15. Nuclear arms control and non-proliferation

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I. Introduction

Several developments during 2003 raised anew questions about the efficacy and future viability of the nuclear non-proliferation regime. The principal legal foundation of the regime, the 1968 Treaty on the Non-Proliferation of Nuclear Weapons (Non-Proliferation Treaty, NPT), suffered a setback when the Democratic People's Republic of Korea (DPRK, North Korea) became the first state party to formally withdraw from the treaty.[1] Key weaknesses in the regime were highlighted when evidence emerged that Iran had been secretly pursuing nuclear fuel cycle technologies with direct military applications, in contravention of its NPT-mandated nuclear safeguards agreement with the International Atomic Energy Agency (IAEA). In addition, the United States Congress's vote to lift a decade-long ban on research work on low-yield nuclear weapons was widely seen as undermining efforts to delegitimize nuclear weapons as military instruments.

There was one significant positive development in 2003 for the global non-proliferation regime. In December, Libya announced that it would verifiably abandon and verifiably dismantle, under international inspection, its weapons of mass destruction (WMD) and ballistic missile programmes.

This chapter reviews the principal developments in nuclear arms control and non-proliferation in 2003. Section II examines the international controversy over the scope and nature of Iran's nuclear programme, focusing on the country's implementation of its NPT-mandated safeguards agreement with the IAEA. Section III summarizes efforts to resolve the diplomatic impasse over North Korea's nuclear programme and related developments. Section IV describes Libya's unexpected decision to abandon its nuclear and other, non-conventional weapon programmes. Section V summarizes the interim findings of the search by US inspection teams for evidence of Iraq's alleged nuclear weapon programmes. Section VI describes the ratification and entry into force of the US–Russian Strategic Offensive Reduction Treaty (SORT), and section VII examines the US debate over the development of new types of nuclear weapons. Section VIII describes international initiatives aimed at enhancing the safety and custodial security of nuclear materials and facilities, and section IX presents the conclusions.

[1] Legal aspects of North Korea's withdrawal from the NPT are discussed in chapter 19 in this volume. For the signatories and parties to the NPT see annex A in this volume. The full text of the treaty is available at URL <http://www.iaea.org/Publications/Documents/Treaties/npt.html>.

II. Iran and nuclear proliferation concerns

Iran's nuclear programme has been the subject of controversy since a 1995 decision by the Russian Ministry for Atomic Energy (Minatom) to complete a 1000-megawatt-electric (MW(e)) light-water power reactor, started by Germany in the 1980s, at Bushehr, on Iran's south-western coast. The USA has sought to halt the project, arguing that Iran might seek to separate weapon-usable plutonium from the reactor's spent fuel.[2]

During 2003 the controversy over Iran's nuclear programme intensified, as evidence emerged that Iran had secretly pursued a range of nuclear fuel cycle technologies, including enrichment and reprocessing, without declaring these activities to the IAEA, as it is required to do under the terms of its 1974 safeguards agreement with the Agency.[3] This gave rise to concerns that Iran might be putting into place, under the cover of a civil nuclear energy programme, the facilities needed to produce fissile material for a nuclear weapon programme. However, Iranian officials insisted throughout 2003 that the country's ambitious nuclear programme was aimed solely at producing electricity.[4] They also emphasized that Iran was entitled under the terms of the NPT to develop nuclear energy for peaceful purposes.[5]

Disclosure of previously undeclared nuclear fuel cycle facilities

The controversy had taken on a new dimension at the end of 2002 with the publication of commercial satellite images that showed the construction of two nuclear fuel facilities south of Tehran. It was determined that one of the facilities, near the town of Natanz, was a uranium enrichment plant; the other facility, near the town of Arak, was related to the production of heavy water.[6] The discovery of the previously undeclared facilities sounded international alarm bells, since it suggested that Iran was covertly pursuing two alternative

[2] For detail about the controversy surrounding the Bushehr reactor see Kile, S. N., 'Nuclear arms control, non-proliferation and ballistic missile defence', *SIPRI Yearbook 2003: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2003), pp. 596–97.

[3] Iran concluded a safeguards agreement with the International Atomic Energy Agency (IAEA) on 13 Dec. 1974, contained in IAEA document INFCIRC/214, URL <http://www.iaea.org/Publications/Documents/Infcircs/Others/infcirc214.pdf>.

[4] In 2002 Iran announced plans to construct, over the next 20 years, nuclear power plants with a total capacity of 6000 megawatts (MW) as part of a long-term energy policy to make up for the expected depletion of the country's extensive fissile fuel reserves. Statement by H. E. Reza Aghazadeh, President of the Atomic Energy Organization of Iran, at the 46th General Conference of the IAEA, Vienna, 16 Sep. 2002, URL <http://www.iaea.org/About/Policy/GC/GC46/iran.pdf>.

[5] According to Art. IV of the NPT, all parties have an 'inalienable right' to research, produce and use nuclear energy 'for peaceful purposes without discrimination'. Art. IV also mandates that 'Parties to the Treaty in a position to do so' shall cooperate in contributing to the development of nuclear energy for peaceful purposes.

[6] Albright, D. and Hinderstein, C., 'Iran building nuclear fuel cycle facilities: international transparency needed', Institute for Science and International Security (ISIS), *ISIS Issues Brief*, 12 Dec. 2002, URL <http://www.isis-online.org/publications/iran/iranimages.html>. The facilities appeared to be designed to withstand aerial attack, which heightened international suspicion about their true purpose.

routes—uranium enrichment and plutonium separation—to obtain weapon-grade fissile material.

International concern about Iran's nuclear activities grew when President Mohammad Khatami announced for the first time, in February 2003, that the country planned to develop a complete nuclear fuel cycle, from mining and processing uranium ore for use in nuclear power reactors to reprocessing spent fuel and storing of waste.[7] According to Khatami, the goal was to achieve self-sufficiency in fuel manufacture, thereby obviating the need for potentially unreliable foreign suppliers. He revealed that the Atomic Energy Organization of Iran (AEOI) was constructing or already operating a number of facilities, including uranium mines, uranium concentration and conversion facilities, and fuel fabrication plants, to produce fuel for nuclear power reactors.[8] Outside experts, however, argued that the plan made little economic sense in the light of current global surpluses of plutonium and enriched uranium. They also pointed out that this meant that Iran would have in place all the elements needed to produce fissile material for military purposes.[9]

Discussions between Iran and the IAEA

On 21–22 February 2003, IAEA Director General Mohamed ElBaradei travelled to Tehran for talks with Khatami and other senior Iranian officials. During the visit, the AEOI acknowledged that previously undeclared pilot gas centrifuge and commercial-scale uranium enrichment plants were under construction at Natanz.[10] It also confirmed that a heavy-water production plant, which was not subject to safeguards, was under construction near Arak in conjunction with a planned heavy-water nuclear research reactor.[11] ElBaradei toured both facilities at Natanz and reportedly was surprised by the pilot plant's advanced stage of construction.[12] The presence in the plant of an operating centrifuge cascade led experts at the IAEA and elsewhere to suspect that Iran might have already introduced nuclear material into the centrifuges in order to test them—a violation of Iran's safeguards agreement, if this had been

[7] Albright, D., 'Iran at a nuclear crossroads', *ISIS Issues Brief*, 20 Feb. 2003, URL <http://www.isis-online.org/publications/iran/crossroads.html>.

[8] 'Iran mining uranium for fuel', BBC News Online, 9 Feb. 2003, URL <http://news.bbc.co.uk/1/hi/world/middle_east/2743279.stm>; and Hafezi, P., 'Iran reveals plans to make fuel for nuclear plants', Reuters, 9 Feb. 2003, *Washington Post* (Internet edn), 10 Feb. 2003, URL <http://www.washingtonpost.com/ac2/wp-dyn/A48960-2003Feb9?language=printer>.

[9] Slevin, P. and Warrick, J., 'U.S. wary of Iranian nuclear aims', *Washington Post* (Internet edn), 10 Feb. 2003, URL <http://www.washingtonpost.com/ac2/wp-dyn/A54213-2003Feb10>.

[10] 'Introductory statement by IAEA Director General Mohamed ElBaradei to the Board of Governors', Vienna, 17 Mar. 2003, URL <http://www.iaea.org/NewsCenter/Statements/2003/ebsp2003n008.shtml>.

[11] Some independent experts have expressed particular concern about the intended purpose of the 40-MW heavy-water reactor to be built near Arak, since such reactors are suitable for producing weapon-grade plutonium. See Boureston, J. *et al*., 'Iran pursues plans for heavy water reactor', *Jane's Intelligence Review*, vol. 15, no. 12 (Dec. 2003), pp. 40–41.

[12] Kerr, P., 'IAEA "taken aback" by speed of Iran's nuclear program', *Arms Control Today*, vol. 33, no. 3 (Apr. 2003), p. 32.

done without first informing the IAEA.[13] At the end of the visit, Iran announced that it had agreed to amend its safeguards agreement and would henceforth provide the IAEA with design information on new fuel cycle facilities when construction was first authorized.[14]

ElBaradei's visit paved the way for discussions between Iran and the IAEA aimed at clarifying a number of safeguards-related issues. These primarily had to do with Iran's reporting of nuclear material imported into the country and its declaring of the facilities and other locations where the material had been stored and processed. During the spring and summer of 2003, IAEA inspectors were allowed to take environmental samples at Natanz and several other nuclear sites in order to verify the absence of undeclared nuclear material and activities. However, ElBaradei reported in August that the AEOI had been slow to grant IAEA experts full access to certain key facilities and at times had provided them with incomplete or contradictory information.[15]

IAEA Board of Governors deadline

This and other shortcomings led the IAEA Board of Governors to adopt, on 12 September 2003, a resolution expressing 'grave concern' that Iran still had not enabled the IAEA to verify that all nuclear material was declared and submitted to IAEA safeguards and that there were no undeclared nuclear activities in the country.[16] The resolution stated that it was 'essential and urgent . . . that Iran remedy all failures identified by the Agency and cooperate fully with the Agency . . . by taking all necessary actions by the end of October 2003'.[17] It also called on Iran to promptly sign and implement an Additional Protocol to its safeguards agreement. The resolution implicitly threatened to refer the matter to the United Nations (UN) Security Council if Iran failed to resolve outstanding issues by the deadline.

