sensitive parts of the fuel cycle.

4.82 Multinational approaches are not an unrealistic aspiration – examples already exist, like the European enrichment group URENCO and the International Uranium Enrichment Centre at Angarsk, Siberia. The IUEC was established by Russia in 2007, with the mission to ensure equal and assured access for all countries to the benefits of atomic energy.[41] Russia invites other states to join the centre as shareholders. The benefits include a guaranteed supply of fuel and services. Kazakhstan, Ukraine and Armenia have joined, and several others have indicated interest.

4.83 The precedents of URENCO and the International Uranium Enrichment Centre have important characteristics that can be built upon in future models, for example a treaty providing for mutual oversight of facility operations, consumers having product supply guarantees and equity participation, or supply of sensitive technology only on a black box basis.

4.84 Drawing all this together, a possible model for future fuel cycle arrangements could be along the following lines.

- Fuel suppliers and fuel consumers form comprehensive partnerships covering all aspects of the fuel cycle, including fuel supply guarantees and cooperation in safety and security, fuel fabrication, and management of used fuel and high level waste:
  - partnership arrangements, including fuel guarantees, are covered by treaty, with provisions binding in international law and under IAEA oversight;
  - these include fall-back arrangements in case of supplier default.
- Sensitive facilities – enrichment and reprocessing – are operated by fuel suppliers under multination arrangements:
  - where possible, technology is provided to the operator on a *black box* basis, as is currently the case with URENCO supplying the United States and France, and TENEX supplying China;

38. IAEA, *Report of the International Nuclear Fuel Cycle Evaluation*, 1980.

39. IAEA, *Multilateral Approaches to the Nuclear Fuel Cycle*, 2005, http://www-pub.iaea.org/books/IAEABooks/7281/Multilateral-Approaches-to-the-Nuclear-Fuel-Cycle.

40. The "black box" concept implies transfer of complete turnkey systems and facilities, without transfer of enabling design and manufacturing technology, under conditions that do not permit or enable replication of the facilities.

41. See http://eng.iuec.ru.

- fuel consumers have the opportunity for equity participation in the facilities, including profit-sharing;
- fuel consumers are involved in facility operations (without accessing sensitive technology) as an additional measure to assure against misuse of the facility.

4.85 Gaining support for multilateralization of proliferation-sensitive stages of the fuel cycle will be a challenge, but already there are practical precedents as described in the above two examples. What is needed now is to change the focus from national fuel cycle programs to the common interests of non-proliferation, energy security and strengthened international cooperation.

§4.5 Nuclear Safety and Security Commitments

4.86 The primary focus of this section is on nuclear safety: nuclear security is discussed in greater detail in Chapter 3 of this report. But it is increasingly being acknowledged, for example at the 2012 and 2014 Nuclear Security Summits (NSS), that there is a significant connection between these issues, not least because failures in safety protection may create opportunities for sabotage. The close connection between nuclear security and nuclear safety is recognized by the 2005 Amendment to the CPPNM which, when it enters into force, will extend the convention to include protection of nuclear facilities against sabotage.

4.87 The Fukushima nuclear accident in 2011 underscores the connection between safety and security. Terrorists might well attempt to replicate an accident of this kind, for example by sabotaging a reactor's cooling system and emergency power supply or by sabotaging spent fuel ponds.

4.88 The international concerns have been reinforced by the conclusions of the Kurokawa panel's findings for the Japanese parliament, that:

> The TEPCO Fukushima Nuclear Power Plant accident was the result of collusion between the government, the regulators and TEPCO, and the lack of governance by said parties. They effectively betrayed the nation's right to be safe from nuclear accidents. Therefore, we conclude that the accident was clearly "manmade." We believe that the root causes were the organizational and regulatory systems that supported faulty rationales for decisions and actions…[42]

4.89 For reasons of both safety and security concerns, the principal lesson of the Fukushima accident is that nuclear activities cannot be regarded as the exclusive province of individual states – nuclear activities have potential consequences well beyond the borders of any one state. While the primary responsibility for nuclear safety and security rests with each state, every state is a stakeholder in how well other states meet this responsibility. A major nuclear accident will have global consequences. Even if an accident does not result in significant trans-boundary contamination, there will be an impact on confidence in and support for nuclear energy. Likewise, a nuclear detonation or major nuclear sabotage by terrorists will have global repercussions.

42. *The official report of The Fukushima Nuclear Accident Independent Investigation Commission – Executive summary* (Tokyo: National Diet of Japan, 2012), p. 16.

Box 4.1. The Fukushima Nuclear Meltdown 2011

The meltdown of three nuclear reactors at Fukushima in March 2011 was caused as a consequence of the massive earthquake and tsunami to hit eastern Japan that month, through loss of emergency electrical supply needed to maintain systems vital to safety. But the tragedy also showed up major deficiencies in Japan's nuclear disaster preparedness arrangements and vulnerabilities in Japan's nuclear security governance.

Not only had neither the Tokyo Electric Power Co. (TEPCO) nor the government failed to construct a protection wall high enough to withstand a tsunami after a major earthquake, they had failed to adopt a multi-redundancy approach to secure power supplies at Fukushima No. 1 plant, and therefore were unable to mitigate the severity of the crisis as the critical cooling systems shut down.

The system vulnerability shown up in March 2011 was foreseeable and had been imagined. American specialists had in fact identified the very elements worst affected as the possible targets of terrorist attack: spent fuel pools, cooling systems, and backup electricity.* Since 9/11 the US has adopted a multi-redundancy approach to power supply to reactors as a precaution against a possible nuclear terrorist attack. But in Japan the risk was ignored – apparently because it was modelled against nuclear terrorists, not natural disasters.

The lesson of Fukushima is that both existing and planned nuclear reactor plants must pay full attention to the safety–security interface, including access control mechanisms, at the plant design stage. There should be common, mandatory standards for the siting, construction and operation of nuclear power plants, and for treatment of spent fuel and nuclear waste.

* Associated Press, "Following U.S. antiterrorism advice might have prevented meltdowns," *Japan Times*, 4 April 2012.

4.90 Fukushima demonstrated that neither individual states nor the international community as a whole are well served by relying exclusively on national oversight of nuclear activities. If a leading state such as Japan has difficulties with nuclear regulation and emergency management, what can be expected with smaller states, and those planning new nuclear programs? Fukushima shows the need to find a more appropriate balance between national and international interests and responsibilities in the conduct of nuclear energy. There is a need for greater international cooperation and collaboration, together with international transparency and accountability.

4.91 **Participation in Treaties.** The international interest in non-proliferation is long-recognized, through a number of treaties and institutions, notably the NPT and the IAEA safeguards system. The international interest in nuclear safety and nuclear security is also of fundamental importance, but regrettably less well reflected both in uptake of the relevant treaties, and in the comparatively weak commitments under those treaties. Too much of the international governance arrangements in these areas is voluntary.

There is nothing remotely equivalent to IAEA safeguards inspections. Participation in relevant treaties is uneven, a key nuclear security treaty – the 2005 Amendment to the CPPNM – still has insufficient parties to enter into force, and there is an absence of international transparency and accountability mechanisms.

4.92 Participation in the key nuclear safety and security conventions is shown in Tables 4.4 and 4.5 respectively. While universalization of these conventions is a major goal, it is especially important to have the participation of all the states with significant nuclear activities[43] – in the interest of space the tables focus on these states.

Table 4.4: States with Significant Nuclear Activities: Participation in Nuclear Safety Conventions (indicated by shaded squares)

	Nuclear Safety Convention	Joint Convention on Spent Fuel and Radioactive Waste	Early Notification Convention	Nuclear Assistance Convention
Algeria	signed			
Argentina				
Armenia				
Australia				
Austria				
Bangladesh				
Belarus				
Belgium				
Brazil				
Bulgaria				
Canada				
Chile				
China				
Colombia				
Congo, DR			signed	signed
Czech Rep				
Denmark				
Egypt	signed			
Estonia				
Finland				
France				
Georgia				
Germany				
Ghana				
Greece				
Hungary				
India				
Indonesia				
Iran				

43. As defined by the IAEA – primarily applies to states with nuclear facilities.

	Nuclear Safety Convention	Joint Convention on Spent Fuel and Radioactive Waste	Early Notification Convention	Nuclear Assistance Convention
Iraq				
Israel	signed			
Italy				
Jamaica				
Japan				
Kazakhstan				
Latvia				
Libya				
Lithuania				
Malaysia				
Mexico				
Morocco	signed			
Netherlands				
Nigeria				
North Korea			signed	signed
Norway				
Pakistan				
Peru		signed		
Philippines	signed	signed		
Poland				
Portugal				
Romania				
Russia				
Serbia				
Slovakia				
Slovenia				
South Africa				
South Korea				
Spain				
Sweden				
Switzerland				
Syria	signed		signed	signed
Tajikistan				
Thailand				
Turkey				
Ukraine				
UK				
United States				
Uzbekistan				
Venezuela				
Vietnam				

Source: IAEA (December 2014).

Table 4.5: States with Significant Nuclear Activities: Participation in Nuclear Security Conventions (indicated by shaded squares)

	CPPNM	CPPNM Amendment	ICSANT
Algeria			
Argentina			signed
Armenia			
Australia			
Austria			
Bangladesh			
Belarus			
Belgium			
Brazil			
Bulgaria			signed
Canada			
Chile			
China			
Colombia			signed
Congo, DR			
Czech Rep			
Denmark			
Egypt			signed
Estonia			signed
Finland			
France			
Georgia			
Germany			
Ghana			signed
Greece			signed
Hungary			
India			
Indonesia			
Iran			
Iraq			
Israel			signed
Italy			signed
Jamaica			
Japan			
Kazakhstan			
Latvia			
Libya			
Lithuania			
Malaysia			signed
Mexico			

	CPPNM	CPPNM Amendment	ICSANT
Morocco	■		■
Netherlands	■	■	■
Nigeria	■	■	■
North Korea			
Norway	■	■	■
Pakistan	■		
Peru	■	■	■
Philippines	■		signed
Poland	■	■	■
Portugal	■	■	■
Romania	■	■	■
Russia	■	■	■
Serbia	■		■
Slovakia	■	■	■
Slovenia	■	■	■
South Africa	■		■
South Korea	■	■	■
Spain	■	■	■
Sweden	■	■	■
Switzerland	■	■	■
Syria			signed
Tajikistan	■	■	signed
Thailand			signed
Turkey	■		■
Ukraine	■	■	■
UK	■	■	■
United States	■		signed
Uzbekistan	■	■	■
Venezuela			
Vietnam	■	■	

Sources: IAEA, CPPNM, A/CPPNM (accessed December 2014); UN Treaties Collection Database: ICSANT (December 2014).

4.93 After the Chernobyl accident in 1986, governments and industry realized that substantial steps were needed to regain public confidence in nuclear energy. This prompted a series of new agreements – particularly the Convention on Nuclear Safety (CNS), the Convention on Early Notification of a Nuclear Accident, and the Convention on Assistance in the Case of a Nuclear Accident. In contrast, after the Fukushima accident the international response has been surprisingly muted. With some notable exceptions, governments and industry do not seem to understand the damage to public confidence and the need for change, to move from state primacy to greater international cooperation and accountability.

