9. Reducing security threats from chemical and biological materials

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I. Introduction

At the international, national and regional levels in 2010 states continued to develop strategies to prevent and remediate the effects of the possible misuse of toxic chemical and biological materials for hostile purposes. The parties to the 1972 Biological and Toxin Weapons Convention (BTWC) held the final meetings of the 2007–10 inter-sessional process (consisting of annual expert and political meetings) and prepared for the Seventh Conference of the States Parties, which will be held in December 2011. The new director-general of the Organisation for the Prohibition of Chemical Weapons (OPCW) established an advisory panel to review the implementation of the 1993 Chemical Weapons Convention (CWC) with a focus on how the convention's activities should be structured after the destruction of chemical weapon stockpiles ends, sometime after 2012. Allegations were made that states are failing to fully implement their international obligations to prevent chemical and biological warfare (CBW). These allegations highlighted the difficulty of distinguishing between fundamental and technical violations of international law and the possible role of a form of politicized legal dispute that aims to cast aspersions on the behaviour of other states.

Section II of this chapter considers biological weapon arms control and disarmament. Section III reviews chemical weapon arms control and disarmament, while CBW development, use, prior programmes and activities are discussed in section IV. Section V presents CBW prevention, response and remediation efforts. The conclusions are presented in section VI.

II. Biological weapon arms control and disarmament

The BTWC is the principal international legal instrument against biological warfare. No new parties joined the BTWC in 2010.[1] Much of the parties'

[1] For a summary and lists of parties and signatories of the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction see annex A in this volume. The states that had signed but not ratified the BTWC were Burundi, Central African Republic, Côte d'Ivoire, Egypt, Guyana, Haiti, Liberia, Malawi, Myanmar, Nepal, Somalia, Syria and Tanzania. The states that had neither signed nor ratified the conven-

activities in 2010 focused on the Seventh Review Conference; preparations included the consideration and structuring of relevant topics and the drafting of background text.

In December 2006 the Sixth Review Conference of the BTWC agreed an inter-sessional process for 2007–10, which consisted of four annual meetings to 'discuss, and promote common understanding and effective action' on four areas.[2] The inter-sessional meetings in 2010 considered 'the provision of assistance and coordination with relevant organizations upon request by any State Party in the case of alleged use of biological or toxin weapons, including improving national capabilities for disease surveillance, detection and diagnosis and public health systems'.[3] The Meeting of Experts took place on 23–27 August, and the Meeting of States Parties was held on 6–10 December.[4] Ambassador Pedro Oyarce of Chile chaired both meetings, which included the exchange of information and views on operational activities, such as disease surveillance and response. In particular, the exchanges continued to build on the recognition of the commonalities in responding to an outbreak of disease, whether it stems from natural, accidental or deliberate causes.[5]

The 2010 inter-sessional meetings saw increased participation in the confidence-building measure (CBM) data exchange, with submissions from 70 parties (as of 15 November), the highest number since its initiation in 1987.[6] Nevertheless, the submissions represented fewer than half the states parties. Among the CBMs declared in 2010, 18 data exchanges were made publicly available. They showed that 23 states operate high-level containment (biosafety level 4, BSL-4) laboratories, of which 15 are partially or wholly funded by their ministries of defence; 12 states have active biodefence programmes; and 28 possess operational vaccine production facilities.[7] Six states also declared unusual disease outbreaks.

tion were Andorra, Angola, Cameroon, Chad, the Comoros, Djibouti, Eritrea, Guinea, Israel, Kiribati, Marshall Islands, Mauritania, Micronesia, Mozambique, Namibia, Nauru, Niue, Samoa and Tuvalu.

[2] On the Sixth Review Conference see Hart, J. and Kuhlau, F., 'Chemical and biological weapon developments and arms control', *SIPRI Yearbook 2007*, pp. 578–83.

[3] Sixth BTWC Review Conference, 'Final document', document BWC/CONF.VI/6, 8 Dec 2006.

[4] The BioWeapons Prevention Project (BWPP) in cooperation with the Verification Research, Training and Information Centre (VERTIC) produced daily briefing papers on the work of the meetings. See the BWPP website, <http://www.bwpp.org/>; and the VERTIC website, <http://www.vertic.org/>. See also the United Nations Office at Geneva website, <http://www.unog.ch/bwc>; and the Biological and Toxin Weapons Convention website, <http://www.opbw.org>.

[5] United Nations Office at Geneva, 'Biological Weapons Convention meeting of states parties concludes in Geneva', 10 Dec. 2010, <http://www.unog.ch/80256EDD006B9C2E/(httpNewsByYear_en)/F786B593BEC91F17C12577F5005B029B>.

[6] University of Hamburg, Research Group for Biological Arms Control, '2010 reader on publicly available CBMs', Dec. 2010, <http://www.biological-arms-control.org/>, p. 1. See also Lentzos, F. and Hamilton, R. A., *Preparing for a Comprehensive Review of the CBM Mechanism at the Seventh BWC Review Conference*, 2009–2010 Workshop Series Report (Geneva Forum: Geneva, Aug. 2010).

[7] University of Hamburg (note 6), pp. 1, 3–4. For a non-governmental organization assessment of the CBMs of 4 states parties, including a general overview of biotechnology and life sciences for

At the December Meeting of States Parties, the Non-Aligned Movement (NAM) states focused considerable attention on the Seventh Review Conference in their plenary statements.[8] They referred to the importance of international cooperation under Article X of the BTWC—which calls for the convention to be implemented in a manner that avoids hampering economic and technological development and preventing the exchange of information, material and equipment for peaceful purposes.[9]

Many states made reference to the United Nations Secretary-General's mechanism for investigating allegations of use of a chemical or biological weapon.[10] Partly because the UN Secretary-General's mechanism was successfully employed in the 1980s and early 1990s (e.g. during the 1980–88 Iran–Iraq War), it is seen by some parties as a practical means to strengthen the international regime against biological warfare. Russia stated during the inter-sessional process that the mechanism should only be used to investigate allegations of breaches of the BTWC or the 1925 Geneva Protocol, effectively limiting its use to state-level biological warfare.[11] Russia also proposed that the international legal framework for providing assistance to a state following the alleged use of a biological weapon against it be discussed at the Seventh Review Conference because Russia regarded the current framework to be insufficient.[12] China stated that under Article VI, on the investigation of non-compliance with the BTWC, allegations of use that have been presented to the UN Security Council should be investigated within the framework of that body.[13] The Meeting of States Parties also discussed integrating a similar mechanism into other international arrangements and the way that states targeted by a biological weapon could communicate such an allegation.

During the Meeting of Experts the UN Office for Disarmament Affairs (UNODA) described developments in the Secretary-General's investigation mechanism: 41 countries have nominated a total of 237 experts and 42 associated laboratories, as encouraged by a 2006 UN General Assembly

Brazil, Germany, India and Kenya see Hunger, I. (ed.), *BioWeapons Monitor 2010* (BioWeapons Prevention Project: Berlin, Nov. 2010).

[8] For a list of members of the NAM see annex B in this volume.

[9] E.g. 'Statement by Ambassador Hamid Ali Rao, Permanent Representative of India to the Conference on Disarmament', Meeting of Experts of States Parties to the Biological Weapons Convention, Geneva, 23 Aug. 2010.