The IAEA Board of Governors' imposition of a deadline intensified tensions over Iran's nuclear programme. Iran warned that its willingness to accept

[13] Art. 34(c) of Iran's safeguards agreement with the IAEA stipulates that 'nuclear material of a composition and purity suitable for fuel fabrication or being isotopically enriched, or any nuclear material produced at a later stage in the nuclear fuel cycle, is subject to all of the safeguards procedures specified in the Agreement'. INFCIRC/214 (note 3).

[14] 'Implementation of the NPT safeguards agreement in the Islamic Republic of Iran', Report by the Director General to the IAEA Board of Governors, IAEA document GOV/2003/40, 6 June 2003, p. 4, URL <http://www.iaea.org/NewsCenter/PressReleases/2003/06JUNEStatementIRAN.pdf>. Under the original terms of its safeguards agreement, Iran was not obligated to provide the IAEA with design information about a nuclear facility until 180 days before the introduction of nuclear material into the facility.

[15] 'Implementation of the NPT safeguards agreement in the Islamic Republic of Iran', Report by the Director General to the IAEA Board of Governors, IAEA document GOV/2003/63, 26 Aug. 2003, p. 10, URL <http://www.iaea.org/Publications/Documents/Board/2003/gov2003-63.pdf>.

[16] 'Implementation of the NPT safeguards agreement in the Islamic Republic of Iran', Resolution adopted by the IAEA Board of Governors, IAEA document GOV/2003/69, 12 Sep. 2003, p. 2, URL <http://www.iaea.org/Publications/Documents/Board/2003/gov2003-69.pdf>.

[17] Resolution adopted by the IAEA Board of Governors (note 16), pp. 2–3. The actions to be taken by Iran included: providing a full declaration of all imported material and components relevant to the enrichment programme; granting access, including environmental sampling, to all sites requested by the IAEA; resolving questions about the testing of gas centrifuges with nuclear material; and providing complete information regarding uranium conversion experiments.

more comprehensive nuclear inspections depended on receiving assurances that it could develop uranium enrichment technology for peaceful purposes. Iranian leaders also called on the IAEA Board of Governors to resist US pressure to refer the matter to the UN Security Council.[18] At the same time, there were signs of disagreement between the USA and some of its European partners over how best to deal with Iran's safeguards violations, with the latter resisting US calls for a more confrontational approach.[19]

The European–Iranian joint declaration

On 21 October 2003, following intensive negotiations in Tehran, the foreign ministers of France, Germany and the United Kingdom issued a joint declaration with their Iranian counterpart on the nuclear issue.[20] Iran stated in the declaration that, after having received the necessary clarifications, it would sign an Additional Protocol to its safeguards agreement.[21] It also stated that, as an additional confidence-building measure, the AEOI would voluntarily suspend all uranium enrichment and reprocessing activities.[22] However, it did not specify in the declaration or in subsequent statements how long the moratorium would last or what the scope of application of the moratorium would be. The three European governments recognized the right of Iran to pursue the peaceful use of nuclear energy in accordance with the NPT. They noted that once Iran acted to fully resolve international concerns about its nuclear programme, it 'could expect easier access to modern technology and supplies in a range of areas'.[23] It was unclear whether this meant that these European states would provide assistance for civil nuclear energy projects in Iran.

The IAEA Director General's report on safeguards implementation in Iran

While the signing of the joint declaration defused, at least temporarily, a growing crisis over Iran's nuclear activities, there remained numerous concerns about the nature and aim of those activities. On 10 November 2003, the IAEA Board of Governors received the latest in a series of reports from Dir-

[18] Barringer, F., 'Iranian envoy blames U.S. for nation's reticence on nuclear plans', *New York Times* (Internet edn), 12 Sep. 2003, URL <http://www.nytimes.com/2003/09/12/international/middleeast/12IRAN.html>; and Dinmore, G. and Turner, M., 'Iran demands a trade-off between nuclear power goals and inspections', *Financial Times*, 29 Sep. 2003, p. 1.

[19] Daalder, I. and Levi, M., 'How to counter the Iranian threat', *Financial Times*, 24 Sep. 2003, p. 13; and Taylor, P. and Charbonneau, L., 'Defying U.S., 3 European nations engage Iran on nuclear program', Reuters, *Washington Post* (Internet edn), 20 Sep. 2003, URL <http://www.washingtonpost.com/ac2/wp-dyn/A37181-2003Sep19?language=printer>. For a discussion of US and EU strategies for combating the proliferation of WMD see chapter 15 in this volume.

[20] 'Iran agrees to key nuclear demands', BBC News Online, 22 Oct. 2003, URL <http://news.bbc.co.uk/1/hi/world/middle_east/3210574.stm>.

[21] 'Statement by the Iranian Government and visiting EU foreign ministers', Tehran, 21 Oct. 2003, URL <http://www.iaea.org/NewsCenter/Focus/IaeaIran/statement_iran21102003.shtml>.

[22] 'Statement by the Iranian Government and visiting EU foreign ministers' (note 21).

[23] 'Statement by the Iranian Government and visiting EU foreign ministers' (note 21).

Table 15.1. Iran's nuclear infrastructure relevant to IAEA safeguards, as of 1 January 2004

Location	Facility	Status
Arak	IR-40 research reactor[a]	40-MW(t) heavy-water reactor in final design stage, construction to begin in 2004[b]
Bushehr	Bushehr Nuclear Power Plant	Construction work on Russian-designed 1000-MW(e) light-water power reactor at advanced stage; plant expected to become operational in 2006
Esfahan Nuclear Technology Centre	Research reactors/ critical assemblies[c]	Supplied by China; operating, under IAEA safeguards
	Fuel fabrication laboratory	Operating, under IAEA safeguards
	Fuel manufacturing plant[a]	In detailed design stage, construction to begin in 2004
	Uranium conversion facility	Plant for converting uranium ore into UF_6 for use in domestic enrichment programme. Under construction, with first process units in operation
Karaj	Radioactive waste storage facility[a]	Under construction, partially operational
Lashkar Ab'ad	Pilot laser enrichment plant	Site of laser uranium enrichment experiments in 2002–03 using undeclared uranium metal; equipment dismantled and presented to IAEA inspectors in May 2003
Natanz	Pilot gas centrifuge plant[a]	Research-scale uranium enrichment facility. Construction at advanced stage, with *c*. 1000 centrifuges to be installed by early 2004
	Uranium enrichment plant[a]	Commercial-scale plant under construction, designed to house *c*. 50 000 gas centrifuges; [d] first centrifuges to be introduced in 2005
Tehran Nuclear Research Centre	Research reactor	5-MW(t) research reactor; operating under IAEA safeguards
	Jabr Ibn Hayan Multi-purpose Laboratories[a]	In operation; site of undeclared experiments using nuclear material, including production of uranium metal
Tehran	Kalaye Electric Company	Dismantled in mid-2003; housed workshop for production and testing of centrifuge parts

MW(e) = megawatt-electric; MW(t) = megawatt-thermal; UF_6 = uranium hexafluoride

[a] Facilities first declared by Iran to the International Atomic Energy Agency in 2003. The nuclear waste storage facilities at Arak and at the Tehran Nuclear Research Centre were also first declared in 2003.

[b] Some non-governmental experts have estimated that the reactor could produce 8–10 kg of plutonium annually, or enough for 1–2 simple nuclear weapons.

[c] These include the Miniature Neutron Source Reactor, the Light Water Subcritical Reactor and the Heavy Water Zero Power Reactor. The Graphite Sub-Critical Reactor has been decommissioned.

[d] According to one estimate, this will provide a separative capacity sufficient to produce *c*. 500 kg of highly enriched uranium annually, or enough for 25–30 nuclear weapons.

Sources: 'Implementation of the NPT safeguards agreement in the Islamic Republic of Iran', Report by the Director General to the IAEA Board of Governors, IAEA document GOV/2003/75, 10 Nov. 2003, p. 9, URL <http://www.iaea.org/Publications/Documents/Board/2003/gov2003-75.pdf>; and Albright, D. and Hinderstein, C., 'Iran, player or rogue?', *Bulletin of the Atomic Scientists*, vol. 59, no. 5 (Sep./Oct. 2003), pp. 52–58.

ector General ElBaradei describing the IAEA's activities to verify Iran's implementation of its safeguards agreement. The report stated that Iran clearly had 'failed in a number of instances over an extended period of time to meet its obligations under its Safeguards Agreement with respect to the reporting of nuclear material and its processing and use, as well as the declaration of facilities where such material has been processed and stored'.[24] While it concluded that there was 'no evidence' that the country's previously undeclared nuclear material and activities were related to a nuclear weapon programme, the report also stated that 'given Iran's past pattern of concealment, it will take some time before the Agency is able to conclude that Iran's nuclear programme is exclusively for peaceful purposes'.[25] ElBaradei's report included detailed descriptions of Iran's nuclear programme as well as of its failures to comply with its safeguards obligations.