4.94 The 1994 CNS is the principal treaty on nuclear safety. The convention applies to power reactors, but many states without power reactors have joined to show their support for safety principles. The convention has 77 parties.[44] States that have not become parties include Iran – the only state with a power reactor not a party – and Egypt (which has signed but not yet ratified), which plans to establish a nuclear power program.

4.95 Another major treaty on nuclear safety is the 1997 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. This applies primarily to spent fuel and radioactive waste resulting from civilian nuclear reactors and applications, and to planned and controlled releases into the environment of liquid or gaseous radioactive materials from regulated nuclear facilities. The joint convention also imposes obligations in relation to the trans-boundary movement of spent fuel and radioactive waste, and the safe management of disused sealed sources. It has 69 parties.[45] It is of concern that a number of states operating power reactors are not party to this convention, namely India, Iran, Mexico and Pakistan.

4.96 The 1986 Convention on Early Notification of a Nuclear Accident has 119 parties[46] and the 1986 Convention on Assistance in the Case of a Nuclear Accident has 112 parties, including all of the states with power reactors and most of the states with significant nuclear activities. Exceptions include North Korea and Syria (each of which has signed) and Uzbekistan, and for the Assistance Convention Georgia and Venezuela.

4.97 As noted in the preceding chapter on nuclear security (section 3.3.1), the principal convention on nuclear security – and currently the only legally binding multilateral instrument dealing with nuclear security – is the 1980 CPPNM. This is some way from achieving universality, and as at 31 December 2014 the 2005 Amendment to the CPPNM had received only 83 of the 101 ratifications required for it to enter into force. Similarly, it was noted in section 3.3.2 of the last chapter that significant states are yet to become party to the 2005 International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT).

4.98 **Standards and accountability.** Compared to non-proliferation and safeguards, international governance in nuclear safety and nuclear security is weak. The IAEA has only a recommendatory role. By its statute, the IAEA is authorized to develop and promulgate nuclear safety standards.[47] As with safeguards, the statute provides that states may conclude arrangements giving the IAEA authority to apply safety standards. To date however no such arrangements have been concluded by any state.

4.99 The IAEA Statute, which was concluded in 1956 before awareness of nuclear security issues had developed, makes no specific reference to nuclear security. This has led some states to question whether the IAEA should have any role in nuclear security – though the reference in the statute to "standards of safety for protection of health and minimization of danger to life and property"[48] can certainly be interpreted to encompass nuclear security.

44. As at 9 January 2014.
45. As at 9 October 2013.
46. As at 22 September 2014.
47. IAEA Statute Article III.A.6.
48. IAEA Statute Article III.A.6.

Reflecting this lack of specific reference to nuclear security, much of the IAEA's work in this area is funded by voluntary contributions rather than through its regular budget. In nuclear security the IAEA's role is limited to recommendations and advice.

4.100 The CNS is described as an "incentive instrument." Parties are committed to apply fundamental safety principles but there are no detailed or binding standards. The convention relies on the common interest of the parties to achieve higher levels of safety which will be developed and promoted through regular meetings. The IAEA promulgates nuclear safety standards, but the application of these is voluntary. When the convention was negotiated some states proposed an active monitoring role for the IAEA, but this was not agreed.

4.101 The absence of binding standards makes it all the more important to have mechanisms for external review of nuclear safety and security implementation, and sharing of best practices in these areas. External review is not just about compliance, but helps share best practice and can be vital in identifying overlooked vulnerabilities. At present peer review is the only mechanism for external review.

4.102 The CNS has a broad peer review process, which requires each party to report on its national implementation of the convention. These national reports are discussed at meetings held every three years. While many parties publish their reports, formally these reports and the discussion of them are confidential to the parties.

4.103 More specific peer reviews, including at the facility level, are offered by the IAEA and by the non-government World Association of Nuclear Operators (WANO). IAEA reviews are entirely voluntary – there is no obligation to invite a review or to follow its recommendations. In October 2011 the members of WANO, which include nearly all the world's nuclear power reactor operators, agreed to regular mandatory peer review of nuclear safety at power reactors. While this is a welcome development, the WANO process, like the IAEA review process, lacks transparency. Outsiders have no way of knowing how well the process works in practice.

4.104 The Fukushima accident led to the calling of two high-level nuclear safety meetings in 2011. The first, held by the IAEA on 20–24 June, resulted in the adoption of an action plan on nuclear safety. However, this plan is seen by a number of states as failing to meet international expectations, containing few new commitments and little in the way of increased transparency or safety peer reviews.[49] A number of states, notably France, proposed mandatory, regular and transparent external safety inspections. This was resisted by the United States, India, China and Pakistan, among others. The second meeting was convened by UN Secretary-General Ban Ki-moon on 22 September 2011. Ban called for "greater transparency and open accountability," and for stronger international safety standards. French President Nicolas Sarkozy said that while the IAEA plan was a step in the right direction, the world could not accept different states having different standards. "The highest requirements must be applied to everybody on all continents," he said. "This must go through a harmonization of technical safety standards."

49. Reuters, "IAEA states divided on how to best to boost nuclear safety," http://www.reuters.com/article/2011/09/13/nuclear-safety-iaea-idUSL5E7KD1IY20110913.

4.105 Despite the position taken by France and several others, at this stage nuclear safety remains very much a matter of national prerogative. Fukushima shows the risks in this. For example, the IAEA and others had identified the issue of inadequate regulatory independence in Japan over a number of years, but only after Fukushima did the Japanese government accept this criticism and introduce more effective arrangements.

4.106 On 15–17 December 2012 the Fukushima Ministerial Conference on Nuclear Safety was convened by the IAEA and the Japanese government. According to the chairpersons' summaries from this conference, participants noted the importance of peer review missions and transparency of the results of these, as well as ensuring that regulatory bodies operate in an open and transparent manner. The summaries note that "there has been considerable focus on enhancing the international peer review mechanisms for nuclear operators and regulators worldwide, as well as on promoting openness and transparency to ensure that stakeholders – in particular the public – can hold industry and regulators properly to account, thereby enhancing trust and confidence." They also note that "One of the most effective actions to strengthen nuclear safety worldwide is for member states to utilize the IAEA safety standards as broadly and effectively as possible in a consistent manner."

4.107 While the discussion at the Fukushima Conference is encouraging, serious consideration of binding safety standards and international inspections seems to be as far away as ever. Currently there is resistance from key states to the idea of binding nuclear safety standards and international safety inspections. Until governments are prepared to give the IAEA an active monitoring role in nuclear safety, for example through concluding bilateral agreements with the agency as is done with safeguards, their commitment to substantial reform of nuclear safety governance will be open to question.

4.108 Given the challenges of achieving global consensus for major changes, it may be more productive to proceed initially on a regional basis. For example, in 2013 the Asia Pacific Leadership Network (APLN) issued a discussion paper on the concept of an Asia Pacific Nuclear Energy Community, partly modelled on EURATOM, to establish a regional governance system for nuclear energy, in particular for strengthening safety and security.[50] In August 2014 South Korean President Park Geun-hye proposed a North East Asia nuclear safety body, modelled on EURATOM. This has been followed by a high-level meeting between South Korea, China and Japan, and the idea is being developed further.

4.109 The CPPNM sets out broad security standards and the 2005 CPPNM Amendment (not yet in force) sets out fundamental principles, but there are no detailed or binding security standards. The IAEA promulgates nuclear security guidelines, but as with nuclear safety standards, application of these guidelines is voluntary. By contrast, the CPPNM has neither any mechanism for reporting national implementation, nor even any mechanism for the parties to convene meetings.

4.110 Unlike nuclear safety, in nuclear security there is no form of mandated peer review process. The need to avoid compromising security should not be used as an excuse for

50. John Carlson, "An Asia Pacific Nuclear Energy Community," APLN/CNND *Policy Brief* No. 4 (Canberra: Centre for Nuclear Non-Proliferation and Disarmament, June 2013), https://cnnd.crawford.anu.edu.au/sites/default/files/publication/cnnd_crawford_anu_edu_au/2014-06/policy_brief_no._4_-_an_asia-pacific_nuclear_energy_community.pdf.

avoiding external review. The managed access concept is well established and states can readily establish appropriate procedures. The members of WANO have endorsed mandatory peer review – it is to be hoped that the members of WINS (which in many cases are the same entities as in WANO) will do the same.

4.111 Today the idea of an international nuclear security inspectorate is anathema to most national security officials. For the future, states should seriously consider how an international security inspection process could be developed so as to operate to mutual benefit.

4.112 The importance of international accountability needs to be recognized. In nuclear safety at least there is the reporting process under the CNS. There is no similar process in nuclear security for national reporting on adherence to the conventions, IAEA recommendations, and so on. The only current mechanism is reporting under UN Security Council Resolution 1540 – this contains some reporting requirements for nuclear security, but to date there has been no substantial follow-up on this particular aspect.

4.113 In an encouraging move 35 of the 53 participating states at the 2014 NSS joined together for a "gift basket" or initiative on strengthening nuclear security implementation. Among other things they committed to hosting peer reviews and acting on the recommendations of such reviews. If implemented, this initiative will lead to broader assurance and accountability mechanisms being addressed. As with nuclear safety, greater progress may be possible initially on a regional basis.

4.114 **Liability for Nuclear Damage.** Recognition of the possibility of trans-boundary damage from a nuclear accident led to the conclusion of several international conventions dealing with international compensation issues. The principal conventions are the 1960 Convention on Third Party Liability in the Field of Nuclear Energy (the Paris Convention) – open only to members of the Organisation for Economic Co-operation and Development (OECD); the 1963 Convention on Civil Liability for Nuclear Damage (the Vienna Convention); and the 1997 Convention on Supplementary Compensation for Nuclear Damage (CSC) – developed as an umbrella for the other conventions.[51] Participation in these conventions is shown in Table 4.6.

4.115 With some variations, these conventions set out the following basic principles:

- Strict liability of the nuclear operator – claimants do not have to prove fault;
- Exclusive liability of the operator – all claims are brought against the operator;
- Exclusive jurisdiction in the courts of the state in which the accident occurs;
- Mandatory insurance cover – the operator must insure to the liability limit;
- Limitation of the operator's liability in amount and in time. Beyond the limit the state and/or operators collectively take responsibility for paying compensation. The liability limit differs depending on the convention.

51. In addition to these conventions there is the Convention Supplementary to the Paris Convention of 1963 (Brussels Supplementary Convention) and a number of protocols amending the Paris and Vienna Conventions, and the 1988 Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention.

Table 4.6: Participation in Liability Conventions by States with Nuclear Power

State	Convention	State	Convention
Argentina	Vienna, CSC	Mexico	Vienna
Armenia	Vienna	Netherlands	Paris
Belgium	Paris	Pakistan	
Brazil	Vienna	Romania	Vienna, CSC
Bulgaria	Vienna	Russia	Vienna
Canada	CSC signed	Slovak Republic	Vienna
China		Slovenia	Paris
Czech Republic	Vienna, CSC signed	South Africa	
Finland	Paris	South Korea	
France	Paris	Spain	Paris, Vienna signed
Germany	Paris	Sweden	Paris
Hungary	Vienna	Switzerland	Paris
India	CSC signed	Ukraine	Vienna, CSC signed
Iran		UK	Paris, Vienna signed
Japan		United States	CSC

Sources: (accessed December 2014): Vienna Convention and CSC: IAEA; Paris Convention: OECD/Nuclear Energy Agency.