[10] United Nations, General Assembly, 'Chemical and bacteriological (biological) weapons', Report of the Secretary-General, A/44/561, Annex I, 4 Oct. 1989.

[11] 'Statement by H. E. Ambassador Valery Loshchinin, Permanent Representative of the Russian Federation at the Biological and Toxin Weapons Convention, Meeting of Experts' (unofficial translation), Geneva, 23 Aug. 2010, p. 2. For a summary and other details of the 1925 Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare (Geneva Protocol) see annex A in this volume.

[12] 'Statement by H. E. Ambassador Valery Loshchinin' (note 11), p. 3.

[13] 'Statement by Counsellor Li Yang, Head of the Chinese Delegation at the Meeting of Experts to the Biological Weapons Convention', Geneva, 23 Aug. 2010, p. 2.

resolution.[14] South Africa expressed its willingness to nominate experts on the condition of first reviewing the appendices to the guidelines. The UNODA continued to coordinate efforts to update the technical guidelines and procedures and the roster of experts and laboratories that the UN Secretary-General may draw on when initiating such investigations. The roster and technical guidelines were last updated in 1989. The World Health Organization (WHO) assists with peer review of the draft investigation procedures.[15] At the Meeting of Experts a number of states presented their activities to enhance national emergency response capabilities, including reaction to the use of a biological weapon, through technological advancements, departmental or ministerial restructuring and improved coordination among existing departmental structures. The meeting drew links between national disease surveillance and the International Health Regulations (IHR).[16] International organizations, such as the WHO, the World Organization for Animal Health (OIE) and the UN Food and Agriculture Organization (FAO), described the coordination of their activities to detect unusual events related to animal diseases with potential human consequences, including through the joint Global Early Warning and Response System for Major Animal Diseases, including Zoonoses (GLEWS).[17] Several countries also recounted their activities and experiences gained from investigating so-called biological events, such as the United Kingdom's cases of *Bacillus anthracis* (the causative agent of anthrax) infection from imported drums in 2008, contaminated heroin in 2009–10 and the accidental release of *Aphtea epizooticea* (the causative agent of foot-and-mouth disease) from a laboratory near Pirbright in Surrey in 2007.[18] The Meeting of Experts recognized the need for coordinated activities across government, including law enforcement agencies, and the need to strengthen laboratory networks.

The parties also noted commonalities between states' need to enhance human resource training and logistics support (for disease surveillance, detection and diagnosis, and public health systems) and infrastructure for sampling and analysis of animal, human and plant pathogens. Additionally,

[14] See UN General Assembly Resolution 60/288, 20 Sep. 2006; and Hjalmarsson, K. et al., 'Global watch: the state of biological investigations', *Bulletin of the Atomic Scientists*, vol. 66, no. 4 (July/Aug. 2010), p. 73.

[15] Hjalmarsson (note 14), p. 74.

[16] World Health Organization (WHO), *International Health Regulations (2005)*, 2nd edn (WHO: Geneva, 2008).

[17] See the GLEWS website, <http://www.glews.net>.

[18] *HPA* [Health Protection Agency] *Zoonoses Network Newsletter*, no. 3 (Jan. 2009); and Riley, A., *Report on the Management of an Anthrax Incident in the Scottish Borders July 2006–May 2007* (NHS Borders: Melrose, Dec. 2007). On the cases involving contaminated heroin see Hart, J. and Clevestig, P., 'Reducing security threats from chemical and biological materials', *SIPRI Yearbook 2008*, pp. 450–51. On the accidental release of *Aphtea epizooticea* see Health and Safety Executive (HSE), *Final Report on Potential Breaches of Biosecurity at the Pirbright Site 2007* (HSE: London, 7 Sep. 2007).

the meeting highlighted the need for efficient policy structures to enable prompt decision making in all relevant areas.

In other developments, on 7 August 2010 Russia issued an assessment of the United States' compliance with its arms control and non-proliferation commitments, including with the BTWC and the biological-related commitments under UN Security Council Resolution 1540, which requires states to adopt and enforce laws criminalizing acts by citizens or legal persons related to developing, acquiring, manufacturing, possessing, transporting, transferring or using nuclear, biological and chemical weapons and their means of delivery.[19] Russia claimed that the USA downplays the role of the BTWC in strengthening the biological weapon non-proliferation regime, conducts questionable biodefence work, fails to fully implement biosafety and biosecurity measures, and excludes part of its biodefence establishment from its CBM declarations. In particular, Russia argued that the USA should declare in its annual CBMs the presence of US 'military medical research facilities' in, among other states, Egypt, Indonesia, Kenya, Peru and Thailand. Russia also claimed that the USA avoids declaring traditional biodefence research by shifting some such activities to bioterrorism protection programmes in the private sector.

III. Chemical weapon arms control and disarmament

The CWC is the principal international legal instrument against chemical warfare. No state joined the convention in 2010. Two states had signed but not ratified it; and five states had neither signed nor ratified it.[20]

With respect to national implementation of the CWC, as of November, 185 parties (98 per cent) had designated or established a national authority to, among other things, serve as the national focal point for effective liaison with the OPCW and other states parties, and 87 parties (46 per cent) had adopted legislation covering all key areas required under Article VII on national implementation measures.[21] With respect to efforts to achieve universal membership, the OPCW continued to discuss possible accession with states not party to the convention. Ambassador Ahmet Üzümcü of Turkey, who became the third Director-General of the OPCW in July, wrote letters to all such states requesting an informal dialogue and possible

[19] UN Security Council Resolution 1540, 28 Apr. 2004; and Russian Ministry for Foreign Affairs, 'The facts of the violation by the USA of its obligations in the sphere of nonproliferation of weapons of mass destruction and arms control', 7 Aug. 2010, <http://www.mid.ru/brp_4.nsf/0/CC9C7D192F0EBC5AC325777A0057E1AE>. See section III below for further compliance-related developments.

[20] For a summary and lists of parties and signatories of the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction see annex A in this volume. The states that had not signed or ratified the CWC were Angola, Egypt, North Korea, Somalia and Syria. Israel and Myanmar had signed but not ratified the CWC.

[21] OPCW, 'Opening statement by the Director-General to the Conference of the States Parties at its fifteenth session', OPCW document C-15/DG.14, 29 Nov. 2010, paras 72–73.

visits from the Technical Secretariat to discuss accession to the CWC.[22] Only North Korea declined to respond. In 2009 a Technical Secretariat team visited Israel, and in 2010 Egypt informed the Technical Secretariat that it is prepared to receive a similar visit. At the 15th Conference of the States Parties (CSP), on 29 November–3 December 2010, Üzümcü called on Angola and Myanmar to follow suit and noted that 'exchanges with officials of Myanmar have indicated that ratification of the Convention could be considered positively following the national elections in the country'.[23]

On 13 October Üzümcü summarized the status of implementation of the CWC and noted that the OPCW will be expected to 'progressively concentrate the larger percentage of its resources to the nonproliferation dimension' as the time approaches when chemical weapon stockpiles have been eliminated. Üzümcü cited several such areas, including the need to continue to better focus the number and intensity of chemical industry inspections, the requirement to make 'more rigorous' the 'surveillance of transfers and trade in chemicals', and the need to incorporate OPCW activities into support of implementation of UN Security Council Resolution 1540 and the UN Global Counter-Terrorism Strategy.[24] This last activity is carried out by the OPCW Working Group on Terrorism and includes the development of guidelines for the safety of chemical plants and tabletop exercises to test the preparedness of such facilities against non-state actor threats.[25]

Üzümcü established an independent advisory panel to review the CWC's implementation. Chaired by Ambassador Rolf Ekéus of Sweden, it convened its first meeting in The Hague on 14–15 December and will submit its final report to the Director-General in June 2011.[26] The body consists of experts in diplomacy, industry, and science and technology; its task is to help to develop a strategic vision of the future focus and balance of resources of the OPCW following the end of the destruction of chemical weapon stockpiles.[27] The Director-General will share the report with the

[22] Üzümcü's 4-year term expires in 2014 and may be extended once for a further 4 years. OPCW, 'Ambassdor Ahmet Üzümcü assumes office as new OPCW Director-General', Press release, 29 July 2010, <http://www.opcw.org/news/article/ambassador-ahmet-uezuemcue-assumes-office-as-new-opcw-director-general/>.