Uranium enrichment. Iran began a gas-centrifuge uranium enrichment programme in 1985. The results of environmental samples taken by IAEA inspectors at the Natanz pilot gas-centrifuge enrichment plant in the spring of 2003 revealed particles of low enriched uranium (LEU) and highly enriched uranium (HEU).[26] This suggested that Iran had produced weapon-grade uranium—a possibility which alarmed many analysts since none of Iran's power reactors require HEU. The Iranian authorities attributed the presence of the particles to contamination originating from centrifuge components that had been imported from abroad. However, this explanation contradicted Iran's previous insistence that the centrifuge programme was completely indigenous.

Iran also had been pursuing a laser-based uranium enrichment programme since 1991. In 2002–2003 it conducted secret laser enrichment experiments at a pilot facility using undeclared natural uranium metal. Iran dismantled the laser equipment in May 2003 and presented it to IAEA inspectors.[27]

Uranium conversion. Iran carried out a large number of laboratory- and bench-scale experiments between 1981 and 1993 involving multiple phases of the uranium conversion and fabrication process. Contrary to Iran's previous statements, it had produced 'practically all of the materials important to uranium conversion', including enriched uranium metal, without notifying the

[24] 'Implementation of the NPT safeguards agreement in the Islamic Republic of Iran', Report by the Director General to the IAEA Board of Governors, IAEA document GOV/2003/75, 10 Nov. 2003, p. 9, URL <http://www.iaea.org/Publications/Documents/Board/2003/gov2003-75.pdf>.

[25] Report by the Director General to the IAEA Board of Governors (note 24), p. 10.

[26] Iran also admitted that it had failed to report the use of imported uranium hexafluoride (the feedstock for uranium enrichment) for the testing of centrifuges at the Kalaye Electric Company between 1999 and 2002 and the consequent production of small amounts of enriched uranium.

[27] Report by the Director General to the IAEA Board of Governors (note 24), pp. 7–8.

IAEA.[28] Iran's production of uranium metal has raised particular concern, since it has few uses outside of a nuclear weapon programme.

Reprocessing. Iran conducted experiments at the Tehran Nuclear Research Centre from 1988 to 1992 involving the irradiation of uranium dioxide targets and the subsequent separation of a 'small amount' of separated plutonium. Iran did not report either the experiments or the separated plutonium at the time, as it was required to do under the terms of its safeguards agreement.[29]

Reactions to the report

The contents of ElBaradei's report surprised many Western nuclear experts. It revealed a nuclear programme that was both more extensive and more advanced than previously believed as well as one that had been kept hidden from international scrutiny for decades. However, many US Administration officials and independent analysts were sceptical of its conclusion that there was 'no evidence' that Iran had a clandestine nuclear weapon programme.[30] By contrast, President Khatami and other Iranian officials stated that the report vindicated claims that the country did not have a nuclear weapon programme. They argued that the infractions attributed to Iran in the report were of a minor, technical nature and were bound to occur over decades of nuclear activity.[31]

The IAEA Board of Governors resolution criticizing Iran

On 26 November 2003 the IAEA Board of Governors approved a resolution 'strongly deplor[ing] Iran's past failures and breaches of its obligation to comply with the provisions of its Safeguards Agreement' and urging 'Iran to adhere strictly to its obligations under its Safeguards Agreement in both letter and spirit'.[32] While welcoming Iran's 'positive response' to the IAEA's concerns, the resolution warned that 'should any further serious Iranian failures come to light, the Board of Governors would meet immediately to consider . . . all options at its disposal, in accordance with the IAEA Statute.'

The resolution called for 'the urgent, full and close co-operation with the Agency of all third countries' to clarify outstanding questions concerning Iran's nuclear programme.[33] The need for 'third country co-operation' referred

[28] Report by the Director General to the IAEA Board of Governors (note 24), p. 5.

[29] Report by the Director General to the IAEA Board of Governors (note 24), p. 5.

[30] See, e.g., Sanger, D. and Broad, W., '2 nuclear reports surprise experts', *International Herald Tribune*, 13 Nov. 2003, p. 3.

[31] 'Iran plays down IAEA report describing hidden nuclear activity', Global Security Newswire, 14 Nov. 2003, URL <http://www.nti.org/d_newswire/issues/print.asp?story_id=EE41C2D8-6A9F-4F77-8FB4-708893A952E5>; and Fathi, N., 'Iran's leader says UN report removes suspicions of weapons', *New York Times* (Internet edn), 13 Nov. 2003, URL <http://www.nytimes.com/2003/11/13/international/middleeast/13IRAN.html>.

[32] 'Implementation of the NPT safeguards agreement in the Islamic Republic of Iran', Resolution adopted by the IAEA Board of Governors, IAEA document GOV/2003/81, 26 Nov. 2003, p. 3, URL <http://www.iaea.org/Publications/Documents/Board/2003/gov2003-81.pdf>.

[33] Resolution adopted by the IAEA Board of Governors (note 32).

to the multiple instances, described in ElBaradei's 10 November report, of undeclared foreign assistance that provided components, material and technical expertise used in Iran's enrichment programme. Pakistan's role came under particular scrutiny, since the IAEA reportedly discovered that Iran's clandestine enrichment programme used advanced centrifuge technology identical to Pakistani design plans.[34]

The Board of Governors' resolution stopped short of referring the issue to the UN Security Council for possible sanctions—a move that had been urged by the US Administration and strongly opposed by Iran.[35] US Secretary of State Colin Powell reportedly was able to persuade only a few of the IAEA Board's 35 member states to go along with the administration's call for tougher action.[36] Many European states argued that Iran's recent steps warranted a more conciliatory approach—one that would include a variety of carrots, such as the prospect of concluding a new cooperation and trade agreement with the European Union (EU), as well as sticks.[37]

Senior Iranian officials sought to portray the Board's resolution as a victory for Iran, arguing that it showed how little support the USA's 'policy of pressure' enjoyed.[38] They emphasized that making further progress towards resolving European concerns depended on the latter upholding their commitment to improve relations.[39] Some influential officials also noted that Iran's decision to suspend its enrichment programme was voluntary and that the government would restart the programme once the issues raised by the IAEA had been resolved.[40]

Iran's Additional Protocol

On 18 December 2003, Iran signed an Additional Protocol to its NPT safeguards agreement.[41] The Iranian Government had indicated in the 21 October joint declaration that it would act in accordance with the Protocol's provisions, pending its formal entry into force. However, the Protocol must be submitted to the Majlis (Parliament) for ratification, where some influential conservatives have vowed to oppose it. The signing of the Protocol has been criticized,

[34] Frantz, D., 'Iran–Pakistan atomic link seen', *Los Angeles Times* (Internet edn), 28 Nov. 2003, URL <http://www.latimes.com/la-fg-iaea28nov28,1,7994091,print.story>.

[35] Weisman, S., 'U.S. acquiesces to allies on new Iran resolution', *International Herald Tribune*, 26 Nov. 2003, p. 3; and Reuters, 'Iran warns of a crisis if UN finds it violated nuclear pact', *International Herald Tribune*, 14 Nov. 2003, p. 9.

[36] Australia, Canada and Japan supported the US view. Sanger, D., 'Nuclear board said to rebuff Bush over Iran', *New York Times* (Internet edn), 20 Nov. 2003, URL <http://www.nytimes.com/2003/11/20/international/middleeast/20IRAN.html>.

[37] Fuller, T., 'A top EU aide backs Iran in feud over arms', *International Herald Tribune*, 18 Nov. 2003, p. 2. See also chapter 14 in this volume.

[38] 'Winners and losers in IAEA resolution on Iran', *Iran News*, 29 Nov. 2003, p. 2; and 'US plot will get nowhere: foreign ministry official', *Tehran Times*, 29 Nov. 2003, p. 2.

[39] 'Kharrazi calls policy of dialogue and interaction with Iran fruitful', *Iran News*, 29 Nov. 2003, p. 2.

[40] 'Iran will start uranium enrichment program at its own discretion: official', *Tehran Times*, 29 Nov. 2003, p. 2.

[41] 'Iran signs Additional Protocol on nuclear safeguards', IAEA News Center, 18 Dec. 2003, URL <http://www.iaea.org/NewsCenter/News/2003/iranap20031218.html>.

especially in the conservative media, as a capitulation to US pressure and an infringement of the 'national sovereignty' of Iran.[42]

III. North Korea's nuclear programme

In 2003 the crisis over North Korea's nuclear programme showed no sign of abating. It had entered into a new, more perilous phase in October 2002, when North Korea reportedly admitted, in response to US Government accusations, that it had a secret uranium enrichment programme to produce HEU. The admission led to a series of retaliatory moves by North Korea and the USA that resulted in the collapse of the 1994 Agreed Framework.[43]

North Korea's actions in the spring of 2003 further raised the stakes in the crisis. In April, it became the first party to withdraw from the NPT.[44] North Korea also announced that it had begun to reprocess the 8000 spent nuclear fuel rods stored in a cooling pond at Yongbyon.[45] This was followed in May 2003 by an announcement from the North Korean Government that its 1992 denuclearization pledge with South Korea had been reduced to 'a dead document' by the USA's 'constant nuclear threats'.[46]

These actions came at a time when the George W. Bush Administration was preoccupied with Iraq. White House officials insisted that the impasse over North Korea's nuclear programme did not constitute a 'crisis' and emphasized the USA's commitment to finding a diplomatic solution, in cooperation with US allies and other countries in the region. They attached particular importance to China's perceived influence in restraining North Korea and to its role as a possible mediator. This restrained approach stood in sharp contrast to the administration's calls for pre-emptive military action to eliminate Iraq's alleged WMD capabilities, and it led some critics to accuse the administration

[42] Smyth, G., 'Iran signs up to tougher supervision of nuclear sites', *Financial Times*, 19 Dec. 2003, p. 6. See also Vick, K., 'Iranian hardliners wary of nuclear deal', *Washington Post* (Internet edn), 20 Nov. 2003, URL <http://www.washingtonpost.com/ac2/wp-dyn/A63382-2003Nov19?language=printer>.