4.116 The IAEA has been seeking to establish a single liability regime – the CSC is considered a possible basis for such a regime – but so far without success. The CSC is not yet in force – this requires ratification by five states with a minimum installed nuclear capacity of 400,000 megawatts thermal, roughly equivalent to 130,000 megawatts electrical (MWe). To date five states (Argentina, Morocco, Romania, UAE and the United States) have ratified, with a total installed capacity of 102,000 MWe. Eighteen other states have signed, including four with nuclear power programs (Canada, Czech Republic, India and Ukraine). In December 2013 Japan announced its intention to ratify the convention and the necessary legislation was passed by the Diet in November 2014. Japan's ratification is expected to take effect in the first quarter of 2015, at which point the CSC should enter into force.

4.117 Over half the world's reactors are in states that are outside the Paris and Vienna Conventions. Some have ratified or signed the CSC (for example United States, India). A number of significant nuclear power states, including Canada,[52] China, Japan and South Korea, have not joined any of the conventions. The situation has been exacerbated by the two major nuclear power states, France and the United States, supporting different conventions – France the Paris Convention and the United States the CSC. Those outside these two conventions were waiting to see which prevailed. In August 2014, however, the United States and France committed to work to bring the CSC into force.

4.118 If a major nuclear accident occurs in a state outside the Paris or Vienna conventions, or the CSC when it enters into force, claimants will be dependent on the domestic legislation of the state concerned. This would result in uncertainty not only for the victims of an accident, but for other parties that rightly or wrongly might become the subject of litigation, such as reactor vendors and fuel fabricators (the latter concern has been raised about

52. Canada signed the Convention on Supplementary Compensation on 3 December 2013.

India's liability legislation). Every effort should be made to establish a single international liability regime – the CSC is now looking like the best prospect – and to universalize it with all states that have nuclear reactors joining it.

4.119 **Prohibition of Attacks on Nuclear Facilities.** In 2009 the IAEA General Conference, in a decision on "Prohibition of armed attack or threat of attack against nuclear installations, during operation or under construction," noted that "any armed attack on and threat against nuclear facilities devoted to *peaceful purposes* constitutes a violation of the principles of the United Nations Charter, international law and the Statute of the Agency" (emphasis added).[53] Action 64 from the 2010 NPT Review Conference called on all states to abide by this decision. The obvious concern with possible attacks on nuclear facilities is the danger of widespread radioactive contamination, not only affecting the host state but potentially extending well beyond that state.

4.120 To date there have been several attacks on nuclear facilities, in most cases before they had commenced operation. None of these attacks resulted in significant radiation releases:

- In 1980 Iranian aircraft attacked Iraq's Osirak research reactor, then under construction, damaging ancillary buildings but not the reactor itself.
- In 1981 Israeli aircraft destroyed the Osirak reactor.
- From 1984 to 1987, during the Iran–Iraq war, Iraq launched several air strikes on Iran's two Bushehr power reactors, then under construction, causing major damage.
- In 1991 and 1993, during the First Gulf War, the US attacked the Tuwaitha research centre and other nuclear targets in Iraq.
- In 2007 Israeli aircraft destroyed Syria's al-Kibar reactor. This was a plutonium production reactor supplied by North Korea and built in secret. At the time of the attack it was close to start-up.
- The most recent example involved a non-state actor – in July 2014 Hamas launched unsuccessful rocket attacks against Israel's Dimona reactor.

4.121 There is no current action to develop a new multilateral treaty on this subject. At present the only relevant multilateral treaties are the 1977 Additional Protocols to the Geneva Conventions (Article 56 of Additional Protocol I and Article 15 of Additional Protocol II), and the 1996 Pelindaba Treaty (Article 11).[54] The only other treaty in this field is bilateral, but important nonetheless – the 1988 Agreement on the Prohibition of Attack against Nuclear Installations and Facilities concluded between India and Pakistan. This has an unqualified prohibition, applying to all nuclear facilities. In addition, under the agreement the parties regularly exchange updated lists of their nuclear facilities. In the 1980s the Conference on Disarmament (CD) developed a compilation of draft provisions for a multilateral treaty prohibiting attacks on nuclear facilities, but this work was never taken further.

53. GC(53)/DEC/13 of September 2009.
54. African Nuclear-Weapon-Free Zone Treaty.

PART II
SPECIFIC COMMITMENTS AND RECOMMENDATIONS

A. NPT REVIEW CONFERENCE 2010: ACTION PLAN

AGREED FOLLOW-ON ACTIONS	PARAGRAPHS WHERE DISCUSSED IN STATE OF PLAY REPORT	STATE OF PLAY AS AT DECEMBER 2014

I. Nuclear Disarmament

A. Principles and objectives

Action 1: All States Parties commit to pursue policies that are fully compatible with the Treaty and the objective of achieving a world without nuclear weapons. — 1.19–33

Action 2: All States Parties commit to apply the principles of irreversibility, verifiability and transparency in relation to the implementation of their treaty obligations. — 1.34–54

B. Disarmament of nuclear weapons

Action 3: In implementing the unequivocal undertaking by the nuclear-weapon States to accomplish the total elimination of their nuclear arsenals, the nuclear weapon States commit to undertake further efforts to reduce and ultimately eliminate all types of nuclear weapons, deployed and non-deployed, including through unilateral, bilateral, regional and multilateral measures. — 1.19–33, 1.55–100

Action 4: The Russian Federation and the United States of America commit to seek the early entry into force and full implementation of the Treaty on Measures for the Further Reduction and Limitation of Strategic Offensive Arms and are encouraged to continue discussions on follow-on measures in order to achieve deeper reductions in their nuclear arsenals. — 1.22, 1.30, 1.32, 1.82–90

Action 5: The nuclear-weapon States commit to accelerate concrete progress on the steps leading to nuclear disarmament, contained in the Final Document of the 2000 Review Conference, in a way that promotes international stability, peace and undiminished and increased security. To that end, they are called upon to promptly engage with a view to, inter alia: — 1.19–33, 1.248–53

(a) Rapidly moving towards an overall reduction in the global stockpile of all types of nuclear weapons, as identified in action 3; — 1.55–100

No Progress	Minimal Progress	Some Progress	Significant Progress	Fully implemented

(b) Address the question of all nuclear weapons regardless of their type or their location as an integral part of the general nuclear disarmament process;	1.55–100	
(c) To further diminish the role and significance of nuclear weapons in all military and security concepts, doctrines and policies;	1.108–47	
(d) Discuss policies that could prevent the use of nuclear weapons and eventually lead to their elimination, lessen the danger of nuclear war and contribute to the non-proliferation and disarmament of nuclear weapons;	1.93–100	
(e) Consider the legitimate interest of non-nuclear-weapon States in further reducing the operational status of nuclear weapons systems in ways that promote international stability and security;	1.155–74	
(f) Reduce the risk of accidental use of nuclear weapons; and	1.167–74	
(g) Further enhance transparency and increase mutual confidence.	1.38–47	
Action 6: All States agree that the Conference on Disarmament should immediately establish a subsidiary body to deal with nuclear disarmament, within the context of an agreed, comprehensive and balanced programme of work.	1.91	

C. Security assurances

Action 7: All States agree that the Conference on Disarmament should, within the context of an agreed, comprehensive and balanced programme of work, immediately begin discussion of effective international arrangements to assure non-nuclear-weapon States against the use or threat of use of nuclear weapons, to discuss substantively, without limitation, with a view to elaborating recommendations dealing with all aspects of this issue, not excluding an internationally legally binding instrument. The Review Conference invites the Secretary-General of the United Nations to convene a high-level meeting in September 2010 in support of the work of the Conference on Disarmament.	1.138–47	
Action 8: All nuclear-weapon States commit to fully respect their existing commitments with regard to security assurances. Those nuclear-weapon States that have not yet done so are encouraged to extend security assurances to non-nuclear-weapon States Parties to the Treaty.	1.138–47	

Action 9: The establishment of further nuclear-weapon-free zones, where appropriate, on the basis of arrangements freely arrived at among States of the region concerned, and in accordance with the 1999 Guidelines of the United Nations Disarmament Commission, is encouraged. All concerned States are encouraged to ratify the nuclear-weapon-free zone treaties and their relevant protocols, and to constructively consult and cooperate to bring about the entry into force of the relevant legally binding protocols of all such nuclear-weapon-free zones treaties, which include negative security assurances. The concerned States are encouraged to review any related reservations. 1.145 2.119–45

D. Nuclear testing

Action 10: All nuclear-weapon States undertake to ratify the Comprehensive Nuclear-Test-Ban Treaty with all expediency, noting that positive decisions by nuclear-weapon States would have the beneficial impact towards the ratification of that Treaty, and that nuclear-weapon States have the special responsibility to encourage Annex 2 countries, in particular those which have not acceded to the Treaty on the Non-Proliferation of Nuclear Weapons and continue to operate unsafeguarded nuclear facilities, to sign and ratify. 2.163

Action 11: Pending the entry into force of the Comprehensive Nuclear-Test- Ban Treaty, all States commit to refrain from nuclear-weapon test explosions or any other nuclear explosions, the use of new nuclear weapons technologies and from any action that would defeat the object and purpose of that Treaty, and all existing moratoriums on nuclear-weapon test explosions should be maintained. 2.163 2.168

Action 12: All States that have ratified the Comprehensive Nuclear-Test-Ban Treaty recognize the contribution of the conferences on facilitating the entry into force of that Treaty and of the measures adopted by consensus at the Sixth Conference on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty, held in September 2009, and commit to report at the 2011 Conference on progress made towards the urgent entry into force of that Treaty. 2.169–71

Action 13: All States that have ratified the Comprehensive Nuclear-Test-Ban Treaty undertake to promote the entry into force and implementation of that Treaty at the national, regional and global levels. 2.169–71

Action 14: The Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization is to be encouraged to fully develop the verification regime for the Comprehensive Nuclear-Test-Ban Treaty, including early completion and provisional operationalization of the international monitoring system in accordance with the mandate of the Preparatory Commission, which should, upon entry into force of that Treaty, serve as an effective, reliable, participatory and non-discriminatory verification system with global reach, and provide assurance of compliance with that Treaty.	2.172	