[23] OPCW (note 21), paras 77–79.

[24] The UN Global Counter-Terrorism Strategy and its Plan of Action are contained in UN General Assembly Resolution 60/288 (note 14).

[25] 'Statement by H. E. Ambassador Ahmet Üzümcü, Director-General of the Organisation for the Prohibition of Chemical Weapons', Presented at the 65th session of the UN General Assembly, First Committee (Disarmament and International Security), New York, 13 Oct. 2001, <http://www.opcw.org/news/article/opcw-director-general-meets-un-secretary-general-and-addresses-first-committee-of-the-general-assemb-6/>, pp. 1–2.

[26] OPCW (note 21), para. 101.

[27] See Hart, J., 'The future of the Chemical Weapons Convention: towards a conceptualization of medium term planning by the OPCW', Paper presented at the 10th International Symposium on Protection against Chemical and Biological Warfare Agents, Swedish Defence Research Agency (FOI), Stockholm, 8–11 June 2010.

states parties 'in order to assist them in their consideration of issues affecting the evolution' of the OPCW.[28]

Russia criticized the US implementation of the CWC in several respects. Its first criticism referred to one of the 21 conditions that the US Congress attached to US accession to the CWC in 1997: that condition prohibits the transfer of samples taken by OPCW inspectors for out-of-country analysis. Russia also faulted the USA for not providing the OPCW with 'timely information' on the discovery and destruction of chemical weapon agents and munitions recovered by US forces in Iraq in 2003–2008. Additionally, Russia criticized the USA for failing to make available information on any area decontamination work that US forces carried out in Iraq.[29]

On 11–15 October the OPCW held its third major field exercise on the delivery of assistance and protection against chemical weapons in Tunisia (ASSISTEX 3). On 22–23 November the Government of Poland and the Technical Secretariat held a tabletop exercise on how to deal with terrorism.[30] More than 500 people participated in the exercise, including representatives from the UN Office for the Coordination of Humanitarian Affairs (OCHA). On 24–25 November the OPCW hosted a workshop on Article XI of the CWC, on economic and technological development.

In 2010 academic researchers recommended that the OPCW should individually or collectively (via appropriate mechanisms) consider whether the development, production, stockpiling, transfer and use of large-calibre munitions filled with riot control agents (including 2-chlorobenzalmalononitrile, CS) are prohibited under the convention.[31] The International Committee of the Red Cross (ICRC) convened an expert meeting on the challenges and risks to international peace and security posed by incapacitants. The ICRC noted that 'any "de facto" use of "incapacitating agents" in warfare may trigger escalation to the use of classical chemical weapons, as has happened in the past following the use in warfare of riot control and harassing agents'.[32]

[28] The 14 members of the panel serve in their personal capacities. OPCW, 'New advisory panel on future priorities of the OPCW holds first meeting in The Hague', Press release, 16 Dec. 2010, <http://www.opcw.org/news/article/new-advisory-panel-on-future-priorities-of-the-opcw-holds-first-meeting-in-the-hague/>.

[29] Russian Ministry for Foreign Affairs (note 19).

[30] OPCW, 'Table top exercise on preparedness to prevent terrorist attacks involving chemicals held in Poland', Press release, 26 Nov. 2010, <http://www.opcw.org/news/article/table-top-exercise-on-preparedness-to-prevent-terrorist-attacks-involving-chemicals-held-in-poland/>.

[31] Omega Research Foundation, Institute for Security Studies and University of Bradford, 'The production and promotion of 120mm munitions containing CS: a briefing note for the CWC states parties attending CSP-15, 29th November 2010', Paper presented at the 15th Conference of the States Parties to the Chemical Weapons Convention, 29 Nov. 2010, The Hague <http://www.brad.ac.uk/acad/nlw/publications/CSP15pape_Crowley.pdf>.

[32] International Committee of the Red Cross (ICRC), *Incapacitating Chemical Agents: Implications for International Law* (ICRC: Geneva, Oct. 2010), pp. 74–75.

The 15th Conference of the States Parties to the CWC approved the 2011 Programme and Budget of €68 368 500 ($95 million) and an update of the list of permitted inspection equipment with operational requirements and technical specifications.[33] China and Russia provided poster sessions on their chemical weapon destruction activities; Iraq presented a poster session on the use of chemical weapons by the regime of Saddam Hussein; and the US delegation briefed the other delegations for the second consecutive year on the status of the destruction of the US chemical weapon stockpile.

Destruction of chemical weapons

As of 30 September 2010, of 71 194 agent tonnes of declared chemical weapons, 44 131 agent tonnes had been verifiably destroyed; of 8.67 million declared items and chemical weapon containers, 3.95 million had been destroyed. As of November 2010, 13 states had declared 70 former chemical weapon production facilities (CWPFs), of which 43 have been converted to peaceful purposes.[34]

The states that have declared chemical weapon stockpiles to the OPCW are Albania, India, Iraq, South Korea, Libya, Russia and the USA. Albania, India and South Korea have destroyed all of their declared chemical weapons, and all declared Category 3 chemical weapons have also been destroyed.[35] For many years it has been understood that Russia and the USA would be unable to meet the CWC-mandated deadlines mainly due to economic and political constraints. The OPCW Director-General reconfirmed to the CSP that the two countries will not meet the final chemical weapon destruction deadline of April 2012 and stated that the OPCW's Executive Council will continue to seek a 'prudent way forward' in order to 'seek a balanced and constructive solution that preserves the long-term effectiveness of the Convention as a unique instrument for banning chemical weapons from the world'.[36]

In 2010 Iraq's national authority presented an overview of the country's past chemical weapon programme to the OPCW.[37] Iraq declared the pos-

[33] OPCW, 'Decision: scale of assessments for 2011', OPCW document C-15/DEC.7, 2 Dec. 2010; and OPCW, 'Decision, list of approved inspection equipment with operational requirements and technical specifications', OPCW document C-I/DEC.71, 30 Nov. 2010.

[34] The 13 parties are Bosnia and Herzegovina, China, France, India, Iran, Iraq, Japan, South Korea, Libya, Russia, Serbia, the UK and the USA. OPCW (note 21), para. 27.