[43] For further detail about the terms of the 1994 Agreed Framework between North Korea and the USA and the events leading up to its breakdown, see Kile (note 2), pp. 578–87. For the text of the Agreed Framework see URL <http://www.kedo.org/pdfs/AgreedFramework.pdf>.

[44] As provided for in Art. X of the NPT, North Korea's withdrawal from the treaty, which it announced on 10 Jan. 2003 for reasons of 'supreme national interest', took effect on 10 Apr. 2003. See also chapter 19 in this volume. North Korea's safeguards agreement (INFCIRC/403) was also considered to have lapsed on that date. See 'Agreement of 30 January 1992 between the Government of the Democratic People's Republic of Korea and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons', IAEA document INFCIRC/403, May 1992, URL <http://www.iaea.org/Publications/Documents/Infcircs/Others/inf403.shtml>.

[45] 'Spokesman for DPRK Foreign Ministry on expected U.S.–DPRK talks', Korean Central News Agency (KCNA), 18 Apr. 2003, URL <http://www.kcna.co.jp/item/2003/200304/news04/19.htm#1>.

[46] 'U.S. to blame for derailing process of denuclearisation on Korean Peninsula', KCNA, 12 May 2003, URL <http://www.kcna.co.jp/item/2003/200305/news05/13.htm#1>. The Joint Declaration by South and North Korea on the Denuclearization of the Korean Peninsula entered into force on 19 Feb. 1992; the text is available at URL <http://www.fas.org/news/dprk/1992/920219-D4129.htm>.

of inconsistency in applying its new strategy to combat proliferation threats from so-called rogue states.[47]

The six-party talks

In 2003 two rounds of talks were held involving North Korea and the USA and aimed at resolving the crisis. The first round took place, with Chinese participation, in Beijing on 23–25 April, after intensive diplomatic efforts by China to find an acceptable meeting format.[48] A second round of talks, between China, Japan, South Korea and Russia, was held in Beijing on 27–29 August 2003. Despite hints of diplomatic flexibility from both North Korea and the USA, the two rounds of talks made little headway.

The principal reason behind the impasse was a fundamental difference between the two main protagonists over the timing, or sequencing, of a possible deal. North Korean officials insisted on a multi-phase agreement, consisting of step-by-step 'simultaneous actions',[49] under which North Korea would address all US security concerns regarding the nuclear issue in exchange for the USA abandoning its 'hostile policy' towards it.[50] This would involve, in the first phase, the normalization of bilateral diplomatic relations. The USA would resume the shipments of heavy fuel oil which were suspended in November 2003, provide increased food aid and pledge not to hinder North Korea's economic cooperation with other countries. In return, North Korea would declare its willingness to scrap its nuclear programme. In the next phase, North Korea and the USA would conclude a formal non-aggression treaty; following this, North Korea would refreeze its nuclear facility at Yongbyon and allow inspections to take place there 'from time to time'. In the final phase, North Korea would begin to dismantle its Yongbyon facility once the construction of the two light-water nuclear power reactors promised by the USA under the Agreed Framework was completed. [51]

The Bush Administration continued to insist that a complete, verifiable and irreversible dismantlement of North Korea's nuclear programme was a precondition for beginning serious negotiations. This meant that North Korea had to first place all its nuclear facilities, including the alleged undeclared uranium enrichment facility, under IAEA safeguards and to dismantle them under international supervision. On the issue of security assurances, the US Administration—at the urging of Japan and South Korea—softened its position by

[47] Dobbs, M., 'N. Korea tests Bush's policy of preemption', *Washington Post*, 6 Jan. 2003, p. A1. The Bush Administration's strategy to prevent WMD proliferation was published as The White House, 'National strategy to combat weapons of mass destruction', Washington, DC, Dec. 2002, URL <http://www.whitehouse.gov/news/releases/2002/12/WMDStrategy.pdf>.

[48] The USA had insisted on multilateral talks, arguing that the crisis affected all the countries in the region; North Korea had insisted that the nuclear issue was a bilateral one between itself and the USA. For more on China's role in the talks see chapter 6 in this volume.

[49] 'Keynote speeches made at six-way talks', KCNA, 30 Aug. 2003, URL <http://www.kcna.co.jp/item/2003/200308/news08/30.htm#5>.

[50] See, e.g., 'KCNA slams U.S. talk about "early inspection"', KCNA, 20 Aug. 2003, URL <http://www.kcna.co.jp/item/2003/200308/news08/21.htm#5>.

[51] 'Keynote speeches made at six-way talks' (note 49).

indicating that it would be willing to offer North Korea written assurances; however, the USA continued to rule out the possibility of a formal non-aggression treaty.

In early 2004, there was some sign of movement towards restarting talks. North Korea stated that it would refrain from the testing and production of nuclear weapons and halt its nuclear energy programme as 'first-phase measures of the package solution'.[52] Colin Powell described the offer as 'interesting' and 'positive', leading some observers to conclude that the USA might seize upon the North Korean offer to restart discussions.[53] However, the US Administration has consistently ruled out agreeing to any new freeze of North Korea's nuclear programme.

Production of fissile material

North Korea has several nuclear fuel cycle facilities capable of producing weapon-grade fissile material. However, there remains considerable uncertainty about how much material North Korea may have produced for weapon purposes. In the summer of 2003 there were indications from US satellite imagery and other national technical means that North Korea had begun reprocessing the 8000 spent fuel rods stored at Yongbyon. The fuel rods are believed to contain about 25–30 kilograms of plutonium.[54] The North Korean news service carried a number of statements claiming that the country had 'successfully finished' reprocessing the fuel rods; one of these confirmed that the purpose of the reprocessing was to 'increase the country's nuclear deterrent force'.[55] However, outside experts were unable to verify these claims. There has been speculation that North Korea may have encountered technical problems that slowed reprocessing operations or reduced the amount of weapon-grade plutonium that could be separated from the spent fuel rods.[56] In early January 2004, a non-official US delegation was shown the empty cooling pond where the spent fuel rods had been stored at Yongbyon, apparently as part of an effort by North Korea to give credence to its claims to have reprocessed the rods.[57]

[52] 'KCNA urges U.S. not to shun core issue at six-way talk', KCNA, 6 Jan. 2004, URL <http://www.kcna.co.jp/item/2004/200401/news01/07.htm#2>.

[53] Weisman, S., 'Powell hails North Korea for new step', *New York Times* (Internet edn), 7 Jan. 2004, URL <http://www.nytimes.com/2004/01/07/politics/07KORE.html>.

[54] Albright, D., 'North Korea's current and future plutonium and nuclear weapon stocks', *ISIS Issues Brief*, 15 Jan. 2003, URL <http://www.isis-online.org/publications/dprk/currentandfutureweaponsstocks.html>. This would be sufficient to manufacture 5–6 nuclear weapons, assuming that each weapon requires *c.* 5 kg of plutonium.

[55] 'DPRK to continue increasing its nuclear deterrent force', KCNA, 2 Oct. 2003, URL <http://www.kcna.co.jp/item/2003/200310/news10/03.htm#12>.

[56] South Korea's National Intelligence Service told a parliamentary committee in July 2003 that it believed that North Korea had reprocessed only a 'small number' of the rods. 'North Korea: Seoul says North Korea reprocessed some fuel rods', Global Security Newswire, 9 July 2003, URL <http://www.nti.org/d_newswire/issues/2003/7/9/10p.html>; and Ward, A., 'North Korea "has reprocessed fuel rods"', *Financial Times*, 10 July 2003, p. 6.

[57] 'In first visit by outsiders in a year, U.S. experts tour Korea', *International Herald Tribune*, 12 Jan. 2004, p. 4.

Uranium enrichment programme

During 2003, there remained many unresolved questions about North Korea's alleged uranium enrichment programme. For its part, North Korea continued to deny that it had an enrichment programme or had ever admitted to US officials that it had such a programme.[58]

The US Government accused North Korea of secretly pursuing a uranium enrichment capability. According to media reports, US intelligence analysts believed that the programme was based on centrifuge technology purchased from Pakistan.[59] However, there was considerable uncertainty about its status as well as about how much HEU it might be able to produce.[60] In March 2003, a US State Department official testified that North Korea's uranium enrichment programme was 'not far behind' its plutonium-based nuclear weapon programme and could produce HEU 'in months and not years'.[61] This represented a shorter time-line estimate than one included in a 2002 US Central Intelligence Agency (CIA) report, which stated that North Korea was 'constructing a plant that could produce enough weapon-grade uranium for 2 or more nuclear weapons per year when fully operational—which could be as soon as mid-decade'.[62] These assessments have not been universally accepted, especially in the light of growing doubts about the accuracy of US intelligence on Iraq's WMD programmes before the March–May 2003 war.[63] A senior Chinese diplomat reportedly told Asian colleagues that his government is sceptical that North Korea has a secret programme to enrich uranium.[64]

Does North Korea have nuclear weapons?

Although North Korea is believed to have produced weapon-grade plutonium, there remains considerable uncertainty about whether it has taken the further step of building a nuclear weapon. North Korea's own statements have been ambiguous. In June 2003, North Korea declared for the first time that it had 'no other option' but to develop a strong nuclear deterrent in order to combat the threat posed by the USA.[65] It has stated on several occasions that it pos-

[58] Kessler, G., 'N. Korea still denies enriching uranium', *Washington Post* (Internet edn), 13 Jan. 2004, URL <http://www.washingtonpost.com/wp-dyn/articles/A11364-2004Jan12.html>.