E. Fissile materials

Action 15: All States agree that the Conference on Disarmament should, within the context of an agreed, comprehensive and balanced programme of work, immediately begin negotiation of a treaty banning the production of fissile material for use in nuclear weapons or other nuclear explosive devices in accordance with the report of the Special Coordinator of 1995 (CD/1299) and the mandate contained therein. Also in this respect, the Review Conference invites the Secretary-General of the United Nations to convene a high-level meeting in September 2010 in support of the work of the Conference on Disarmament.	2.175–92	
Action 16: The nuclear-weapon States are encouraged to commit to declare, as appropriate, to the International Atomic Energy Agency (IAEA) all fissile material designated by each of them as no longer required for military purposes and to place such material as soon as practicable under IAEA or other relevant international verification and arrangements for the disposition of such material for peaceful purposes, to ensure that such material remains permanently outside military programmes.	2.193–209	
Action 17: In the context of action 16, all States are encouraged to support the development of appropriate legally binding verification arrangements, within the context of IAEA, to ensure the irreversible removal of fissile material designated by each nuclear-weapon State as no longer required for military purposes.	2.193–209	
Action 18: All States that have not yet done so are encouraged to initiate a process towards the dismantling or conversion for peaceful uses of facilities for the production of fissile material for use in nuclear weapons or other nuclear explosive devices.	2.210–20	

F. Other measures in support of nuclear disarmament

Action 19: All States agree on the importance of supporting cooperation among Governments, the United Nations, other international and regional organizations and civil society aimed at increasing confidence, improving transparency and developing efficient verification capabilities related to nuclear disarmament.	1.38–54	

Action 20: States Parties should submit regular reports, within the framework of the strengthened review process for the Treaty, on the implementation of the present action plan, as well as of article VI, paragraph 4 (c), of the 1995 decision entitled "Principles and objectives for nuclear non-proliferation and disarmament," and the practical steps agreed to in the Final Document of the 2000 Review Conference, and recalling the advisory opinion of the International Court of Justice of 8 July 1996. 1.45–47

Action 21: As a confidence-building measure, all the nuclear-weapon States are encouraged to agree as soon as possible on a standard reporting form and to determine appropriate reporting intervals for the purpose of voluntarily providing standard information without prejudice to national security. The Secretary-General of the United Nations is invited to establish a publicly accessible repository, which shall include the information provided by the nuclear-weapon States. 1.45–47

Action 22: All States are encouraged to implement the recommendations contained in the report of the Secretary-General of the United Nations (A/57/124) regarding the United Nations study on disarmament and non-proliferation education, in order to advance the goals of the Treaty in support of achieving a world without nuclear weapons. 1.228–31

II. Nuclear Non-proliferation

Action 23: The Conference calls upon all States Parties to exert all efforts to promote universal adherence to the Treaty, and not to undertake any actions that can negatively affect prospects for the universality of the Treaty. 2.22–35

Action 24: The Conference re-endorses the call by previous review conferences for the application of IAEA comprehensive safeguards to all source or special fissionable material in all peaceful nuclear activities in the States Parties in accordance with the provisions of article III of the Treaty. 2.36–44

Action 25: The Conference, noting that 18 States Parties to the Treaty have yet to bring into force comprehensive safeguards agreements, urges them to do so as soon as possible and without further delay. 2.38–39

Action 26: The Conference underscores the importance in complying with the non-proliferation obligations, addressing all compliance matters in order to uphold the Treaty's integrity and the authority of the safeguards system. 2.65–82

Action 27: The Conference underscores the importance of resolving all cases of non-compliance with safeguards obligations in full conformity with the IAEA statute and the respective legal obligations of Member States. In this regard, the Conference calls upon Member States to extend their cooperation to the Agency. 2.65–82

Action 28: The Conference encourages all States Parties which have not yet done so to conclude and to bring into force additional protocols as soon as possible and to implement them provisionally pending their entry into force.	2.45–49	
Action 29: The Conference encourages IAEA to further facilitate and assist the States Parties in the conclusion and entry into force of comprehensive safeguards agreements and additional protocols. The Conference calls on States Parties to consider specific measures that would promote the universalization of the comprehensive safeguards agreements.	2.61–64	
Action 30: The Conference calls for the wider application of safeguards to peaceful nuclear facilities in the nuclear-weapon States, under the relevant voluntary offer safeguards agreements, in the most economic and practical way possible, taking into account the availability of IAEA resources, and stresses that comprehensive safeguards and additional protocols should be universally applied once the complete elimination of nuclear weapons has been achieved.	2.42–44	
Action 31: The Conference encourages all States Parties with small quantities protocols which have not yet done so to amend or rescind them, as appropriate, as soon as possible.	2.40–41	
Action 32: The Conference recommends that IAEA safeguards should be assessed and evaluated regularly. Decisions adopted by the IAEA policy bodies aimed at further strengthening the effectiveness and improving the efficiency of IAEA safeguards should be supported and implemented.	2.50–60	
Action 33: The Conference calls upon all States Parties to ensure that IAEA continues to have all political, technical and financial support so that it is able to effectively meet its responsibility to apply safeguards as required by article III of the Treaty.	2.83–91	
Action 34: The Conference encourages States Parties, within the framework of the IAEA statute, to further develop a robust, flexible, adaptive and cost-effective international technology base for advanced safeguards through cooperation among Member States and with IAEA.	2.57–60	
Action 35: The Conference urges all States Parties to ensure that their nuclear-related exports do not directly or indirectly assist the development of nuclear weapons or other nuclear explosive devices and that such exports are in full conformity with the objectives and purposes of the Treaty as stipulated, particularly, in articles I, II and III of the Treaty, as well as the decision on principles and objectives of nuclear non-proliferation and disarmament adopted in 1995 by the Review and Extension Conference.	2.92–100	

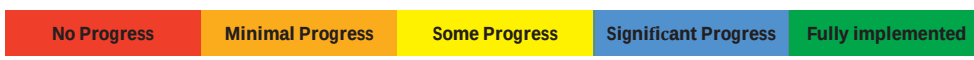
Action 36: The Conference encourages States Parties to make use of multilaterally negotiated and agreed guidelines and understandings in developing their own national export controls.	2.98	
Action 37: The Conference encourages States Parties to consider whether a recipient State has brought into force IAEA safeguards obligations in making nuclear export decisions.	2.102–105	
Action 38: The Conference calls upon all States Parties, in acting in pursuance of the objectives of the Treaty, to observe the legitimate right of all States Parties, in particular developing States, to full access to nuclear material, equipment and technological information for peaceful purposes.	2.99 4.24–38	
Action 39: States Parties are encouraged to facilitate transfers of nuclear technology and materials and international cooperation among States Parties, in conformity with articles I, II, III and IV of the Treaty, and to eliminate in this regard any undue constraints inconsistent with the Treaty.	2.92–99 4.24–38	
Action 40: The Conference encourages all States to maintain the highest possible standards of security and physical protection of nuclear materials and facilities.	3.1–172	
Action 41: The Conference encourages all States Parties to apply, as appropriate, the IAEA recommendations on the physical protection of nuclear material and nuclear facilities (INFCIRC/225/Rev.4 (Corrected)) and other relevant international instruments at the earliest possible date.	3.32–34 3.80–84	
Action 42: The Conference calls on all States Parties to the Convention on the Physical Protection of Nuclear Material to ratify the amendment to the Convention as soon as possible and encourages them to act in accordance with the objectives and the purpose of the amendment until such time as it enters into force. The Conference also encourages all States that have not yet done so to adhere to the Convention and adopt the amendment as soon as possible.	3.37–43	
Action 43: The Conference urges all States Parties to implement the principles of the revised IAEA Code of Conduct on the Safety and Security of Radioactive Sources, as well as the Guidance on the Import and Export of Radioactive Sources approved by the IAEA Board of Governors in 2004.	3.60–61	

Action 44: The Conference calls upon all States Parties to improve their national capabilities to detect, deter and disrupt illicit trafficking in nuclear materials throughout their territories, in accordance with their relevant international legal obligations, and calls upon those States Parties in a position to do so to work to enhance international partnerships and capacity-building in this regard. The Conference also calls upon States Parties to establish and enforce effective domestic controls to prevent the proliferation of nuclear weapons in accordance with their relevant international legal obligations.	2.92–100 2.146–48 3.116–19	
Action 45: The Conference encourages all States Parties that have not yet done so to become party to the International Convention for the Suppression of Acts of Nuclear Terrorism as soon as possible.	3.44–50	
Action 46: The Conference encourages IAEA to continue to assist the States Parties in strengthening their national regulatory controls of nuclear material, including the establishment and maintenance of the State systems of accounting for and control of nuclear material, as well as systems on regional level. The Conference calls upon IAEA Member States to broaden their support for the relevant IAEA programmes.	3.76–100 3.120–23	

III. Peaceful Uses of Nuclear Energy

Action 47: Respect each country's choices and decisions in the field of peaceful uses of nuclear energy without jeopardizing its policies or international cooperation agreements and arrangements for peaceful uses of nuclear energy and its fuel cycle policies.	4.24–38	
Action 48: Undertake to facilitate, and reaffirm the right of States Parties to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy.	4.15–23	
Action 49: Cooperate with other States Parties or international organizations in the further development of nuclear energy for peaceful purposes, with due consideration for the needs of the developing areas of the world.	4.24–48	
Action 50: Give preferential treatment to the non-nuclear-weapon States Parties to the Treaty, taking the needs of developing countries, in particular, into account.	4.26–48	
Action 51: Facilitate transfers of nuclear technology and international cooperation among States Parties in conformity with articles I, II, III, and IV of the Treaty, and eliminate in this regard any undue constraints inconsistent with the Treaty.	4.26–38	
Action 52: Continue efforts, within IAEA, to enhance the effectiveness and efficiency of its technical cooperation programme.	4.39–48	

Action 53: Strengthen the IAEA technical cooperation programme in assisting developing States Parties in the peaceful uses of nuclear energy.	4.39–48	
Action 54: Make every effort and to take practical steps to ensure that IAEA resources for technical cooperation activities are sufficient, assured and predictable.	4.41–48	
Action 55: Encourage all States in a position to do so to make additional contributions to the initiative designed to raise 100 million dollars over the next five years as extra-budgetary contributions to IAEA activities, while welcoming the contributions already pledged by countries and groups of countries in support of IAEA activities.	4.41	
Action 56: Encourage national, bilateral and international efforts to train the necessary skilled workforce needed to develop peaceful uses of nuclear energy.	4.36–48	
Action 57: Ensure that, when developing nuclear energy, including nuclear power, the use of nuclear energy must be accompanied by commitments to and ongoing implementation of safeguards as well as appropriate and effective levels of safety and security, consistent with States' national legislation and respective international obligations.	3.161–64 4.55–57 4.86–113	
Action 58: Continue to discuss further, in a non-discriminatory and transparent manner under the auspices of IAEA or regional forums, the development of multilateral approaches to the nuclear fuel cycle, including the possibilities of creating mechanisms for assurance of nuclear fuel supply, as well as possible schemes dealing with the back-end of the fuel cycle without affecting rights under the Treaty and without prejudice to national fuel cycle policies, while tackling the technical, legal and economic complexities surrounding these issues, including, in this regard, the requirement of IAEA full scope safeguards.	4.79–85	
Action 59: Consider becoming party, if they have not yet done so, to the Convention on Nuclear Safety, the Convention on Early Notification of a Nuclear Accident, the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, the International Convention for the Suppression of Acts of Nuclear Terrorism, the Convention on the Physical Protection of Nuclear Material, and to ratify its amendment so that it may enter into force at an early date.	4.91–97	
Action 60: Promote the sharing of best practices in the area of nuclear safety and security, including through dialogue with the nuclear industry and the private sector, as appropriate.	3.156–64 4.98–113	
Action 61: Encourage States concerned, on a voluntary basis, to further minimize highly enriched uranium in civilian stocks and use, where technically and economically feasible.	4.60	