[35] OPCW (note 21), para. 11. The CWC's Annex on Chemicals comprises 3 'schedules'. Schedule 1 chemicals consists of chemicals and their precursors judged to have few, if any, peaceful applications. Chemicals listed in schedules 2 and 3 have wider peaceful, including commercial, applications. The definition of chemical weapon categories, which is partly based on what schedule a chemical may be listed under, is given in CWC (note 20), Part IV(A) of the Verification Annex, para. 16.

[36] OPCW (note 21), paras 24–25.

[37] The CWC entered into force for Iraq on 12 Feb. 2009. Iraq submitted its initial declaration to the OPCW on 12 Mar. 2009 and provided supplemental information on 1 Dec. 2009. Iraqi National

session of chemical weapon agents, munitions and precursors located at bunkers 13 and 41 of the former Al Muthanna State Establishment, which the UN Special Commission on Iraq (UNSCOM) sealed in the early 1990s.[38] It also declared five former CWPFs and two past chemical weapon research and development facilities: Al Rashad Laboratory (operational 1974–83) and a facility at Al Muthanna (operational 1983–90).[39] All CWPF equipment had been removed or destroyed prior to the entry into force of the CWC for Iraq in 2009.[40] Most of the facilities declared have been looted. Since 2004 multinational explosive ordnance disposal teams in Iraq have destroyed approximately 4000 rounds of chemical ordnance or their remnants.[41]

Iraq intends to destroy the contents of bunkers 13 and 41 at Al Muthanna under OPCW verification. An advisory committee developed a destruction plan in May–August 2010, which the Iraqi Government accepted.[42] In May 2010 Iraq stated that it can support short-term OPCW inspection teams. However, any longer-term verification presence would require either 'normalization of the Iraqi security situation' or a 'large and continuing military guard'.[43] The country is also not able to provide a full accounting of the contents of the bunkers, partly because some relevant official documents are under seal until 2038 or 2068 at the UN archive in New York.[44] Additionally, Iraq has stated that some CWC implementing regulations have not been ratified by its legislature and that any decisions regarding the assessment and destruction of the bunkers' contents 'must take into account the feasibility of carrying out the agreed measures under existing circumstances'.[45] The OPCW Director-General noted that, although 'substantial progress' has been achieved in meetings with Iraqi officials concerning their declarations to the OPCW, 'a number of matters that are a

Monitoring Directorate, 'The past Iraqi CW program', Slides presented at British Defence Science and Technology Laboratory, 13th International Chemical Weapons Demilitarisation Conference, Prague, 24–27 May 2010.

[38] Iraqi National Monitoring Directorate (note 37), p. 25. The site reverted to full Iraqi control following a final June 1994 UNSCOM mission to document its status.

[39] One facility was located at Al Muthanna, 1 at Al Rashad and 3 at Fallujah (Fallujah 1, 2 and 3). Iraqi National Monitoring Directorate (note 37), p. 25, 26.

[40] Iraqi National Monitoring Directorate (note 37), p. 26.

[41] Iraqi National Monitoring Directorate (note 37), p. 29.

[42] 'Statement by H.E. Ambassador Muhammad Abdullah Alhumaimidi, Head of the Department of International Organisations and Cooperation in the Iraqi Ministry of Foreign Affairs at the fifteenth session of the Conference of the States Parties', OPCW document C-15/NAT.18, 30 Nov. 2010, p. 2.

[43] Iraqi National Monitoring Directorate (note 37), p. 57.

[44] Iraqi National Monitoring Directorate (note 37), p. 63. UNSCOM and UN Monitoring, Verification and Inspection Commission (UNMOVIC) files are in the custody of the UN's Archive and Records Management Section in the Department of Management, where they will remain sealed separately from other UN archival material for 30–60 years effective from 1 Mar. 2008. United Nations, Secretariat, 'Records and archives of the United Nations Monitoring, Verification and Inspection Commission', Secretary-General's bulletin, ST/SGB/2009/12, 1 Aug. 2009. Iraq also did not always maintain accurate records and many were destroyed.

[45] Iraqi National Monitoring Directorate (note 37), p. 63.

prerequisite for the identification of appropriate methods' for the destruction of the declared chemical weapons still require 'further consideration or clarification'.[46] In particular, the technical feasibility of opening the storage bunkers and the physical safety of OPCW inspectors remain uncertain.

Iran accused the UK and the USA of violating the CWC by 'refraining from declaring the discovered chemical weapons in Iraq and subsequently destroy[ing] them'.[47] Iran described the British and US actions as 'hasty and unilateral' and stated that it had not received satisfactory responses from the two countries under the provisions of Article IX on consultations, cooperation and fact-finding. It also said that the other parties to the CWC that were part of the 'coalition of the willing' which invaded Iraq in 2003 'should also be held accountable [by the OPCW] for their actions'.[48] The UK strongly denied that it had violated CWC provisions by, for example, not submitting to the OPCW a chemical weapon destruction plan that might have resulted in the dispatch of OPCW inspection teams to Iraq to verify the destruction of the weapons. The UK said its actions to secure and destroy chemical weapons in Iraq were exceptional and carried out in circumstances not envisaged by the CWC negotiators and that the UK had provided sufficient transparency to Iranian information requests at the OPCW.[49] The UK also described the destruction of chemical weapon munitions that occurred after May 2004, when the sovereign authority of the state had been returned to the Iraqis. Sixteen 122-mm Al Borak canisters suspected to be filled with sarin were turned over by Iraqis to British disposal teams in Jan. 2006 for destruction. Five 122-mm Al Borak canisters suspected to be filled with sarin were similarly transferred in May 2006.[50]

In October WikiLeaks placed on its website a second batch of approximately 392 000 restricted US Government documents concerning Iraq since the 2003 British–US-led invasion of the country—the Iraq War Logs. The leaked reports contain hundreds of references to chemical and bio-

[46] OPCW (note 21), para. 23.

[47] The full context of the accusation is difficult to ascertain. However, it is probably a partial reflection of broader political tension between Iran and the USA outside the CWC regime.

[48] 'Statement by H. E. Mr Mohammad Mahdi Akhondzadeh, Deputy [Iranian] Foreign Minister for Legal and International Affairs at the fifteenth session of the Conference of the States [Parties]', OPCW document C-15/NAT.15, 29 Nov. 2010, pp. 3–4. On Iran's legal argument see 'The Islamic Republic of Iran's view and concern over the discovery and destruction of chemical weapons by the United States and the United Kingdom in Iraq', OPCW document C-15/NAT.1, 29 Nov. 2010.

[49] The OPCW Executive Council is continuing to develop procedures for the verified destruction of chemical weapons in cases where there is a high risk of injury or death to OPCW personnel. 'Response by the United Kingdom to a request for clarification submitted under Article IX, paragraph 2, of the Chemical Weapons Convention', OPCW document C-15/NAT.11, 30 Nov. 2010.