[59] See, e.g., Sanger, D. and Dao, J., 'U.S. says Pakistan gave technology to North Korea', *New York Times*, 18 Oct. 2002, pp. A1, 6.

[60] Kerr, P., 'North Korea's uranium enrichment program shrouded in mystery', *Arms Control Today*, vol. 33, no. 4 (May 2003), p. 25.

[61] 'Regional implications of the changing nuclear equation on the Korean peninsula', Statement of James Kelly, Assistant Secretary of State for East Asian and Pacific Affairs, before the Senate Foreign Relations Committee, US Senate, 12 Mar. 2003, URL <http://www.state.gov/p/eap/rls/rm/2003/18661.htm>.

[62] The findings of the CIA report are reproduced in Nonproliferation Policy Education Center, 'Beyond the Agreed Framework: the DPRK's projected atomic bomb making capabilities, 2002–09', Appendix 1, 3 Dec. 2002, URL <http://www.npec-web.org/projects/fissile2.htm>.

[63] For more on the Iraq war see chapter 2 in this volume.

[64] Kessler, G., 'China not convinced of North Korean uranium effort', *Washington Post* (Internet edn), 7 Jan. 2004, URL <http://www.washingtonpost.com/ac2/wp-dyn/A60332-2004Jan6>.

[65] 'KCNA on DPRK's nuclear deterrent force', KCNA, 10 June 2003, URL <http://www.kcna.co.jp/item/2003/200306/news06/10.htm#6>.

sesses a 'nuclear deterrent' that is ready for use and powerful enough to deter any US attack.[66] At the same time, North Korea publicly denied that it had built a nuclear warhead and claimed that many outside assessments of its nuclear capabilities were 'exaggerated'.[67] Taken together, the statements suggest that North Korea may have adopted a policy of deliberate ambiguity about its nuclear weapon status.[68]

The US Government considers North Korea to be a de facto nuclear weapon state. The CIA judged, in a December 2001 report, that North Korea had produced 'one, possibly two, nuclear weapons' in the mid-1990s from plutonium extracted from spent reactor fuel.[69] The basis for this judgement has not been publicly disclosed.[70] A CIA assessment in August 2003 concluded that North Korea might have built one or two additional nuclear weapons 'in recent months'.[71] However, these official assessments have been called into question by independent experts and former US officials, who caution that they were based on inconclusive or contradictory intelligence reports.[72] The US assessments of North Korea's nuclear weapon capabilities also differed from those made by South Korea. In October 2003 a government minister in Seoul cited South Korean intelligence assessments which stated that North Korea had yet to develop nuclear weapons, although it was attempting to do so.[73]

North Korea has not conducted a nuclear test explosion, although it occasionally has hinted that it might do so.[74] It is reported to have a programme under way to test key non-nuclear components for a nuclear weapon. In July 2003, South Korea's National Intelligence Service reported that North Korea had carried out about 70 tests of the conventional high explosives needed to detonate an implosion-type nuclear warhead.[75] In an unclassified letter sent to Congress in mid-August, the CIA stated that it believed North Korea had been

[66] See, e.g., 'U.S. urged to drop attempt at preemptive nuclear attack on DPRK', KCNA, 19 July 2003, URL <http://www.kcna.co.jp/item/2003/200307/news07/22.htm#2>.

[67] Demick, B., 'N. Korea denies it has a warhead', *Los Angeles Times*, 13 Jan. 2004, p. A3.

[68] 'In first visit by outsiders in a year, U.S. experts tour Korea' (note 57), p. 4.

[69] National Intelligence Council, *Foreign Missile Developments and the Ballistic Missile Threat Through 2015*, Dec. 2001, p. 9, unclassified summary available at URL <http://www.cia.gov/nic/other_missilethreat2001.html>.

[70] According to a former US Department of Energy official, the Dec. 2001 National Intelligence Estimate represented an important revision of assessments made in the mid-1990s in that it implied that North Korea had accomplished all the phases of nuclear warhead manufacturing. Trulock, N., 'Going nuclear in North Korea', *Washington Times* (Internet edn), 26 June 2002, URL <http://nucnews.net/nucnews/2002nn/0206nn/020625nn.htm#035>.

[71] Sanger, D., 'Intelligence puzzle: North Korean bombs,' *New York Times* (Internet edn), 15 Oct. 2003, pp. 1 and 6, URL <http://www.nytimes.com/2003/10/14/international/asia/14KORE.html>.

[72] Frantz, D., 'N. Korea's nuclear success is doubted', *Los Angeles Times* (Internet edn), 9 Dec. 2003, URL <http://www.latimes.com/news/nationworld/world/la-fg-norkor9dec09,1,2129745.story?coll=la-homhome-headlines>.

[73] Jeong Se-hyon, Minister for Unification, Republic of Korea, quoted by Yonhap News Service (Seoul), 7 Oct. 2003, in 'ROK UnifMin says "momentum" for early resumption of nuclear talks "has been lost"', Foreign Broadcast Information Service, *Daily Report–China and East Asia* (FBIS-CHI), FBIS-CHI-2003-1007, 8 Oct. 2003.

[74] Yonhap News Service (Seoul), 3 Sep. 2003, 'Possibility grows on N. Korea's nuclear weapons test', in FBIS-CHI-2003-0903, 4 Sep. 2003.

[75] Ward, A., 'Plenty of intelligence but few facts available on North Korea's weapons of mass destruction', *Financial Times*, 11 July 2003, p. 6.

able to validate its weapon designs without conducting a nuclear test explosion.[76]

Responses to a North Korean nuclear weapon capability

A key question in 2003 was how the international community should respond to the possibility that North Korea might already have one or two nuclear 'bombs in the basement' and had the fuel cycle facilities in place to produce considerably more. One of the greatest concerns among both government officials and independent experts was the prospect that North Korea would decide to sell fissile material, or the technology for producing it, to other countries or even to terrorist groups.[77] This concern led the USA to focus its attention on the question of how to manage the consequences of North Korean nuclear proliferation. It was one of the main factors that led to President Bush's announcement, in May 2003, of the creation of a heightened interdiction effort known as the Proliferation Security Initiative (PSI).[78]

However, the new US initiative received a lukewarm response in South Korea, where President Roh Moo Hyun had taken office in early 2003 keen to preserve and expand on the progress made by his predecessor towards promoting reconciliation between the two Korean states.[79] Two other key states in the region—China and Russia—were also reluctant to embrace the new initiative and the wider US policy of aggressively isolating and containing North Korea. This reluctance was in part due to the perceived risks of armed conflict entailed by such a policy and in part due to concern that the North Korean leadership's willingness to negotiate a comprehensive deal to peacefully resolve the crisis had not been sufficiently tested.[80]

IV. Libya and proliferation concerns

Libya has been a perennial source of concern about the proliferation of non-conventional weapons and ballistic missile delivery systems. Libya has a modest civil nuclear infrastructure, centred on a Soviet-designed 10-megawatt-thermal (MW(t)) research reactor.[81] It ratified the NPT in 1975

[76] Sanger, D., 'New CIA concerns on North Korean weapons', *New York Times* (Internet edn), 9 Nov. 2003, URL <http://www.nytimes.com/2003/11/09/international/09KORE.html>.

[77] Levy, M., 'Uncontainable: North Korea's loose nukes', *New Republic*, 26 May 2003, URL <http://www.brook.edu/views/articles/fellows/levi20030526.htm>.

[78] The White House, Office of the Press Secretary, 'Remarks by the President to the people of Poland', Krakow, Poland, 31 May 2003, URL <http://www.whitehouse.gov/news/release/2003/05/20030531-2.html>. For a discussion of the PSI interdiction principles see chapter 14 in this volume.

[79] Pinkston, D., 'South Korean electoral politics and Seoul's position on the North Korean nuclear crisis', Center for Nonproliferation Studies, Monterey Institute of International Studies, 25 Apr. 2003, URL <http://cns.miis.edu/pubs/week/030425.htm>.

[80] Graham, B., 'Gaps in plan to halt arms trade', *Washington Post* (internet edn), 3 Aug. 2003, URL <http://www.washingtonpost.com/ac2/wp-dyn/A15522-2003Aug2?language=printer>.

[81] For further detail about Libya's nuclear programme see Feldman, Y. and Mahaffey, C., 'Country profile 6: Libya', in the SIPRI series 'Countries of nuclear strategic concern', URL <http://projects.sipri.se/nuclear/cnsc1lya.htm>.

and concluded a full-scope safeguards agreement with the IAEA in 1980.[82] However, many analysts have long suspected that the regime in Tripoli, under the leadership of Colonel Muammar Qadhafi, was pursuing a nuclear weapon capability.[83] In addition, Libya was known to have a long-running programme to obtain ballistic missile-related equipment, materials, technology and expertise from foreign sources. There was also evidence suggesting that Libya sought to develop and produce chemical weapons (CW) as well as biological warfare agents.[84]

On 19 December 2003, US President Bush and British Prime Minister Tony Blair announced that Libya had agreed to abandon, under international supervision, its non-conventional weapon programmes and ballistic missile activities and to cooperate fully in the war against terrorism.[85] On the same day, the Libyan Government issued a statement in which it pledged to dismantle all elements of its nuclear weapon programme; to declare to the IAEA all past and current nuclear activities, as a prelude to signing an Additional Protocol to its safeguards agreement with the IAEA; to eliminate all ballistic missiles capable of carrying a 500-kg payload beyond 300 km; and to destroy all CW stocks and munitions, and accede to the 1993 Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (Chemical Weapons Convention, CWC).[86] Libya emphasized that its decision to abandon its WMD programmes was an historic one intended to spur the creation of a WMD-free zone in the Middle East.