Action 62: Transport radioactive materials consistent with relevant international standards of safety, security and environmental protection, and to continue communication between shipping and coastal States for the purpose of confidence-building and addressing concerns regarding transport safety, security and emergency preparedness. 3.115 4.86–113

Action 63: Put in force a civil nuclear liability regime by becoming party to relevant international instruments or adopting suitable national legislation, based upon the principles established by the main pertinent international instruments. 4.114–18

Action 64: The Conference calls upon all States to abide by the decision adopted by consensus at the IAEA General Conference on 18 September 2009 on prohibition of armed attack or threat of attack against nuclear installations, during operation or under construction. 4.119–21

IV. The Middle East, particularly implementation of the 1995 Resolution on the Middle East

... 7. The Conference emphasizes the importance of a process leading to full implementation of the 1995 Resolution on the Middle East. To that end, the Conference endorses the following practical steps:

(a) The Secretary-General of the United Nations and the co-sponsors of the 1995 Resolution, in consultation with the States of the region, will convene a conference in 2012, to be attended by all States of the Middle East, on the establishment of a Middle East zone free of nuclear weapons and all other weapons of mass destruction, on the basis of arrangements freely arrived at by the States of the region, and with the full support and engagement of the nuclear-weapon States. The 2012 Conference shall take as its terms of reference the 1995 Resolution; 2.140–45

(b) Appointment by the Secretary-General of the United Nations and the co-sponsors of the 1995 Resolution, in consultation with the States of the region, of a facilitator, with a mandate to support implementation of the 1995 Resolution by conducting consultations with the States of the region in that regard and undertaking preparations for the convening of the 2012 Conference. The facilitator will also assist in implementation of follow-on steps agreed by the participating regional States at the 2012 Conference. The facilitator will report to the 2015 Review Conference and its Preparatory Committee meetings; 2.140

(c) Designation by the Secretary-General of the United Nations and the co-sponsors of the 1995 Resolution, in consultation with the States of the region, of a host Government for the 2012 Conference; 2.140 2.142

(d) Additional steps aimed at supporting the implementation of the 1995 Resolution, including that IAEA, the Organisation for the Prohibition of Chemical Weapons and other relevant international organizations be requested to prepare background documentation for the 2012 Conference regarding modalities for a zone free of nuclear weapons and other weapons of mass destruction and their delivery systems, taking into account work previously undertaken and experience gained; 2.141–42

(e) Consideration of all offers aimed at supporting the implementation of the 1995 Resolution, including the offer of the European Union to host a follow-on seminar to that organized in June 2008. 2.141

Other regional issue [DPRK]

The Conference strongly urges the Democratic People's Republic of Korea to fulfil the commitments under the Six-Party Talks, including the complete and verifiable abandonment of all nuclear weapons and existing nuclear programmes in accordance with the September 2005 joint statement, and urges the Democratic People's Republic of Korea to return, at an early date, to the Treaty and to its adherence with its IAEA safeguards agreement. The Conference also calls on the Democratic People's Republic of Korea and all States Parties to fully implement all relevant nuclear non-proliferation and disarmament obligations. The Conference reaffirms its firm support for the Six-Party Talks and remains determined to achieve the satisfactory and comprehensive resolution to the issues involved through diplomatic means. 1.101–107

B. NUCLEAR SECURITY SUMMITS, 2010, 2012 AND 2014: COMMITMENTS

COMMITMENT	PARAGRAPHS WHERE DISCUSSED IN STATE OF PLAY REPORT	STATE OF PLAY AS AT DECEMBER 2014

WASHINGTON SUMMIT 2010

[A. Global Nuclear Security Architecture]

[ICSANT] Recognizing the importance of the International Convention for the Suppression of Acts of Nuclear Terrorism as an important legally binding multilateral instrument addressing threats posed by acts of nuclear terrorism:

1	Participating States Parties to the Convention will work together to achieve universality of the Convention, as soon as possible;	3.42	
2	Participating States Parties to the Convention will assist States, as appropriate and upon their request, to implement the Convention; and	3.44–50	
3	Participating States Parties to the Convention encourage discussions among States Parties to consider measures to ensure its effective implementation, as called for in Article 20 of the Convention.	3.44–50	

[CPPNM] Recognizing the importance of the Convention on the Physical Protection of Nuclear Material, as the only multilateral legally binding agreement dealing with the physical protection of nuclear material in peaceful uses, and the value of the 2005 Amendment to the Convention in strengthening global security:

1	Participating States Parties to the Convention will work towards its universal adherence and where applicable, to accelerate the ratification processes of the Amendment to the Convention and to act for early implementation of that Amendment; and	3.37–43	
2	Participating States Parties to the Convention call on all States to act in accordance with the object and purpose of the Amendment until such time as it enters into force.	3.40	

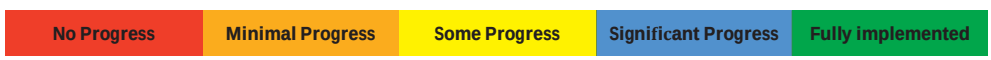
[UNSCR 1540] Noting the need to fully implement United Nations Security Council Resolution (UNSCR) 1540 (2004) on preventing non-State actors from obtaining weapons of mass destruction (WMD), their means of delivery and related materials, in particular as it relates to nuclear material:

1	Participating States support the continued dialogue between the Security Council committee established pursuant to UNSCR 1540 and States and support strengthened international cooperation in this regard, in accordance with relevant United Nations resolutions and within the framework of the United Nations Global Counterterrorism Strategy;	3.51–55	
2	Participating States support the activities of the Security Council committee established pursuant to UNSCR 1540 to promote full implementation;	3.53–55	
3	Participating States recognize the importance of complete and timely reporting as called for by UNSCR 1540, and will work with other States to do so, including by providing technical support or assistance, as requested;	3.55	
4	Participating States note the outcome of Comprehensive Review by the Security Council committee established pursuant to UNSCR 1540, including the consideration of the establishment of a voluntary fund, and express their support for ensuring the effective and sustainable support for the activities of the 1540 Committee;	3.51–55	
5	With respect to the nuclear security-related aspects of Paragraph 3, sections (a) and (b) of UNSCR 1540, Participating States recognize the importance of evaluating and improving their physical protection systems to ensure that they are capable of achieving the objectives set out in relevant International Atomic Energy Agency (IAEA) Nuclear Security Series documents and as contained in the document "Physical Protection of Nuclear Material and Nuclear Facilities," (INFCIRC/225); and	3.52 –54	
6	Participating States in a position to do so are encouraged to provide technical assistance to those States that request it through appropriate mechanisms, including through the Committee's efforts to match needs with available resources.	3.51–55	

[B. Role of the IAEA]

Welcoming IAEA activities in support of national efforts to enhance nuclear security worldwide and commending the work of the IAEA for the provision of assistance, upon request, through its Nuclear Security Programme and for the implementation of the Nuclear Security Plan 2010 –2013, approved by the Board of Governors in September 2009 and noted by the IAEA General Conference, and welcoming IAEA programs to advance new technologies to improve nuclear security and nuclear materials accountancy.

Recognizing that the IAEA is facilitating the development by member states, in the framework of the Nuclear Security Series, of guidance and recommendations relating to the prevention and detection of, and response to, theft, sabotage, unauthorized access and illegal transfer, or other malicious acts involving, inter alia, nuclear material, and associated facilities, and is providing guidance in developing and implementing effective nuclear security measures.



Noting that pursuit of the objectives of this Work Plan will not be interpreted so as to alter the mandate or responsibilities of the IAEA:

1	Participating States note that the IAEA's Nuclear Security Series of documents provides recommendations and guidance to assist States in a wide range of aspects of nuclear security, and encourage the widest possible participation by all its member states in the process;	3.79–84	
2	Participating States in a position to do so, will work actively with the IAEA towards the completion and implementation, as appropriate, of the guidance provided by the Nuclear Security Series, and to assist, upon request, other States in doing so;	3.79–84	
3	Participating States in particular welcome and support the IAEA's efforts to finalize the fifth revision of the recommendations contained in INFCIRC/225, which will be published in the Nuclear Security Series;	3.80–82	
4	Participating States recognize the importance of nuclear material accountancy in support of nuclear security and look forward to the completion of the technical guidance document on "Nuclear Material Accountancy Systems at Facilities;	3.82	
5	Participating States will endeavor to incorporate, as appropriate, the relevant principles set out in the Nuclear Security Series documents, into the planning, construction, and operation of nuclear facilities;	3.85–86	
6	Participating States, when implementing their national nuclear security measures, will support the use of the IAEA Implementing Guide on the Development, Use and Maintenance of the Design Basis Threat to elaborate their national design basis threat as appropriate, to include the consideration of outsider and insider threats;	3.85–86	
7	Participating States welcome the IAEA's efforts to assist States to develop, upon request, Integrated Nuclear Security Support Plans to consolidate their nuclear security needs into integrated plans for nuclear security improvements and assistance;	3.85–86	
8	Participating States recognize the value of IAEA support mechanisms such as the International Physical Protection Advisory Service missions to review, as requested, their physical protection systems for civilian nuclear material and facilities; and	3.85–86 3.167–69	
9	Participating States call upon all member states of the IAEA in a position to do so to provide the necessary support to enable the IAEA to implement these important activities.	3.87–88 3.93	

[C. International Cooperation]

Noting the contributions to the promotion of nuclear security by the U.N. and initiatives such as the Global Initiative to Combat Nuclear Terrorism, the G-8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, as well as other bilateral, regional, multilateral, and nongovernmental activities within their respective mandates and memberships:

1	Participating States will work together, as appropriate, to ensure that nuclear security cooperation mechanisms are complementary, reinforcing, efficient, consistent with related IAEA activities, and appropriately matched to identified needs in those States requesting assistance;	3.101–19	
2	Participating States encourage, where appropriate, expanded participation in and commitment to international initiatives and voluntary cooperative mechanisms aimed at improving nuclear security and preventing nuclear terrorism; and	3.105–19	
3	Participating States welcome the intent of the members of the G-8 Global Partnership, in a position to do so, to undertake additional programming to enhance nuclear security.	3.105–19	

[D. Nuclear Materials]

Recognizing States' rights to develop and use nuclear energy for peaceful purposes, and noting the responsibility of each State for the use and management of all nuclear materials and facilities under its jurisdiction and recognize that highly enriched uranium and separated plutonium are particularly sensitive and require special precautions:

1	Participating States will consider, where appropriate, the consolidation of national sites where nuclear material is held;	3.129	
2	Participating States will continue to exercise particular care in ensuring the safe and secure transport of nuclear materials, both in domestic and international transport;	3.34–36 3.115 3.127	
3	Participating States, where appropriate, will consider on a national basis the safe, secure and timely removal and disposition of nuclear materials from facilities no longer using them;	3.128–39	
4	Participating States will continue to exercise particular care in securing and accounting for separated plutonium, taking into consideration the potential of various forms for use in a nuclear explosive device;	3.128–39 4.60–68	
5	Participating States will consider, where appropriate, converting highly-enriched-uranium fuelled research reactors, and other nuclear facilities using highly enriched uranium, to use low enriched uranium, where it is technically and economically feasible;	3.128–39	