[50] 'Response by the United Kingdom to a request for clarification submitted under Article IX, paragraph 2, of the Chemical Weapons Convention', OPCW document C-15/NAT.11, 30 Nov. 2010. See also 'Statement by Ambassador Robert P. Mikulak, United States Permanent Representative at the fifteenth session of the Conference of the States Parties', OPCW document C-15/NAT.3, 29 Nov. 2010, p. 5.

logical weapons. Most reports detailed suspicions that were later proved groundless. The British and US forces did not uncover state-run functional stockpiles or programmes, but the logs indicate that insurgents accessed some chemical weapons (or their remnants). A January 2006 log claims that insurgents smuggled a 'neuroparalytic' chemical weapon into Iraq from Iran. According to the reports, the same month British and US forces arrested 'chemical weapon specialists' in Balad, Iraq, and intelligence reports referred to another chemical weapon 'expert'.[51]

In April 2010 Libya started the pilot-scale hydrolysis and neutralization of, among other chemicals, 4.4 tonnes of phosphorus trichloride at Ruwagha. Phosphorus trichloride is a potential precursor for organophosphorus nerve agents. However, Libya had apparently intended to use it as a chlorinating agent for the production of sulphur mustard. The country accumulated approximately 23 tonnes of sulphur mustard.[52] The CSP also extended the intermediate deadline for Libya to destroy its Category 1 chemical weapons.[53]

As of 31 October, Russia had destroyed 19 423 tonnes (48.6 per cent) of its Category 1 chemical weapons.[54] Destruction operations have been completed at Gorny, Saratov oblast, and Kambarka, Udmurtia Republic. On 26 November a chemical weapon destruction facility (CWDF) began operation at Pochep.[55] Russia plans to open a CWDF at Kizner in 2011 and to increase the capacities of the currently operating CWDFs at Leonidovka, Maradykovsky and Shchuchye.

As of 21 November, the USA had destroyed 81.6 per cent of its Category 1 chemical weapons at an estimated total cost of $22.1 billion. The destroyed chemical weapons included all of the USA's binary chemical weapons, 96.6 per cent of its organophosphorus nerve agents and 82.2 per cent of its chemical weapon rockets. Chemical weapon stocks remain at five of the original nine sites.[56] Of these five sites, CWDF pilot plants were under construction at Blue Grass, Kentucky, and Pueblo, Colorado. The projected dates of operation for these CWDFs are 2014–17 and 2018–21, respectively.[57]

[51] Schachtman, N., 'WikiLeaks show WMD hunt continued in Iraq—with surprising results', *Wired*, 23 Oct. 2010; and Shachtman, N. and Ackerman, S., 'Chemical weapons, Iranian agents and massive death tolls exposed in WikiLeaks' Iraq docs', *Wired*, 22 Oct. 2010.

[52] These operations will be optimized and resumed in 2011. OPCW (note 21), para. 14.

[53] OPCW, 'Decision: extension of the intermediate deadlines for the destruction by the Libyan Arab Jamahiriya of its category 1 chemical weapons', OPCW document C-15/DEC.3, 30 Nov. 2010.

[54] OPCW (note 21), para. 16.

[55] [Address by Viktor Kholstov, the head of the delegation of the Russian Federation at the 15th session of the Conference of the States Parties to the Convention on the Prohibition of Chemical Weapons], 29 Nov.–3 Dec. 2010 (in Russian), p. 2.

[56] Weber, A. C., 'United States chemical demilitarization program', Presented by the US delegation to the 15th session of the Conference of the States Parties to the CWC, The Hague, 1 Dec. 2010, p. 2; and 'Statement by Ambassador Robert P. Mikulak' (note 50), p. 4.

[57] Weber (note 56), p. 8.

Old, abandoned and sea-dumped chemical weapons

Old, abandoned and sea-dumped chemical weapons are a continuing environmental and human safety concern. As of December 2010, 3 countries had declared that abandoned chemical weapons (ACWs) are present on their territories, and 13 countries had declared that they possess old chemical weapons (OCWs).[58]

Since 2001 France has consolidated OCWs from former World War I battlefields in the north of the country inside former nuclear missile launch bunkers at Mailly-le-Camp, Suippes, north-eastern France. As of 2010 approximately 240 tonnes had been collected at this site at a rate of approximately 20 tonnes per annum. France is still finalizing plans for the construction of a destruction facility, and the General Directorate for Ordnance has estimated that destruction operations could begin in 2015.[59]

In 2010 China and Japan continued to carry out joint investigation, excavation and recovery operations in and around 10 Chinese cities of a currently estimated 330 000 ACWs left by Japan during World War II. Approximately 70 ACW sites have been confirmed to exist in 17 provinces, and approximately 47 000 ACWs have been excavated and placed in temporary storage at 31 facilities.[60] The ACW sites are located throughout the east of China, but most are concentrated in the north-east. Destruction operations will be concentrated at Haerbaling, Jilin province, and Nanjing, Jiangsu province.[61] China and Japan will jointly operate two mobile destruction units and one fixed destruction facility; between 1 January and 25 November 2010 the two countries excavated 355 ACWs.[62] On 30 July bidding ended on two test destruction units for use in Haerbaling, a detonation chamber and a static kiln detonation furnace. On 12 October destruction operations began at Nanjing and, as of 24 November,

[58] The countries that have declared ACWs to the OPCW are China, Italy and Panama. The countries that have declared OCWs to the OPCW are Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, the Marshall Islands, Russia, Slovenia, the UK and the USA. ACWs are defined as chemical weapons that were abandoned by a state after 1 Jan. 1925 on the territory of another state without the permission of the latter. CWC (note 20), Article II, para. 6. OCWs are defined as chemical weapons that were produced before 1925 or chemical weapons produced between 1925 and 1946 that have deteriorated to such an extent that they are no longer usable in the manner in which they were designed. CWC (note 20), Article II, para. 5. For information on countries not discussed here see CBW chapters in previous editions of the SIPRI Yearbook.

[59] Laporte, S., 'Vent de panique sur les obus chimiques du camp de Suippes' [Wave of panic over the chemical warfare shells at Suippes facility], L'Union, 14 Sep. 2010.

[60] China poster session, 15th Conference of the States Parties to the Chemical Weapons Convention, 29 Nov.–3 Dec. 2010, The Hague.

[61] China poster session (note 60).

[62] For an overview of emergency response preparations in case of accidents during recovery and destruction operations see Guochua, S. and Haiyan, W., 'PRC S&T: medical supports for processing abandoned Japanese WW II chem weapons', *Jiefangiun Yufang Yixue Zazhi* (Tianjin) [Journal of Preventive Medicine of the Chinese People's Liberation Army], 1 June 2010, Translation from Chinese, Open Source Center.

5474 ACWs (15.4 per cent of those stored at the location) had been destroyed.[63] A mobile destruction unit will operate at Nanjing for approximately 12 months in order to destroy an estimated 35 000 ACWs recovered at the site and in nearby provinces. The ACWs comprise at least 27 ACW munition types (canisters, shells and air bombs) filled (singly or in mixtures) with diphenyl cyanoarsine, diphenyl chloroarsine, disphosgene and hydrocyanide (HCN), lewisite and sulphur mustard. Some munitions were dumped in water (e.g. at Tianjin, Tianjin province).