Libya's announcement, which reportedly came after nine months of secret diplomacy initiated by President Qadhafi, marked the first time that the country had admitted to having non-conventional weapons or programmes to produce them.[87] Libya had reportedly approached British intelligence officials in early March following contacts regarding Libya's involvement in the 1988 bombing of Pan Am flight 103 over Lockerbie, Scotland.[88] Soon after, US officials were invited to participate in the discussions.

[82] Libya's safeguards agreement with the IAEA entered into force on 8 July 1980 and is contained in IAEA document INFCIRC/282, 'Agreement between the Socialist People's Libyan Arab Jamahiriya and the Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons', 13 Oct. 1980. Libya is also party to the 1996 African Nuclear-Weapon-Free Zone Treaty (Treaty of Pelindaba), which established an African nuclear weapon-free zone. For a list of the states that have signed and ratified the treaty see annex A in this volume.

[83] See, e.g., Cirincione, J., Wolfstahl, J. and Rajkumar, M., *Deadly Arsenals: Tracking Weapons of Mass Destruction* (Carnegie Endowment for International Peace: Washington, DC, 2002), pp. 307–12.

[84] US Central Intelligence Agency, 'Unclassified report to Congress on the acquisition of technology relating to weapons of mass destruction and advanced conventional munitions, 1 January through 30 June 2003', URL <http://www.cia.gov/cia/reports/721_reports/jan_jun2003.htm>.

[85] Sanger, D. and Miller, J., 'Libya to give up arms programs, Bush announces', *New York Times*, 20 Dec. 2003, pp. A1, A8.

[86] Text of statement released by Libyan Foreign Ministry, 19 Dec. 2003, in 'Libyan call against arms', *New York Times*, 20 Dec. 2003, p. A8. In addition, on 6 Jan. 2004 Libya ratified the Comprehensive Nuclear Test-Ban Treaty (CTBT). For a list of the states that have signed and ratified the CTBT, and the signatories and parties to the CWC, see annex A in this volume.

[87] Frankel, G., '"A long slog" led to Libya's decision', *Dallas Morning News*, 21 Dec. 2003, p. 18A.

[88] The Lockerbie bombing had led the UN Security Council, on 31 Mar. 1992, to adopt Resolution 748 imposing diplomatic and economic sanctions against Libya. In Aug. 2003, Libya accepted responsibility for the bombing and agreed to pay $2.7 billion in compensation. On 12 Sep. 2003 the UN Security Council adopted Resolution 1506, which lifted the sanctions imposed in 1992.

White House officials sought to portray the Libyan action as a vindication of the administration's robust approach to combating the spread of WMD.[89] They noted that Qadhafi had initiated the discussions a few days before the US-led invasion of Iraq began. They also suggested that an October 2003 operation that interdicted a Libyan freighter carrying a secret shipment of centrifuge parts may have been an important factor in convincing Libya to give up its WMD programmes.[90] Other observers described the decision as being part of the Qadhafi regime's longer-term effort to overcome two decades of political and economic isolation. The stringent international sanctions regime imposed on Libya had caused serious damage to the country's economy.[91]

Cooperation with the IAEA

At a 20 December 2003 meeting, Libyan officials informed the IAEA that the country had had a uranium enrichment programme under way for more than decade.[92] It included importing natural uranium and centrifuge and conversion equipment and the construction of now-dismantled pilot scale centrifuge facilities. Some of these activities should have been reported to the IAEA under Libya's 1980 safeguards agreement with the Agency. The officials pledged that, as part of a policy of full transparency in its nuclear activities, Libya would take steps to conclude an Additional Protocol to its safeguards agreement.[93]

On 28 December, IAEA Director General ElBaradei travelled to Tripoli with a team of IAEA experts in order to 'initiate an in-depth process of verification of all of Libya's past and present nuclear activities'.[94] They were shown nine nuclear sites, four of which were previously undisclosed, containing crates of equipment, including dozens of centrifuges. ElBaradei confirmed that Libya's enrichment programme, which appeared to be completely dismantled, had been 'in the very initial stages of development'.[95] He stated that Libya had not produced any HEU and estimated that it was 'years away' from being able to do so at the time the programme was halted.[96]

[89] The White House, Office of the Press Secretary, 'The President's national security strategy to combat WMD: Libya's announcement', Fact sheet, Washington, DC, 19 Dec. 2003, URL <http://www.whitehouse.gov/news/releases/2003/12/20031219-8.html>.

[90] Wright, R., 'Ship incident may have swayed Libya', *Washington Post* (Internet edn), 1 Jan. 2004, URL <http://www.washingtonpost.com/ac2/wp-dyn/A46260-2003Dec31>.

[91] Williams, D., 'Possible opening to West stirs hope in Libya', *Washington Post* (Internet edn), 27 Dec. 2003, URL <http://www.washingtonpost.com/wp-dyn/articles/A33259-2003Dec26.html>.

[92] 'IAEA Director General to visit Libya', IAEA Press Release 2003/14, 22 Dec. 2003, URL <http://www.iaea.org/NewsCenter/PressReleases/2003/prn200314.html>.

[93] Slevin, P. and Williams, D., 'Libya agrees to rapid nuclear inspections', *Washington Post* (Internet edn), 23 Dec. 2003, URL <http://www.washingtonpost.com/wp-dyn/articles/A23080-2003Dec22.html>.

[94] 'IAEA Director General to visit Libya' (note 92).

[95] 'Libya "not close to nuclear arms"', BBC News Online, 29 Dec. 2003, URL <http://news.bbc.co.uk/2/hi/africa/3355277.stm>.

[96] Koppel, A., 'ElBaradei: Libya nuclear program dismantled', CNN.com, 29 Dec. 2003, URL <http://edition.cnn.com/2003/WORLD/africa/12/29/libya.nuclear/index.html>.

ElBaradei also stated that Libya had secretly imported nuclear technology through a sophisticated network of foreign middlemen.[97] Media reports indicated that the Libyan centrifuge equipment is identical to that built by Iran based on designs obtained directly or indirectly from Pakistan.[98] Official spokesmen in Islamabad acknowledged that an inquiry was under way into whether individual scientists in Pakistan's nuclear programme had supplied technology to Libya and other nations. They insisted, however, that the Pakistani Government had nothing to do with the transfers.[99]

V. Post-war findings about Iraq's nuclear programme

Iraq's suspected WMD programme remained at the centre of international attention during 2003, in the wake of the successful US-led military campaign to oust Saddam Hussein's regime from power. With regard to nuclear weapons, the main question was whether Iraq had been engaged in proscribed nuclear-related activities, as alleged by intelligence reports prepared by the US and British governments before the war. The accuracy of these reports—and the process by which they had been put together—came under increasing critical scrutiny during the year as US inspection teams failed to find evidence of a reconstituted Iraqi nuclear weapon programme.

The ISG interim progress report

On 2 October 2003, David Kay, the head of the Iraq Survey Group (ISG) tasked with finding evidence of Iraq's WMD programmes, delivered an interim report of the inspectors' findings.[100] According to Kay, the ISG had 'discovered dozens of WMD-related program activities and significant amounts of equipment that Iraq concealed from the United Nations during the inspections that began in late 2002'.[101] With regard to Iraq's nuclear programme, Kay stated that testimony obtained from Iraqi scientists and officials indicated that Saddam Hussein had remained committed to resuming a nuclear weapon programme at some future point, probably after Iraq was free of sanctions.

Kay stated that, despite evidence of Saddam's continued ambition to acquire nuclear weapons, the ISG had not uncovered evidence that 'Iraq undertook

[97] Williams, D., 'Nuclear program in Libya detailed', *Washington Post* (Internet edn), 29 Dec. 2003, URL <http://www.washingtonpost.com/wp-dyn/articles/A38591-2003Dec29.html>.

[98] Tyler, P. and Sanger, D., 'Pakistan called Libyans' source of atom design', *New York Times* (Internet edn), 6 Jan. 2004, URL <http://www.nytimes.com/2004/01/06/international/middleeast/06NUKE.html>.

[99] Traynor, I., 'Pakistan rubbishes claims it gave nuclear equipment to Libya', Guardian Unlimited, 7 Jan. 2004, URL <http://www.guardian.co.uk/international/story/0,3604,1117466,00.html>.

[100] For more on the work of the ISG see chapter 16 in this volume.

[101] 'Interim progress report on the activities of the Iraq Survey Group', Statement by David Kay before the House Permanent Select Committee on Intelligence, the House Committee on Appropriations, Subcommittee on Defense and the Senate Select Committee on Intelligence, 2 Oct. 2003, URL <http://www.fas.org/irp/cia/product/dkay100203.html>.

significant post-1998 steps to actually build nuclear weapons or produce fissile material'.[102] Several small research projects begun by the Iraqi Atomic Energy Commission (IAEC) in 2000 did not 'constitute a resumption of the nuclear weapons program', although they 'could have been useful in developing a weapons-relevant science base' for a future programme.[103] The inspectors found that Iraq had taken steps to preserve some technological capability from its pre-1991 nuclear weapon programme. These included, for example, hiding in scientists' homes documents and equipment that would have been useful in resuming a uranium enrichment programme.