6 Participating States, as appropriate, will collaborate to research and develop new technologies that require neither highly enriched uranium fuels for reactor operation nor highly enriched uranium targets for producing medical or other isotopes, and will encourage the use of low enriched uranium and other proliferation-resistant technologies and fuels in various commercial applications such as isotope production; 3.130–34 4.58–67

7 Participating States in a position to do so will provide assistance to those States requesting assistance to secure, account for, consolidate, and convert nuclear materials; and 3.128–39

8 Participating States will consider how to best address the security of radioactive sources, as well as consider further steps as appropriate. 3.60–61 3.130

[E. National Nuclear Security Regulations]

Mindful of the responsibilities of every Participating State to maintain effective nuclear security and a robust domestic regulatory capacity:

1 Participating States will establish and maintain effective national nuclear security regulations, including the periodic review and adjustment of the regulations as the State considers appropriate; 3.120–23

2 Participating States undertake to maximize regulatory independence, consistent with each State's particular legal and institutional structures; 3.120–23

3 Participating States will undertake to build regulatory capacity and ensure sufficiently trained and fully vetted professional nuclear security staff and adequate resources, taking into account current needs and future expansion of their respective nuclear programs; and 3.120–23

4 Participating States will pursue the review and enforcement of compliance with national nuclear security regulations as a matter of priority. 3.120–23

[F. Nuclear Industry]

Understanding the role of the nuclear industry, including the private sector, in nuclear security and recognizing that national governments are responsible for standard setting within each State:

1 Participating States will work, in guiding the nuclear industry, to promote and sustain strong nuclear security culture and corporate commitment to implement robust security practices, including regular exercises and performance testing of nuclear security features, consistent with national regulations; 3.156–60

2 Consistent with State requirements, Participating States will facilitate exchange of best practices, where legally and practically feasible, in nuclear security in the nuclear industry, and in this respect, will utilize relevant institutions to support such exchanges; 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] 3.156–60 

3 Participating States encourage nuclear operators and architect/engineering firms to take into account and incorporate, where appropriate, effective measures of physical protection and security culture into the planning, construction, and operation of civilian nuclear facilities and provide technical assistance, upon request, to other States in doing so. 3.156–60 

[G. Nuclear Security Culture]

Emphasizing the importance of the human dimension of nuclear security, the need to enhance security culture, and the need to maintain a well-trained cadre of technical experts:

1 Participating States will promote cooperation, as appropriate, among international organizations, governments, industries, other stakeholders, and academia for effective capacity building, including human resources development in nuclear security programs; 3.165–72 

2 Participating States will encourage the creation of and networking among nuclear security support centres for capacity building to disseminate and share best practices and will support IAEA activities in this area; 3.165–72 

3 Participating States encourage the creation of adequate national nuclear security capacities, and encourage supplier countries and technology suppliers to support those capacities in the recipient countries, including human resources development through education and training, upon request and consistent with each State's particular legal and institutional structures; 3.165–72 

4 Participating States will encourage an integrated approach to education and training and institutional capacity building by all stakeholders having a key role in establishing and maintaining adequate security infrastructure; and 3.165–69 

5 Participating States will encourage the implementation of national measures to ensure the proper management of sensitive information in order to prevent illicit acquisition or use of nuclear material, and, where appropriate, will support bilateral and multilateral capacity building projects, upon request. 3.165–72 

[H. Information Exchange]

Underscoring the value of exchanging accurate and verified information, without prejudice to confidentiality provisions, to detect, prevent, suppress, investigate, and prosecute acts or attempted acts of illicit nuclear trafficking and nuclear terrorism:

1	Participating States will strive to improve their national criminal laws, as needed, to ensure that they have the adequate authority to prosecute all types of cases of illicit nuclear trafficking and nuclear terrorism and commit to prosecuting these crimes to the full extent of the law;	3.103–09	
2	Participating States are encouraged to develop and apply mechanisms to expand sharing of information on issues, challenges, risks and solutions related to nuclear security, nuclear terrorism and illicit nuclear trafficking in a comprehensive and timely manner; and	3.103–09	
3	Participating States are encouraged to develop methods and mechanisms, where appropriate, to enhance bilateral and multilateral collaboration in sharing urgent and relevant information on nuclear security and incidents involving illicit nuclear trafficking.	3.103–09	

[I. Nuclear Forensics]

Noting the IAEA's and Participating States' work in the field of nuclear detection and nuclear forensics, aimed at assisting States in connection with the detection of and response to illicitly trafficked nuclear material, and determination of its origin, and recognizing the importance of respecting provisions on confidentiality of information:

1	Participating States will consider taking further steps, nationally, bilaterally or multilaterally, to enhance their technical capabilities, including the appropriate use of new and innovative technologies, to prevent and combat illicit nuclear trafficking;	3.148–55	
2	Participating States will explore ways to work together to develop national capacities for nuclear forensics, such as the creation of national libraries and an international directory of points of contact, to facilitate and encourage cooperation between States in combating illicit nuclear trafficking , including relevant IAEA activities in this area; and	3.148–55	
3	Participating States will explore ways to enhance broader cooperation among local, national and international customs and law enforcement bodies to prevent illicit nuclear trafficking and acts of nuclear terrorism, including through joint exercises and sharing of best practices.	3.148–55	

SEOUL SUMMIT 2012

We will continue to use the Washington Communiqué and Work Plan as a basis for our future work in advancing our nuclear security objectives. At this Seoul Summit, we agree that we will make every possible effort to achieve further progress in the following important areas:

Global Nuclear Security Architecture

1 We recognize the importance of multilateral instruments that address nuclear security, such as the Convention on the Physical Protection of Nuclear Material (CPPNM), as amended, and the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT). We therefore encourage the universal adherence to these Conventions. We urge states in a position to do so to accelerate their domestic approval of the 2005 Amendment to the CPPNM, seeking to bring the Amendment into force by 2014. We acknowledge the important role of the United Nations (UN) in promoting nuclear security, support the UN Security Council Resolutions 1540 and 1977 in strengthening global nuclear security, and welcome the extension of its mandate. We will strive to use the IAEA Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Rev.5) document and related Nuclear Security Series documents, and reflect them into national practice. 3.32–75

2 We recognize the contributions since the 2010 Summit of international initiatives and processes such as the Global Initiative to Combat Nuclear Terrorism (GICNT) and Global Partnership against the Spread of Weapons and Materials of Mass Destruction, within their respective mandates and memberships. We welcome the wider participation in the GICNT and the Global Partnership and value its extension beyond 2012. Noting the importance of strengthening coordination and complementarity among nuclear security activities, we welcome the proposal of the IAEA to organize an international conference in 2013. We welcome contributions from the industry, academia, institutes and civil society that promote nuclear security. 3.62–75

Role of the IAEA

3 We reaffirm the essential responsibility and central role of the IAEA in strengthening the international nuclear security framework, and recognize the value of the IAEA Nuclear Security Plan 2010–2013. We will work to ensure that the IAEA continues to have the appropriate structure, resources and expertise needed to support the implementation of nuclear security objectives. To this end, we encourage States in a position to do so and the nuclear industry to increase voluntary contributions to the IAEA's Nuclear Security Fund, as well as in-kind contributions. We also encourage continued IAEA activities to assist, upon request, national efforts to establish and enhance nuclear security infrastructure through its various support programs, and encourage States to make use of these IAEA resources. 3.76–100

Nuclear Materials

4 Recognizing that highly enriched uranium (HEU) and separated plutonium require special precautions, we reemphasize the importance of appropriately securing, accounting for and consolidating these materials. We also encourage States to consider the safe, secure and timely removal and disposition of nuclear materials from facilities no longer using them, as appropriate, and consistent with national security considerations and development objectives. 3.124–39

5 We recognize that the development, within the framework of the IAEA, of options for national policies on HEU management will advance nuclear security objectives. We encourage States to take measures to minimize the use of HEU, including through the conversion of reactors from highly enriched to low enriched uranium (LEU) fuel, where technically and economically feasible, taking into account the need for assured supplies of medical isotopes, and encourage States in a position to do so, by the end of 2013, to announce voluntary specific actions intended to minimize the use of HEU. We also encourage States to promote the use of LEU fuels and targets in commercial applications such as isotope production, and in this regard, welcome relevant international cooperation on high-density LEU fuel to support the conversion of research and test reactors. 3.128–39

Radioactive Sources

6 Taking into account that radioactive sources are widely used and can be vulnerable to malicious acts, we urge States to secure these materials, while bearing in mind their uses in industrial, medical, agricultural and research applications. To this end, we encourage States in a position to do so to continue to work towards the process of ratifying or acceding to the ICSANT; reflect into national practices relevant IAEA Nuclear Security Series documents, the IAEA Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary document on the IAEA Guidance on the Import and Export of Radioactive Sources; and establish national registers of high-activity radioactive sources where required. We also commit to work closely with the IAEA to encourage cooperation on advanced technologies and systems, share best practices on the management of radioactive sources, and provide technical assistance to States upon their request. In addition, we encourage continued national efforts and international cooperation to recover lost, missing or stolen sources and to maintain control over disused sources. 3.60–61

Nuclear Security and Safety

7 Acknowledging that safety measures and security measures have in common the aim of protecting human life and health and the environment, we affirm that nuclear security and nuclear safety measures should be designed, implemented and managed in nuclear facilities in a coherent and synergistic manner. We also affirm the need to maintain effective emergency preparedness, response and mitigation capabilities in a manner that addresses both nuclear security and nuclear safety. In this regard, we welcome the efforts of the IAEA to organize meetings to provide relevant recommendations on the interface between nuclear security and nuclear safety so that neither security nor safety is compromised. We also welcome the convening of the High Level Meeting on Nuclear Safety and Security initiated by the UN Secretary-General, held in New York on 22 September 2011. Noting that the security of nuclear and other radioactive materials also includes spent nuclear fuel and radioactive waste, we encourage States to consider establishing appropriate plans for the management of these materials. 3.161–64 4.86–113

Transportation Security

8 We will continue efforts to enhance the security of nuclear and other radioactive materials while in domestic and international transport, and encourage States to share best practices and cooperate in acquiring the necessary technologies to this end. Recognizing the importance of a national layered defense against the loss or theft of nuclear and other radioactive materials, we encourage the establishment of effective national nuclear material inventory management and domestic tracking mechanisms, where required, that enable States to take appropriate measures to recover lost and stolen materials. 3.115 3.34–35

Combating Illicit Trafficking

9 We underscore the need to develop national capabilities to prevent, detect, respond to and prosecute illicit nuclear trafficking. In this regard, we encourage action-oriented coordination among national capacities to combat illicit trafficking, consistent with national laws and regulations. We will work to enhance technical capabilities in the field of national inspection and detection of nuclear and other radioactive materials at the borders. Noting that several countries have passed export control laws to regulate nuclear transfers, we encourage further utilization of legal, intelligence and financial tools to effectively prosecute offenses, as appropriate and consistent with national laws. In addition, we encourage States to participate in the IAEA Illicit Trafficking Database program and to provide necessary information relating to nuclear and other radioactive materials outside of regulatory control. We will work to strengthen cooperation among States and encourage them to share information, consistent with national regulations, on individuals involved in trafficking offenses of nuclear and other radioactive materials, including through INTERPOL's Radiological and Nuclear Terrorism Prevention Unit and the World Customs Organization. 3.116–19