In March 2010 a report indicated that the Russian military had left behind some chemical warfare material, including the nerve agent sarin, in the basement of a building at a former base on Bol'shoy Ussuriysk Island.[64]

In the USA in June 2010 dumped sulphur mustard contaminated workers on a clam boat off the coast of New York.[65] The USA dumped large quantities of conventional and chemical munitions in its coastal waters up until the 1960s.[66] In 2010 the University of Hawai'i and a private company released the report of a three-year study that concluded that dumped chemical weapons pose no appreciable threat to humans or the environment for those areas studied off the coast of Hawaii.[67]

The UN General Assembly passed a resolution on dumped chemical weapon munitions that initiates a process of consultation that may lead to expanded efforts to recover and remediate dumped munitions that are deemed to pose a particular risk.[68] The resolution was originally tabled in the UN First Committee, which deals with issues affecting international peace and security, but was then passed to the Second Committee, which deals with economic and financial affairs, including environmental issues. The resolution (*a*) notes the importance of raising awareness of the environmental effects originating from dumped chemical weapons; (*b*) invites the UN member states and international and regional organiza-

[63] 'Statement by H. E. Mr Takashi Koezuka, Ambassador of Japan and Permanent Representative of Japan to the OPCW at the fifteenth session of the Conference of the States Parties of the OPCW', The Hague, 29 Nov. 2010, p. 4. China gives the figure of 5090 ACWs destroyed as of 24 Nov. China poster session (note 60).

[64] Isaeva, K., [The military forgot a chemical stock at Bol'shoy Ussuriysk], *Komsomol'skaya Pravda*, 18 Mar. 2010 (in Russian).

[65] Lindsay, J., 'Officials: fishermen caught mustard gas off NY', Associated Press, 7 June 2010.

[66] See e.g Spiess, F. N. and Sanders, S. M., *Survey of CHASE Disposal Area* (*NITNATOW*), SIO Ref. 71-33, Report no. MPL-U-97/71, unclassified (University of San Diego, Marine Physical Laboratory of the Scripps Institution of Oceanography: San Diego, CA, 28 Dec. 1971); and Ferer, K. M., *Fifth Post-Dump Survey of the CHASE X Disposal Site*, unclassified (Naval Research Laboratory: Washington, DC, Mar. 1975).

[67] University of Hawai'i at Manoa and Environet, Inc., *Hawai'i Undersea Military Munitions Assessment (HUMMA): Final Investigation Report for Hawaii–05, South of Pearl Harbor, O'ahu Hawai'i* (University of Hawai'i at Manoa and Environet: Honolulu, HI, June 2010). See also Hawai'i Undersea Military Munitions Assessment (HUMMA) Project, <http://www.hummaproject.com>.

[68] United Nations, General Assembly, 'Cooperative measures to assess and increase awareness of environmental effects related to waste originating from chemical munitions dumped at sea', A/C.2/65/L.32/Rev.1, 24 Nov. 2010.

tions to monitor such environmental effects; and (*c*) requests the UN Secretary-General to seek the views of the UN member states and relevant regional and international organizations on this topic and to report to the 68th session of the UN General Assembly in 2013.[69]

The 2010 Helsinki Commission (HELCOM) Moscow ministerial meeting established an ad hoc expert group (HELCOM MUNI) to update and review the existing information on dumped chemical weapons.[70] In addition to reviewing information on dumped chemical weapons, HELCOM MUNI will evaluate information on phosphorus munitions in the Baltic Sea and at a dumping site at Måseskär, Sweden.

IV. Allegations of CBW development, use and prior programmes

Allegations of CBW targeting civilians continued in 2010 with little official or otherwise authoritative reporting to clarify them. This led, for example, to further public speculation about the circumstances concerning contaminated heroin in Europe and the reported gas attacks on girls' schools in Afghanistan.

The US Department of State released a status-of-proliferation report in 2010, the first such report since 2005, addressing the activities of China, Cuba, Egypt, India, Iran, Iraq, Libya, North Korea, Pakistan, Russia and Syria and their relation to the BTWC. With respect to the CWC, the report divided compliance issues into cases where (*a*) the parties have responded to 'expressions of concern and taken concrete steps to come into compliance with their obligations', (*b*) the states have 'inherited materials of predecessor governments' activities and have thus far been unable to reconcile past programmes and activities', and (*c*) the states 'are involved in activities that are a cause of significant compliance concern'.[71] Unusually, the report described in some detail the USA's interpretation of the obligations of parties to the CWC and provided general context about the US position, including how best to assess chemical warfare mobilization intent in order to better determine whether a violation has occurred. The report

[69] United Nations (note 68).

[70] Pyhälä, M., 'Activities of the Helsinki Commission with regards to chemical munitions dumped in the Baltic Sea', Slide presentation at the conference 'MIREMAR: Minimizing Risks for the Environment in Marine Ammunition Removal in the Baltic and North Sea', Neumünster, 16–18 Nov. 2010, <http://schleswig-holstein.nabu.de/themen/meeresschutz/miremar/>. The ad hoc Working Group on Dumped Chemical Munitions (HELCOM CHEMU) operated in 1992–95. See HELCOM, 'Final Report of the ad hoc Working Group on Dumped Chemical Munition (HELCOM CHEMU) to the 16th Meeting of the Helsinki Commission (March 1995)', Mar. 1995, <http://www.helcom.fi/environment2/hazsubs/en_GB/chemu/>.

[71] US Department of State, Bureau of Verification, Compliance, and Implementation, *Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments* (US Department of State: Washington, DC, July 2010), p. 37.

found, for example, that 'available information does not allow' the USA 'to confirm whether China has fully declared or explained its historical activities, including [chemical weapon (CW)] production, disposition of CW agents, and transfer of CW agents to another country' and that China has not declared a nitrogen mustard spill at a pharmaceutical facility.[72]

Human rights advocates accused Turkey of using chemical weapons against the Kurds in 2010, and a German forensic expert stated that it was highly probable that eight Kurds had died 'due to the use of chemical substances'.[73] Turkey responded that the allegations were not new and 'pure PKK [Partiya Karkerên Kurdistan, Kurdistan Workers' Party] propaganda'.[74]

Reports emerged in May 2010 of severe crop damage caused by an unusual leaf blight affecting poppies in Helmand and Kandahar provinces in south-western Afghanistan, a region estimated to produce up to 96 per cent of the country's opium.[75] According to the UN Office on Drugs and Crime (UNODC) Afghanistan opium survey for 2010, this led to an estimated 48 per cent decrease in opium yields from 2009.[76] Farmers in the affected regions accused British and US forces of using a biological agent to cause the blight in an effort to hamper the opium production and trade that is essential for the continued Taliban insurgency in the region. *Pleospora papaveracea*, a fungus commonly found around the world, allegedly caused the blight.[77] However, a report of the UNODC's analysis of the Afghan poppy blight was not made public in 2010.

Eight gas attacks on Afghan schoolgirls were reported in 2010, in Kunduz province, in Kabul and in Sar-e Pul province.[78] Authorities believed the

[72] US Department of State (note 71), p. 43.

[73] Steinvorth, D. and Musharbash, Y., 'Turkey accused of using chemical weapons against PKK', *Der Spiegel*, 12 Aug. 2010.

[74] 'Turkish officials deny Der Spiegel's claim on use of chemical weapons', *Hürriyet Daily News*, 13 Aug. 2010.

[75] Arbabzadah, N., 'Killer fungus is no mystery to Afghan poppy growers', *The Guardian*, 17 May 2010. See also UN Office on Drugs and Crime (UNODC) and Afghan Ministry of Counter Narcotics, *Afghanistan Opium Survey 2010: Summary Findings* (UNODC: Vienna, Sep. 2010).

[76] UN Office on Drugs and Crime and Afghan Ministry of Counter Narcotics (note 75).