Kay's interim progress report was followed by several reports that were critical of US intelligence assessments of Iraq's nuclear capabilities prior to the war. One report, prepared by a non-governmental expert, investigated allegations dating from September 2002 that Iraq had attempted to acquire high-strength aluminium alloy tubes for use in the manufacture of gas centrifuges. It concluded that, prior to the war, the US intelligence community knew enough about the aluminium tubes to cast serious doubts on 'exaggerated' assertions that they were intended for use in gas centrifuges, as part of an Iraqi uranium enrichment programme.[104] A second report concluded that the 'dramatic shifts' that occurred during 2002 in US intelligence assessments of Iraq's nuclear programme suggested 'that the intelligence community began to be unduly influenced' by the views of administration officials, who 'systematically misrepresented the threat' posed by Iraq's nuclear and other non-conventional weapon programmes.[105]

VI. US–Russian nuclear arms control

Ratification and entry into force of SORT

The US–Russian Strategic Offensive Reduction Treaty was signed by US President Bush and Russian President Vladimir Putin on 24 May 2002. The treaty obligates the two parties to reduce the number of their operationally deployed strategic nuclear warheads so that the aggregate numbers of these warheads do not exceed 1700–2200 each by 31 December 2012.[106] This entails a two-thirds drop in the ceiling on deployed nuclear warheads man-

[102] 'Interim progress report on the activities of the Iraq Survey Group' (note 101).

[103] 'Interim progress report on the activities of the Iraq Survey Group' (note 101).

[104] Albright, D., 'Iraq's aluminium tubes: separating fact from fiction', *ISIS Issues Brief*, 5 Dec. 2003, URL <http://www.isis-online.org/publications/iraq/IraqAluminumTubes12-5-03.pdf>. President Bush and other officials had cited the tubes as evidence that Iraq had not only reconstituted its nuclear weapon programme but would also soon be able to produce HEU.

[105] Cirincione, J., Mathews, J. and Perkovich, G., *WMD in Iraq: Evidence and Implications* (Carnegie Endowment for International Peace: Washington, DC, Jan. 2004), pp. 50, 52, URL <http://www.ceip.org/files/projects/npp/resources/iraqintell/home.htm>.

[106] For a summary of the main provisions of the START I Treaty see annex A in this volume. For more on SORT see Kile (note 2), pp. 600–605. Prior to SORT's entry into force, START I was the only legally binding agreement in force that regulated the US and Russian strategic nuclear forces. Its verification regime will be used as the basis for monitoring the implementation of SORT.

dated by the 1991 Treaty on the Reduction and Limitation of Strategic Offensive Arms (START I Treaty).

The SORT ratification proceedings were relatively uncontroversial in the US Congress. President Bush transmitted the treaty to the Senate for its advice and consent in June 2002. During ratification hearings, some complaints were raised that the treaty did not impose meaningful constraints on strategic nuclear forces and that it failed to address important arms control goals. On the whole, however, SORT enjoyed bipartisan support, and the Senate approved its ratification by a unanimous vote on 6 March 2003.[107]

In Russia, the ratification of SORT was a more controversial question. The main criticism of the treaty was that it does not require the irreversible elimination of nuclear warheads to be removed from operational deployment, that is, the verified dismantlement of surplus warheads and secure disposal of the fissile material that they contain.[108] The idea of requiring surplus warheads to be verifiably dismantled has gained support in Russia as a mechanism for addressing concerns about asymmetries in the 'reconstitution potential' of Russian and US strategic nuclear forces.[109] In addition, concern was expressed that the treaty's ceiling on deployed strategic nuclear warheads was too low to ensure a robust Russian nuclear deterrent.

Despite these criticisms, most Russian officials and analysts favoured ratification of SORT as a way of maintaining numerical parity, at least on paper, between Russia's and the USA's strategic nuclear forces. In December 2002 President Putin submitted SORT to the Russian Duma (lower house of Parliament) for ratification. On 14 May 2003, the Duma approved ratification of the treaty by a vote of 294–134.[110] It attached a statement specifying a number of exceptional circumstances that would enable Russia to withdraw from the treaty.[111] These included the deployment by some other state or a group of states of anti-ballistic missile defences that might undermine Russia's nuclear deterrence capabilities. A second statement attached to the ratification bill stipulated that the government must submit annual reports to the Duma on the

[107] Dewar, H., 'Senate backs U.S.–Russian nuclear pact', *Washington Post* (Internet edn), 7 Mar. 2003, URL <http://www.washingtonpost.com/ac2/wp-dyn/A53879-2003Mar6>. The Senate defeated 2 amendments to the treaty ratification resolution. One would have required Senate approval before the USA could withdraw from the treaty. The 2nd amendment would have required annual intelligence reports on treaty compliance.

[108] See, e.g., Interfax (Moscow), 6 May 2003, in 'Deputy says Russia to ratify SOR Treaty by mid-May', Foreign Broadcast Information Service, *Daily Report–Central Eurasia (FBIS-SOV)*, FBIS-SOV-2003-0506, 6 May 2003.

[109] See Kile, S. N., 'Ballistic missile defence and nuclear arms control', *SIPRI Yearbook 2002: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2002), pp. 517–18. According to the US Department of Defense's 2001 Nuclear Posture Review (NPR), the USA intends to maintain many of the nuclear warheads removed from delivery vehicles in reserve stockpiles in various states of readiness as a 'responsive capability'. For more on the NPR see Kristensen, H. M. and Kile, S. N., 'World nuclear forces', *SIPRI Yearbook 2003* (note 2), pp. 612–13.

[110] Duma ratifies Moscow Treaty', Radio Free Europe/Radio Liberty, *RFE/RL Newsline*, 15 May 2003, URL <http://www.rferl.org/newsline/2003/05/150503.asp>. The Federation Council (upper house of Parliament) approved the ratification of SORT by a vote of 140–5 on 28 May 2003.

[111] ITAR-TASS (Moscow), 14 May 2003, in 'Russian State Duma attaches condition to SORT ratification', FBIS-SOV-2003-0506, 14 May 2003.

readiness and future of the strategic nuclear forces and on plans for Russia's future nuclear force posture.

SORT entered into force on 1 June 2003. The treaty instruments of ratification were signed and exchanged by Bush and Putin at a summit meeting in St Petersburg, Russia.[112]

VII. New US nuclear weapons

There has been a long-running debate in the US Congress over whether to build new types of nuclear weapons. Proponents argue that robust earth-penetrating weapons ('bunker busters') are needed for the USA to be able to threaten the command-and-control and WMD production facilities that potential adversaries are building deep underground, beyond the reach of current US conventional munitions.[113] They also argue that new very low-yield nuclear weapons (so-called 'mini-nukes') would deter so-called rogue states from using, or threatening to use, non-conventional weapons and even dissuade them from developing such weapons.[114] This dissuasion strategy requires the USA to have the ability to threaten all categories of target that might arise in connection with rogue states, which in turn requires an enhanced ability to destroy hard, deeply buried targets (HDBTs) as well as mobile targets.[115]

However, critics respond that even very low-yield nuclear weapons detonated deep underground will produce considerable collateral blast damage as well as significant radioactive fallout.[116] They also argue that low-yield nuclear weapons are more likely to be viewed as being more usable, especially as part of the US Administration's strategy of pre-empting WMD threats.[117] The development of such weapons is seen as undermining international efforts to devalue the role of nuclear weapons in military planning.[118]

[112] The White House, Office of the Press Secretary, 'President Bush, Russian President Putin sign Treaty of Moscow', St Petersburg, Russia, 1 June 2003, URL <http://www.whitehouse.gov/news/releases/2003/06/20030601-2.html>.

[113] See, e.g., Younger, S., 'Nuclear weapons in the twenty-first century', Los Alamos National Laboratory, Report LAUR-00-2850, 27 June 2000, URL <http://www.fas.org/nuke/guide/usa/doctrine/doe/younger.htm>.

[114] See, e.g., House Policy Committee, Subcommittee on National Security and Foreign Affairs, *Differentiation and Defense: An Agenda for the Nuclear Weapons Program*, Feb. 2003, URL <http://cox.house.gov/files/nuclear_report.pdf>.

[115] See 'National strategy to combat weapons of mass destruction' (note 47).

[116] Nelson, R., 'Low-yield earth-penetrating nuclear weapons', *FAS Public Interest Report*, vol. 54, no. 1 (Jan./Feb. 2001), URL <http://www.fas.org/faspir/2001/v54n1/weapons.htm#note2>; and Ferguson, C. and Zimmerman, P., 'New nuclear weapons?', Center for Nonproliferation Studies, Monterey Institute of International Studies, 28 May 2003, URL <http://cns.miis.edu/pubs/week/030528.htm>.

[117] Peña, C., 'Mini-nukes and preemptive policy: a dangerous combination', *Cato Institute Policy Analysis*, no. 499 (19 Nov. 2003), URL <http://www.cato.org/pubs/pas/pa-499es.html>.

[118] Drell, S. *et al.*, 'A strategic choice: new bunker busters versus nonproliferation', *Arms Control Today,* vol. 33, no. 2 (Mar. 2003), pp. 8–10; and Paine, C. *et al.*, 'Countering proliferation, or compounding it?: the Bush Administration's quest for earth-penetrating and low-yield nuclear weapons', Natural Resources Defense Council, May 2003, URL <http://www.nrdc.org/nuclear/bush/abb.pdf>.

The debate entered into a new phase when Congress passed a compromise version of the fiscal year (FY) 2004 National Defense Authorization Act. On 6 November, House and Senate conferees approved a White House request to repeal the 10-year-old Spratt–Furse ban (named after its two congressional sponsors) on research leading to development of nuclear weapons with yields of less than 5 kilotons.[119] They also approved funding for Bush Administration proposals to continue researching new types of nuclear 'bunker busters' designed to destroy targets deep underground. In addition, they approved measures to shorten the time required to prepare for a full-scale nuclear test from 24 months to 18 months.