Nuclear Forensics

10 We recognize that nuclear forensics can be an effective tool in determining the origin of detected nuclear and other radioactive materials and in providing evidence for the prosecution of acts of illicit trafficking and malicious uses. In this regard, we encourage States to work with one another, as well as with the IAEA, to develop and enhance nuclear forensics capabilities. In this regard, they may combine the skills of both traditional and nuclear forensics through the development of a common set of definitions and standards, undertake research and share information and best practices, as appropriate. We also underscore the importance of international cooperation both in technology and human resource development to advance nuclear forensics. 3.148–55

Nuclear Security Culture

11 Recognizing that investment in human capacity building is fundamental to promoting and sustaining a strong nuclear security culture, we encourage States to share best practices and build national capabilities, including through bilateral and multilateral cooperation. At the national level, we encourage all stakeholders, including the government, regulatory bodies, industry, academia, nongovernmental organizations and the media, to fully commit to enhancing security culture and to maintain robust communication and coordination of activities. We also encourage States to promote human resource development through education and training. In this regard, we welcome the establishment of Centers of Excellence and other nuclear security training and support centers since the Washington Summit, and encourage the establishment of new centers. Furthermore, we welcome the effort by the IAEA to promote networking among such centers to share experience and lessons learned and to optimize available resources. We also note the holding of the Nuclear Industry Summit and the Nuclear Security Symposium on the eve of the Seoul Nuclear Security Summit. 3.165–72

Information Security

12 We recognize the importance of preventing non-state actors from obtaining information, technology or expertise required to acquire or use nuclear materials for malicious purposes, or to disrupt information technology based control systems at nuclear facilities. We therefore encourage States to: continue to develop and strengthen national and facility-level measures for the effective management of such information, including information on the procedures and protocols to protect nuclear materials and facilities; to support relevant capacity building projects; and to enhance cyber security measures concerning nuclear facilities, consistent with the IAEA General Conference Resolution on Nuclear Security(GC(55)/Res/10) and bearing in mind the International Telecommunication Union Resolution 174. We also encourage States to: promote a security culture that emphasizes the need to protect nuclear security related information; engage with scientific, industrial and academic communities in the pursuit of common solutions; and support the IAEA in producing and disseminating improved guidance on protecting information. 3.110–14

International Cooperation

13 We encourage all States to enhance their physical protection of and accounting system for nuclear materials, emergency preparedness and response capabilities and relevant legal and regulatory framework. In this context, we encourage the international community to increase international cooperation and to provide assistance, upon request, to countries in need on a bilateral, regional, and multilateral level, as appropriate. In particular, we welcome the intent by the IAEA to continue to lead efforts to assist States, upon request. We also reaffirm the need for various public diplomacy and outreach efforts to enhance public awareness of actions taken and capacities built to address threats to nuclear security, including the threat of nuclear terrorism.We will continue to make voluntary and substantive efforts toward strengthening nuclear security and implementing political commitments made in this regard. We welcome the information on the progress made in the field of nuclear security since the Washington Summit provided by the participants at this Seoul Summit. The next Nuclear Security Summit will be held in the Netherlands in 2014). 3.101–19

HAGUE SUMMIT 2010

We, the leaders, met in The Hague on 24 and 25 March 2014 to strengthen nuclear security, reduce the continuing threat of nuclear terrorism and assess the progress we have made since the Washington Summit in 2010. In preparing for this Summit we have used the Washington and Seoul Communiqués as the basis for our work and have been guided by the Washington Work Plan. Therefore,

1 We reaffirm our commitment to our shared goals of nuclear disarmament, nuclear non-proliferation and peaceful use of nuclear energy. We also reaffirm that measures to strengthen nuclear security will not hamper the rights of States to develop and use nuclear energy for peaceful purposes.

2 This Summit focuses on strengthening nuclear security and preventing terrorists, criminals and all other unauthorised actors from acquiring nuclear materials that could be used in nuclear weapons, and other radioactive materials that could be used in radiological dispersal devices. Achieving this objective remains one of the most important challenges in the years to come.

3 Our summit in The Hague builds on the Washington and Seoul Summits, and we note with satisfaction that most of the commitments that participants made during previous summits have already been fulfilled. We welcome the considerable progress made in strengthening nuclear security, while recognising that continuous efforts are needed to achieve that goal.

Fundamental responsibility of States

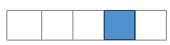
4 We reaffirm the fundamental responsibility of States, in accordance with their respective obligations, to maintain at all times effective security of all nuclear and other radioactive materials, including nuclear materials used in nuclear weapons, and nuclear facilities under their control. This responsibility includes taking appropriate measures to prevent non-state actors from obtaining such materials – or related sensitive information or technology – which could be used for malicious purposes, and to prevent acts of terrorism and sabotage. In this context we emphasise the importance of robust national legislation and regulations on nuclear security. 3.19–31 3.120–23 3.165–72

International cooperation

5 At the same time we emphasise the need to further strengthen and coordinate international cooperation in the field of nuclear security. Much can be done through the International Atomic Energy Agency (IAEA) and other intergovernmental organisations and initiatives, and through bilateral and regional cooperation. 3.101–23

6 International cooperation fosters the capacity of States to build and sustain a strong nuclear security culture and effectively combat nuclear terrorism or other criminal threats. We encourage States, regulatory bodies, research and technical support organisations, the nuclear industry and other relevant stakeholders, within their respective responsibilities, to build such a security culture and share good practices and lessons learned at national, regional and international level. 3.101–23 3.165–72

7 We support stronger international and regional cooperation with regard to education, awareness raising and training, including through nuclear security centres of excellence and support. We therefore welcome the expansion of nuclear security networks for education, and for training and support, by the IAEA and other international organisations. 3.62–123 3.165–72



Strengthened international nuclear security architecture

8 We recognise the need for a strengthened and comprehensive international nuclear security architecture, consisting of legal instruments, international organisations and initiatives, internationally accepted guidance and good practices. 3.32–123

Legal instruments

9 We encourage States that have not yet done so to become party to the Convention on the Physical Protection of Nuclear Material (CPPNM) and to ratify its 2005 amendment. We welcome the new ratifications of the CPPNM amendment since the Seoul Summit. As foreseen in Seoul, we will continue to work towards the entry into force of the 2005 amendment later this year. We stress the need for all contracting parties to comply fully with all its provisions. 3.37–43

10	We underline the importance of the International Convention for the Suppression of Acts of Nuclear Terrorism and stress the need for all contracting Parties to comply fully with all its provisions. We welcome the new ratifications and accessions since the Seoul Summit and encourage all States to become party to this Convention.	3.42–50	
11	We welcome efforts aimed at developing model legislation on nuclear security, which could provide States with building blocks to develop comprehensive national legislation in accordance with their own legal systems and internal legal processes.	3.120–23	

Role of the International Atomic Energy Agency

12	We reaffirm the essential responsibility and the central role of the IAEA in the international nuclear security architecture. We welcome the increased prominence of nuclear security in the Agency's work and its leading role in coordinating activities among international organisations and other international initiatives. The International Conference on Nuclear Security: Enhancing Global Efforts of July 2013 demonstrated the IAEA's ability to enhance political awareness and to address policy, technical and regulatory aspects of nuclear security.	3.76–100	
13	We attach great value to the Agency's support for national efforts to improve nuclear security. Its nuclear security guidance, contained in the IAEA Nuclear Security Series of publications, provides the basis for effective nuclear security measures at national level. We encourage all States to utilise this guidance as appropriate.	3.76–100	
14	We welcome the Integrated Nuclear Security Support Plans (INSSP) with which the IAEA assists States in consolidating their nuclear security needs into comprehensive plans. We encourage States to use their INSSPs for making progress in nuclear security, as appropriate.	3.85–86	
15	We underline the benefits of IAEA review and advisory services provided through mechanisms such as the International Physical Protection Advisory Service (IPPAS). To date, 62 IPPAS missions have been undertaken in 40 countries. While acknowledging the voluntary nature of these services, we encourage all States to utilise them and share the lessons learned without detriment to the protection of sensitive information.	3.112 3.169	
16	The role of the IAEA will be crucial in the years ahead. Therefore we encourage greater political, technical and financial support for the IAEA, including through its Nuclear Security Fund, to ensure that it has the resources and expertise needed to carry out its mandated nuclear security activities.	3.87–88 3.93	

Role of the United Nations

17 We welcome the significant contribution made by the United Nations to strengthening nuclear security – particularly in promoting the ratification and effective implementation of international conventions and protocols against terrorism, including nuclear terrorism – as well as the work undertaken by the UN Security Council Committee, established pursuant to resolution 1540. We urge States to fully implement resolution 1540 and subsequent resolutions, and to continue to report such efforts on a regular basis. We also recognise the important contribution of the United Nations to disarmament and non-proliferation. 3.51–59

Role of other international initiatives

18 We recognise the contribution made by the Global Initiative to Combat Nuclear Terrorism (GICNT) and the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction since the 2010 and 2012 Nuclear Security Summits, within their respective mandates and memberships. Both have expanded in membership and have become valuable platforms for coordination and cooperation on nuclear security. 3.62–75

19 We welcome regional initiatives, which play an important role in strengthening nuclear security collaboration within regions while supporting overall nuclear security goals. We welcome continued developments in this area. 3.62–75

Voluntary measures

20 We have identified a range of voluntary measures States may consider taking to show that they have established effective security of their nuclear materials and facilities while protecting sensitive information. Such voluntary measures may include publishing information about national laws, regulations and organisational structures; exchanging good practices; inviting IAEA review and advisory services and other reviews and following up on their conclusions; providing information through relevant existing reporting mechanisms and forums; further developing training of personnel involved in nuclear security by setting up and stimulating participation in training courses and applying domestic certification schemes. We note that many of the States participating in this summit already take such measures, in some cases in a regional context, and are using them to showcase their nuclear security efforts, thereby building national and international confidence in the effectiveness of their nuclear security regimes. 3.103–09

Nuclear material

21 We recognise that highly enriched uranium (HEU) and separated plutonium require special precautions and that it is of great importance that they are appropriately secured, consolidated and accounted for. Over the past four years we have made considerable progress in safe, secure and timely consolidation inside countries and in removal to other countries for disposal. Furthermore, a considerable amount of HEU has been down-blended to low-enriched uranium (LEU) and separated plutonium converted to mixed oxide (MOX) fuel. We encourage States to minimise their stocks of HEU and to keep their stockpile of separated plutonium to the minimum level, both as consistent with national requirements.

3.128–39

22 We encourage States to continue to minimise the use of HEU through the conversion of reactor fuel from HEU to LEU, where technically and economically feasible, and in this regard welcome cooperation on technologies facilitating such conversion. Similarly, we will continue to encourage and support efforts to use non-HEU technologies for the production of radioisotopes, including financial incentives, taking into account the need for an assured and reliable supply of medical isotopes.