[77] Bailey, B. A. et al., 'Evaluation of infection processes and resulting disease caused by *Dendryphion penicillatum* and *Pleospora papaveracea* on *Papaver somniferum*', *Phytopathology*, vol. 90, no. 7 (July 2000), pp. 699–709; O'Neill, N. R. et al., '*Dendryphion penicillatum* and *Pleospora papaveracea*, destructive seedborne pathogens and potential mycoherbicides for *Papaver somniferum*', *Phytopathology*, vol. 90, no. 7 (July 2000), pp. 691–98; and Bailey, B. A. et al., 'Nep1 protein from *Fusarium oxysporum* enhances biological control of opium poppy by *Pleospora papaveracea*', *Phytopathology*, vol. 90, no. 8 (Aug. 2000), pp. 812–18.

[78] 'Taliban suspected of sickening female students', Afghanistan Crossroads blog, CNN World, 26 Apr. 2010, <http://afghanistan.blogs.cnn.com/2010/04/26/taliban-suspected-of-sickening-female-students/>; Hamed, M., 'Afghan girls fall ill in suspected gas attack', Reuters, 25 Apr. 2010; Starkey, J., 'Girls targeted in "Taliban gas attack"', *The Independent*, 13 May 2009; Shalizi, H. and Mohammad Hamed, M., 'Afghan girls hit again by suspected gas attack', Reuters, 11 May 2010; 'Another suspected poisoning at Afghan girls' school', Afghanistan Crossroads blog, CNN World, 24 June 2010, <http://afghanistan.blogs.cnn.com/2010/06/24/another-suspected-poisoning-at-afghan-girls-school/>; and

attacks to be the work of conservative Afghan groups that oppose allowing education for girls, which was prohibited in 1996–2001 during the Taliban regime. Analysis of blood samples was inconclusive according to the Health Ministry in Kunduz, probably due to poor equipment, and the samples were sent to Kabul for further analysis.[79] The identity of the causative agent was not made public. However, some girls and teachers reported a sweet smell before the onset of symptoms, suggesting parallels with the chemical Mallatin, a trade name for a mixture that contains the organophosphate malathion, which is commonly used by Afghan farmers to poison birds that damage crops.[80]

The first fundamental study of the Dutch chemical weapon programme, which began in 1915, was published in 2010. It showed that, beginning in World War I, the Netherlands sent technical missions to France (e.g. observing field tests in France during World War I) and Belgium. The Netherlands also participated in French chemical weapon field tests in Algeria in the 1950s at Beni Ounif. According to the study, Deelen, Harskamp and Vlieland were Dutch test grounds, and the Dutch research establishment was located at Rijswijk; Belgian field test facilities were situated at Eisenborn and Zoersel, and the Belgian research establishment was at Vilvoorde. The study identified a French chemical weapon field test facility at Mourmelon and French chemical weapon research establishments at Aubervilliers and Vert-le-Petit.[81]

In the USA, George Washington University's National Security Archive placed on the Internet documents that shed light on the Soviet biological weapon programme that were collected by a now deceased staff member of the Soviet Central Committee.[82]

V. CBW prevention, response and remediation

A variety of disparate, yet connected, activities that serve to promote or strengthen prevention, response and remediation of CBW continued in

Boone, J., 'Taliban poison attack or mass hysteria? Chaos hits another Kabul girls' school', *The Guardian*, 25 Aug. 2010.

[79] 'Afghan school girls "poisoned"', Al Jazeera, 26 Apr. 2010, <http://english.aljazeera.net/news/asia/2010/04/201042663711279658.html>.

[80] IB Consultancy, 'Current events report: Afghan school girls chemical attacks', 25 June 2010, <http://www.ibconsultancy.eu/wp-content/uploads/2010/06/IBC-CER1.pdf>.

[81] Roozenbeek, H. and van Woensel, J., *De Geest in de Fles: De Omgang van de Nederlandse Defensieorganisatie met Chemesche Strijdsmeddelen 1915–97* [The genie in the bottle: the development by the Dutch defence organization of chemical warfare agents in 1915–97] (Boom: Amsterdam, 2010), p. 241.

[82] *Washington Post* reporter David E. Hoffman was the first to publicize these papers, which are now located at the Hoover Institution at Stanford University in Stanford, CA. US National Security Archive, 'Cracking open the Soviet biological weapons system, 1990', 6 May 2010, <http://www2.gwu.edu/~nsarchiv/NSAEBB/NSAEBB315/>; and Hoffman, D. E., *The Dead Hand: The Untold Story of the Cold War Arms Race and its Dangerous Legacy* (Doubleday: New York, 2009).

2010. In February the US Department of Justice closed the anthrax letter investigation, which began in October 2001 and was conducted by the Federal Bureau of Investigation (FBI), and reiterated that Bruce E. Ivins was responsible for the letters and acted alone. Thus, the Department of Justice is no longer bound by some of its secrecy requirements and is free to release further information.[83] The FBI posted more than 2700 pages of documentation about the case on the Internet, but it requested in December that the National Academy of Sciences (NAS) delay issuing its evaluation of the scientific basis of the bureau's conclusions that Ivins acted alone in order to consider a further 500 pages of recently declassified material.[84] The 15-member NAS panel agreed to delay its report in order to take this material into account.[85]

Incidents of accidental infection underlined the continuing need to improve prevention, response and remediation capacity to meet possible future CBW threats. On 16 December 2009 British health agencies reported that a heroin user from Glasgow had died of *B. anthracis* infection, with heroin as the likely source of infection.[86] Additional cases of infection and some deaths caused by the contaminated heroin occurred in January–July 2010.[87] The probable origin of the *B. anthracis* was soil that became tainted in connection with harvesting or close proximity to contaminated animal products. The heroin originated from Afghanistan and could also have become contaminated with bone meal that was used as a cutting agent.[88]

The United Nations Office for Disarmament Affairs

The UN Secretary-General has the authority to send teams to investigate allegations of use of a chemical or biological weapon, and the WHO's Global Alert and Response Department has developed mechanisms to pro-

[83] US Department of Justice, Office of Public Affairs, 'Justice Department and FBI announce formal conclusion of investigation into 2001 anthrax attacks', Press release, 19 Feb. 2010, <http://www.justice.gov/opa/pr/2010/February/10-nsd-166.html>.

[84] US Federal Bureau of Investigation, 'Amerithrax or anthrax investigation', <http://www.fbi.gov/about-us/history/famous-cases/anthrax-amerithrax/amerithrax-investigation>.

[85] Shane, S., 'F.B.I. asks panel to delay report on anthrax inquiry', *New York Times*, 9 Dec. 2010.

[86] 'Anthrax found in Glasgow heroin users', BBC News, 18 Dec. 2009, <http://news.bbc.co.uk/2/hi/8419113.stm>.

[87] European Centre for Disease Prevention and Control (ECDC) and European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), 'Anthrax outbreak among drug users in UK and Germany—update 18 May 2010; Joint ECDC and EMCDDA Threat Assessment', 19 May, 2010, <http://www.ecdc.europa.eu/en/activities/sciadvice/Lists/ECDC Reviews/ECDC_DispForm.aspx?ID=827>; and Health Protection Scotland, 'Final tally of anthrax cases announced', News release, 23 Dec. 2010, <http://www.hps.scot.nhs.uk/news/SPdetail.aspx?id=370>.