However, legislators placed some restrictions on the administration's plans to reinvigorate US nuclear weapon research and test preparations. While repealing the ban on research, they withheld authorization for work on designing, engineering and testing new or modified nuclear weapons. They also stipulated that Congress would have to approve any new nuclear weapon development or production activity. In a related move, congressional appropriators had earlier trimmed the administration's proposed 2004 funding for some nuclear weapon-related programmes.[120]

VIII. International cooperation to secure nuclear materials and facilities

In the wake of the 11 September 2001 terrorist attacks, there has been growing international concern about the danger of nuclear and other non-conventional weapons falling into the hands of transnational terrorist groups such as al-Qaeda. This concern was evident in the decision taken by the Group of Eight (G8) industrialized nations in June 2002 to create the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction.[121] During 2003, six additional countries agreed to take part in the Global Partnership activities.[122]

There continued to be interest in strengthening efforts under way within the framework of the Cooperative Threat Reduction (CTR) programme to dismantle or convert the former Soviet Union's sizeable non-conventional weapon complexes and to safeguard nuclear and other hazardous materials.[123]

[119] 'US lawmakers agree to end ban on low-yield nuclear weapons research', Global Security Newswire, 7 Nov. 2003, URL <http://www.nti.org/d_newswire/issues/print.asp?story_id=B8DDB202-0889-427B-AD35-CDD79E709BB1>. For further detail about the 1994 Spratt–Furse ban (Section 3136 of P. L. 103–160) see Wright, D., 'The Spratt–Furse law on mini-nuke development', *Backgrounder*, Union of Concerned Scientists, 11 May 2003, URL <http://www.ucsusa.org/global_security/nuclear_weapons/page.cfm?pageID=1182>.

[120] Ruppe, D., 'U.S. legislators cut Bush nuclear weapon requests', Global Security Newswire, 6 Nov. 2003, URL <http://www.nti.org/d_newswire/issues/2003_11_6.html#BB6B3B7C>.

[121] For a description of the G8 Global Partnership see Anthony, I., 'Arms control in the new security environment', *SIPRI Yearbook 2003* (note 2), pp. 567–70. See also chapter 18 in this volume.

[122] The countries were Finland, the Netherlands, Norway, Poland, Sweden and Switzerland.

[123] See Bunn, M. *et al*., *Controlling Nuclear Warheads and Materials: A Report Card and Action Plan*, Project on Managing the Atom, Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University and the Nuclear Threat Initiative, Mar. 2003, at URL <http://

Despite the considerable progress that has been made in securing and accounting for these materials, a Harvard University report warns that there remains 'a dangerous gap' between the pace of progress and the scope and urgency of the threat.[124] In addition, the CTR programme continued to be hampered by a number of problems and bottlenecks. In 2003, a long-running dispute between the US and Russian governments over legal liability issues delayed the initiation of new threat reduction activities.[125]

The 2002 IAEA–Russia–US Tripartite Initiative

The Tripartite Initiative is a cooperative international effort to reduce, and if possible eliminate, the use and storage of HEU in civil nuclear activities. The programme brings together the US Department of Energy, Russia's Minatom and the IAEA. The purpose is to facilitate the return of both fresh and spent fuel from Russian-supplied HEU research reactor fuel for long-term management and disposition. There are currently about 80 research reactors around the world that still contain HEU subject to international control as potentially weapon-usable material.[126] On 23 December 2003 17 kg of Russian-origin HEU were returned to Russia, under the supervision of IAEA safeguards inspectors, from a research reactor near Sofia, Bulgaria.[127] It was the second shipment of HEU conducted under the Tripartite Initiative. The first took place in September 2003 and involved the return of Russian-origin HEU fuel from Romania to Russia.

The 2003 US–Russia Plutonium Reactor Shutdown Agreement

On 12 March 2003, Russia and the USA signed an agreement resolving outstanding issues connected with a 1994 deal under which Russia had pledged to shut down its last three reactors producing weapon-grade plutonium.[128] Rus-

www.nti.org/cnwm>. For more on CTR see Anthony, I., SIPRI, *Reducing Threats at the Source: A European Perspective on Cooperative Threat Reduction*, SIPRI Research Report no. 19 (Oxford University Press: Oxford, 2004).

[124] The report calculated that only 41% of Russia's nuclear materials had received US-funded 'rapid' security upgrades or more comprehensive upgrades to date, leaving *c*. 354 tonnes of weapon-usable nuclear materials for which cooperative security upgrades had not been completed. Bunn, M., *Preventing Nuclear Terrorism: A Progress Update* (Project on Managing the Atom, Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University and the Nuclear Threat Initiative: Washington, DC, 22 Oct. 2003), pp. 6–7, URL <http://www.nti.org/c_press/analysis_cnwmupdate_102203.pdf>.

[125] Fiorill, J., 'U.S.–Russian liability dispute could bode ill for threat reduction programs', Global Security Newswire, 22 Sep. 2003, URL <http://www.nti.org/d_newswire/issues/newswires/2003_9_22.html#2>.

[126] 'IAEA, USA, Russia assist Bulgaria in removal of HEU fuel', IAEA Press Release, 24 Dec. 2003, URL <http://www.iaea.org/NewsCenter/News/2003/bulgaria20031224.html>.

[127] US Department of Energy, 'U.S. nonproliferation efforts continue as nuclear material is removed from Bulgaria', Press Release PR-03-292, 24 Dec. 2003, URL <http://www.energy.gov/engine/content.do?PUBLIC_ID=14704&BT_CODE=PR_PRESSRELEASES&TT_CODE=PRESSRELEASE>.

[128] US Department of Energy, 'U.S. and Russia agree to plan to shutdown 3 remaining Russian plutonium production reactors', Press Release PR-03-055, 12 Mar. 2003, URL <http://www.energy.gov/

sia's Minatom had backed away from the 1994 commitment, arguing that it could not compensate for the loss of heat and electricity produced by the reactors for the surrounding communities. Under the terms of a 1997 deal, Russia promised to convert the cores of the nuclear reactors, which were located in the Siberian cities of Seversk and Zheleznogorsk, so as to minimize weapon-grade plutonium production. However, Russian and US experts subsequently reassessed the project and determined that core conversion would likely make the reactors less safe and potentially a greater proliferation threat, because they would use HEU.[129]

Under the terms of the 2003 agreement, the three plutonium production reactors will be shut down entirely. The USA will pay to refurbish an existing fossil-fuel plant at Seversk, which will allow the shutdown of the two reactors there in 2008; it will also pay for the construction of a new fossil-fuel plant for Zheleznogorsk scheduled to open in 2011, when the last reactor will be shut down. Russia will be responsible for the cost of decommissioning the reactors.[130] The new agreement is part of the US–Russia Elimination of Weapons Grade Plutonium Production Program.[131]

IX. Conclusions

Developments in 2003 strengthened calls for international action to repair a number of shortcomings or lacunae in the non-proliferation regime. These were seen as undermining the technical chokepoint—that is, the difficulty of producing or otherwise acquiring weapon-usable fissile material—on which the regime is based. There was particular interest in revisiting one of the key provisions of the NPT: the guarantee, contained in Article IV, that non-nuclear weapon states have an 'inalienable right' to import and develop materials and technologies for use in civil nuclear energy programmes. Many observers cited the Iranian and North Korean nuclear programmes as evidence that Article IV creates a generic loophole in the NPT, through which countries can put into place the key fuel cycle facilities for manufacturing nuclear weapons under the cover of civil nuclear energy programmes. Concern about closing this perceived gap led to growing interest in the idea of limiting uranium enrichment and plutonium reprocessing activities for civil nuclear programmes to a handful of fully transparent nuclear fuel cycle facilities, operating under multinational control and close IAEA supervision.[132] These could be

engine/content.do?PUBLIC_ID=12877&BT_CODE=PR_PRESSRELEASES&TT_CODE=PRESSRELEASE>.

[129] Kucia, C., 'US, Russia agree to plutonium reactor shutdown', *Arms Control Today*, vol. 33, no. 3 (Apr. 2003), p. 39. According to the US DOE, these reactors 'have deficiencies in design, equipment and materials and are considered to be among the highest risk reactors in the world'. US Department of Energy (note 128).

[130] US Department of Energy (note 128); and Kucia (note 129).

[131] For more on the programme see US National Nuclear Security Administration, Office of Defense Nuclear Nonproliferation, 'Elimination of Weapons Grade Plutonium Production (EWGPP)', URL <http://www.nnsa.doe.gov/na-20/ewgpp.shtml>.

[132] See, e.g., ElBaradei, M., 'Towards a safer world', *The Economist*, 18 Oct. 2003, pp. 43–44.

supplemented by new multinational programmes for managing and disposing of spent fuel and radioactive waste.

Developments in 2003 also highlighted the difficult problem posed by the willingness of some states, or of individual scientists, to sell sensitive nuclear technologies and design expertise of the kind that Iran, North Korea and Libya are alleged to have purchased. This gave impetus to new counter-proliferation strategies and initiatives aimed at curbing 'secondary proliferation', in which illegally acquired nuclear technologies and materials are re-exported to other would-be proliferators. There were also renewed discussions about imposing sanctions or otherwise penalizing governments which allow such exports, even if the exporters are private companies operating outside the law, in order to force them to police rogue scientists and businessmen.

These weaknesses in the existing non-proliferation regime underscore the urgent need for the international community to revitalize and strengthen the regime. This will involve work to fill gaps in safeguards and export control arrangements as well as to close loopholes that have been exploited in the past by some states. At the same time, as events in Iran and Libya illustrate, these must be accompanied by a renewed commitment to multifunctional approaches to addressing proliferation challenges that make use of the full range of political and economic as well as military instruments that the international community has at its disposal.