3.128–39
4.58–67

Radioactive sources and materials

23 Radioactive sources are used in every country in the world, whether in industry, medicine, agriculture or research. At the same time, high-activity radioactive sources can be used for malicious acts. We have made progress in better protecting sources, inter alia through national registers. Considerably more States have amended their national legislation and regulations, taking into account the guidance in the IAEA Code of Conduct on the Safety and Security of Radioactive Sources and Nuclear Security Series recommendations. We are committed to promoting this guidance, first and foremost through the IAEA. We seek to secure all radioactive sources, consistent with international guidance.

3.60–61

24 We encourage States which have not yet done so to establish appropriate security plans for the management of spent nuclear fuel and high-level radioactive waste.

3.143
4.44,
4.59–64
4.84, 4.95

Nuclear security and safety

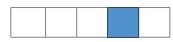
25 We recognise that nuclear security and safety have the common aim of protecting human health, society and the environment. We reaffirm that nuclear safety measures and nuclear security measures need to be designed and managed in a coherent and coordinated manner in the specific areas where nuclear security and nuclear safety overlap. In these areas, efforts to further improve nuclear security might benefit from experience gained with nuclear safety. We emphasise the need to develop a nuclear security culture, with a particular focus on the coordination of safety and security. Sharing good practices, without detriment to the protection of sensitive information, might also be beneficial. The principle of continuous improvement applies to both safety and security. In this regard we acknowledge the IAEA Nuclear Security Guidance Committee and the IAEA Commission on Safety Standards and their activities aimed at properly addressing safety and security interface issues. 3.161–64 4.86–113

26 We reaffirm the need to maintain effective emergency preparedness, response and mitigation capabilities in a manner that addresses both nuclear security and nuclear safety. 3.161–64 4.86–90

Nuclear industry

27 Nuclear operators have the primary responsibility to secure their nuclear material and as such have an important role to play in maintaining and strengthening nuclear security. Operators' security systems should be effective and place a strong emphasis on an effective security culture, physical protection and material accountancy. This needs to be demonstrated nationally by regular routine tests and evaluations, including performance testing and self-evaluation where appropriate. We take note of the emerging interest in using performance-based regulations where appropriate. We support a more intensive dialogue between operators and government bodies, including the national regulator, which should be functionally independent, with a view to improving nuclear security regulations and regulatory effectiveness. 3.156–60

28 In this regard, we recognise the holding of the Nuclear Industry Summit organised as a side event to this Nuclear Security Summit as a positive engagement by the industry with nuclear security issues. 3.156–60



Information and cyber security

29 We recognise the growing importance of information security, including information held on computer systems, related to nuclear material and technology. Security is essential to preventing unauthorised actors from obtaining information, technology and expertise required for acquiring and using nuclear materials for malicious purposes. In these areas further cooperation between government, industry and academia is desirable. We promote a nuclear security culture that emphasises the need to protect sensitive expertise and information and discourages publication of such information in online media and in public forums. 3.110–14

30 In order to address the growing threat of cyber attacks, including on critical information infrastructure and control systems, and their potential impact on nuclear security, we encourage States and the private sector to take effective risk mitigation measures to ensure that the systems and networks of nuclear facilities are appropriately secured. Unauthorised access to these systems could compromise the safe and secure operation of the facility as well as the confidentiality, integrity and availability of the relevant information. 3.112–14

Nuclear Transportation

31 We reaffirm our determination to further enhance the security of nuclear and other radioactive materials while in domestic and international transport. We acknowledge that sharing good practices and lessons learned, without detriment to the protection of sensitive information, can be useful contributions to this goal. We encourage States, the relevant industries and centres of excellence to be involved in these efforts at both national and international level. 3.103–09 3.115

Illicit Trafficking

32 We underline the vital importance of using all tools at our disposal to locate and secure nuclear material out of regulatory control, including effective export control arrangements and law enforcement mechanisms, to regulate nuclear transfers and counter illicit transfers of nuclear material. In this context legislative measures are necessary to enable national prosecutions. We underscore our commitment to sharing information, best practices and expertise, subject to States' national laws and procedures, through bilateral, regional and multilateral mechanisms in relevant areas such as nuclear detection, forensics, law enforcement, and the development of new technologies to enhance enforcement capacity of customs personnel. We urge States to participate in the IAEA Incident and Trafficking Database and to provide the IAEA with relevant information in a timely manner. In the interest of supporting law enforcement efforts, we encourage States, consistent with their respective national regulations and international obligations, to expand information-sharing, including through INTERPOL and the World Customs Organization (WCO), regarding individuals involved in the illicit trafficking of nuclear or other radioactive materials. 3.116–19

Nuclear Forensics

33 Nuclear forensics is developing into an effective tool for determining the origin of nuclear and other radioactive materials and providing evidence for the prosecution of acts of illicit trafficking and other malicious acts. We welcome the progress and recent development of several instruments that improve the use of traditional forensic methods, and emphasise the need to further develop innovative forensic methods and tools for investigating incidents involving nuclear and other radioactive materials. We encourage further international cooperation, within the IAEA and other relevant international organisations, aimed at connecting and enhancing traditional and nuclear forensics capabilities, where feasible, and establishing national nuclear forensics databases to enable better determination of the origin of material. We welcome the organisation by IAEA of a conference on advances in nuclear forensics in July 2014. 3.148–55

Future of Process

34 Continuous efforts are needed to achieve our common goal of strengthening the international nuclear security architecture and we recognise that this is an ongoing process. 3.1–172

35 Our representatives will therefore continue to participate in different international forums dealing with nuclear security, with the IAEA playing the leading role in their coordination. 3.62–123

36 The United States will host the Nuclear Security Summit in 2016.

C: ICNND REPORT 2009: RECOMMENDATIONS

RECOMMENDATION	PARAGRAPHS WHERE DISCUSSED IN STATE OF PLAY REPORT	STATE OF PLAY AS AT DECEMBER 2014
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]	1.23–33	
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]	1.32–33 1.248–53	
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]	1.32–33 1.242–47	
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]	2.22–35	

On NPT Safeguards and Verification

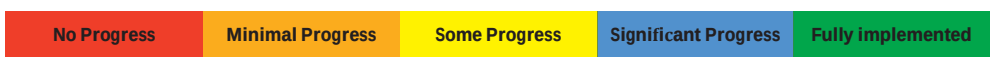
5	All states should accept the application of the Additional Protocol. To encourage universal take-up, acceptance of it should be a condition of all nuclear exports.[9.7]	2.45–49	
6	The Additional Protocol and its annexes should be updated and strengthened to make clear the IAEA's right to investigate 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]	2.45–49	
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]	2.50–60	

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]	2.65–76	
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]	2.77–82	
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]	2.77–82	
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]	2.78–79	

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]	2.65–76	



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: 2.85–91

(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] 2.91

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] 2.116–18

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] 2.148

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] 1.25–33 2.33–35

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] 2.33–35 2.116–18

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] 1.25–33

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]	2.163–74	
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]	2.169–72	

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]	2.175–92	
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]	2.195–209	
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]	2.177–79	
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]	2.195–209	
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]	3.128–39 4.60–64	

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]	3.27–75 3.101–19	

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] 3.28–31

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] 3.60–61

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] 3.103–109

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] 3.148–55

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] 4.24–48

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] 4.38 4.86–113

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] 4.58–67

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] 4.61–67

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] 4.73–74

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] 4.61–67

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] 3.156–60 4.58–67

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] 4.69–85

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] 4.69–78

On Priorities for the 2010 NPT Review Conference

41 The following should be the major priority issues for the 2010 NPT Review Conference: 1.19–33 2.22–35

(a) *Action for Disarmament.* Agreement on a twenty-pointstatement, "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

(c) to recommend to states that they make it a condition of nuclear exports that safeguards agreements continue to apply after any such withdrawal. *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] 1.55–57

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] 1.82–90

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] 1.87–90

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] 1.55–107

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] 1.93–100

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] 1.91

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] 1.54

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] 1.123-27

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] 1.108–27

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] 1.128–37

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] 1.114–16

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] 1.138–47

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] 1.145 2.119–36

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] 1.148–74

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] 1.155–74

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]. 1.38–47

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] 1.39 1.122

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] 1.101–107

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] 2.69–76

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] 1.175–95

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] 2.149–60

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] 1.196–209

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] 1.210–14

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] 1.215–27

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. 1.23–33 2.30–32

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] 1.32–33

68 The Medium Term Action Agenda, for the period between 2012 and 2025, should focus on the issues we identify in Box 18–1. 1.23–33

69 The Longer Term Action Agenda, for the period beyond 2025, should focus on establishing the conditions we identify in Box 19–1. 1.23–33

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] 1.32–33

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] 1.232–38

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]

1.228–31

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]

1.239–47

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]

State of Play Reports published in 2013, 2015

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]

CNND established in Canberra in 2011

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]

CNND structure accords with recommendation

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NUCLEAR WEAPONS: THE STATE OF PLAY 2015

AS AT DECEMBER 2014

Five years ago hopes were high that the world was at last seriously headed towards nuclear disarmament. In 2009 the United States and Russia were negotiating a new strategic arms reduction treaty (START), and there was every sign, in the lead-up to the 2010 Non-Proliferation Treaty (NPT) Review Conference, that there would be significant forward movement on the disarmament and non-proliferation agenda.

By the end of 2012, however, as reported in the inaugural State of Play report, much of this sense of optimism had evaporated. By the end of 2014, the fading optimism had given way to pessimism. North Korea conducted its third nuclear test in early 2013 and the CTBT is yet to enter into force. New START was signed and ratified, but the treaty left stockpiles intact and disagreements about missile defence and conventional-arms imbalances unresolved. Nuclear weapons numbers have decreased overall but increased in Asia; nuclear-weapons programs in India, Pakistan and China have accelerated; and fissile material production is not yet banned. The push for talks on a nuclear-weapon-free zone in the Middle East has stalled and the region remains highly volatile. We are no closer to resolving the challenge posed by North Korea and a comprehensive agreement on Iran eluded negotiators by the extended deadline of 24 November 2014. Cyber-threats to nuclear weapons systems have intensified, outer space remains at risk of nuclearization, and the upsurge of geopolitical tensions over the crisis in Ukraine produced flawed conclusions about the folly of giving up nuclear weapons on the one hand, and open reminders about Russia's substantial nuclear arsenal, on the other.

A key recommendation of the 2009 International Commission on Nuclear Non-Proliferation and Disarmament (ICNND) was that, to help build and sustain momentum, a regular "report card" should be published and disseminated among policymakers and those who influence them. The present report is our second effort to implement that recommendation. It describes the progress – or lack of it – on the commitments and recommendations of the 2010 NPT Review Conference, the 2010, 2012 and 2014 Nuclear Security Summits, and the ICNND report itself.

We hope that *Nuclear Weapons: The State of Play 2015* as at December 2014 will provide an authoritative advocacy tool for governments, organizations and individuals committed to achieving a safer and saner nuclear-weapon-free world in the lead-up to the Ninth NPT Review Conference in New York in April–May 2015.

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