[88] Doward, J. and Saville, J., 'Anthrax deaths expose addicts' plight', *The Observer*, 11 July 2010; and Davies, D. G. and Harvey, R. W. S., 'Anthrax infection in bone meal from various countries of origin', *Journal of Hygiene*, vol. 70, no. 3 (Sep. 1972), pp. 455–57.

vide support to such teams, including the possible sharing of equipment.[89] The WHO's role focuses 'solely on its public health mandate and public health interventions, while avoiding politically more sensitive determinations concerning biological weapons use'.[90]

In 2010 the UN and the WHO concluded a memorandum of understanding on investigating the alleged use of chemical, biological or toxin weapons and the UNODA placed the technical guidelines for such investigations on the Internet.[91] The allegations of the deliberate destruction of poppy fields in Afghanistan highlighted the relevance and importance of agreed and transparent sampling and analysis procedures to help inform determination of whether the outbreak was deliberate.

Scientific research

Researchers from Carnegie Mellon University in Pittsburgh, Pennsylvania, USA, and Universidade Catolica Portuguesa in Lisbon, Portugal, carried out a bibliometric analysis examining the provisions of the 2001 USA Patriot Act and the 2002 Bioterrorism Preparedness Act.[92] The acts require all US entities that possess, use or transport certain listed agents, known as 'select agents', to register with the US Centers for Disease Control and Prevention or the US Department of Agriculture. Personnel who have access to these agents must undergo a security risk assessment, and the Department of Justice is mandated to perform background checks on such personnel. Some categories of people with certain criminal histories and citizens of states that appear on the US Attorney General's list of terrorist states are prohibited from working with select agents. The acts also require extensive biosecurity upgrades of many facilities.[93] Concern has therefore been expressed that some work with such pathogens would be inhibited. The researchers from Carnegie Mellon University and Universidade Catolica

[89] The authority is based on UN General Assembly Resolution 37/98D, 13 Dec. 1982. The OPCW would have principal responsibility for investigation of allegations of chemical weapon use. Hjalmarsson (note 14), p. 74.

[90] Hjalmarsson (note 14), p. 74.

[91] UN Office for Disarmament Affairs, 'Updated appendices to the technical guidelines and procedures', <http://www.un.org/disarmament/WMD/Secretary-General_Mechanism/appendicies/>.

[92] Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism (USA PATRIOT) Act of 2001, US Public Law 107-56, approved 26 Oct. 2001; and Public Health Security and Bioterrorism Preparedness and Response Act of 2002, US Public Law 107-188, approved 12 June 2002—both available via <http://www.gpo.gov/fdsys/>. See also Dias, M. B. et al., 'Effects of the USA PATRIOT Act and the 2002 Bioterrorism Preparedness Act on select agent research in the United States', *Proceedings of the National Academy of Sciences*, vol. 107, no. 21 (25 May 2010), pp. 9556–61.

[93] Select agent regulations are 'Possession of biological agents and toxins, 7 CFR, part 331'; 'Possession, use, and transfer of select agents and toxins, 9 CRF, part 121'; and 'Select agents and toxins, 42 CFR, part 73'. See US Animal and Plant Health Inspection Service and Centers for Disease Control and Prevention, National Select Agent Registry, 'Select agents and toxins', <http://www.selectagents.gov/Select Agents and Toxins List.html>.

Portuguesa sought to determine (*a*) if the volume of select agent research contracted following the passage of the laws; (*b*) if the laws accelerated a switch from research involving live select agent to methods involving avirulent or subcellular fractions of the pathogens studied; (*c*) if fewer researchers now chose to work with restricted organisms; and (*d*) if the patterns for scientific collaboration changed, including collaboration with international partners.

To address these questions, another team of researchers examined, with mixed results, publications involving two pathogens that appear on the US select agent list, *Bacillis anthracis* and Ebola virus, and a control pathogen, *Klebsiella pneumoniae*, that does not. They determined that the number of articles co-authored by international and US scientists grew for Ebola virus research but contracted for *B. anthracis* research that did not involve the possession of a viable, virulent bacterium. They found that research had not become centralized around a limited number of 'gatekeeper institutions' but, in the select agent field, there was an increased turnover rate of authors that the control pathogen research group did not demonstrate. Measured by the number of research papers published per million US research dollars awarded, the authors also estimated an increase in the cost of conducting research with select agents by a factor of between two and five. One reason why US researchers did not stop work on select agents may have been the increase in biodefence funding.[94]

On 16 December 2010 the US Presidential Commission for the Study of Bioethical Issues (PCSBI) released a report on bioethical issues stemming from advances in biomedicine and related areas of science and technology; it found no need to temporarily stop synthetic biology research or to develop new regulations.[95] The report also recommended awareness raising and education on bioethical issues. A letter signed by 58 international environmental groups called for a moratorium on the release and use of 'synthetic organisms' in the absence of further research on risks and regulation.[96] In the context of biological arms control and non-proliferation, synthetic biology has often been cited as a developing area of science and technology that should be subject to effective oversight and control to prevent the misuse of dual-purpose technology and associated material.[97] Drew Endy and J. Craig Venter, whose work has driven and created much of the synthetic biology field, assessed the PCSBI report as balanced.[98]

[94] Dias et al. (note 92).

[95] Presidential Commission for the Study of Bioethical Issues (PCSBI), *New Directions: The Ethics of Synthetic Biology and Emerging Technologies* (PCSBI: Washington, DC, Dec. 2010).

[96] Vergano, D., 'Synthetic biology bioethics panel reaction round-up', *USA Today*, 16 Dec. 2010.

[97] E.g. see Tucker, J. B., 'The convergence of biology and chemistry: implications for arms control verification', *Bulletin of the Atomic Scientists*, vol. 66, no. 6 (Nov./Dec. 2010), pp. 56–66.

[98] See the J. Craig Venter Institute website, <http://www.jcvi.org/>; and the Endy Lab website, <http://openwetware.org/wiki/Endy_Lab>.

In 2010 the US Department of Defense (DOD) asked the JASON defence advisory board, an informal scientific and technical advisory body, to consider the impact of the coming decade's advances in genome sequencing technology as both the cost and speed of whole genome sequencing are increasing and the technology is becoming available to the general public. JASON is tasked to consider opportunities and challenges for the US military and has called for the systematic collection and archiving of all US military personnel's DNA to determine the phenotypes of 'greatest relevance' to the DOD.[99]

In 2009 JASON recommended that strain collection efforts by the US National Biodefense Forensic Analysis Center and the US National Bioforensic Reference Collection should be expanded and integrated into a relational database system that includes genetic, geographic and 'other contextual information' and that high-fidelity sequencing should be carried out for 'a few representative strains'.[100]

JASON has argued that the DOD—with its well-defined, healthy population and vast medical health records—is in a position to facilitate longitudinal studies to correlate genetic genotypes with phenotypes and could exploit personal genomic technologies in partnership with academia and industry. Such activities (*a*) would allow improvements in important areas, such as predicting genetic variation (genotype) and individual susceptibility to diseases (phenotype); (*b*) would show how patients would respond to specific treatments; (*c*) would answer questions on the type and usefulness of specific genetic information; (*d*) would enable the assessment of current and emerging related technologies; (*e*) would elucidate the effect of biological determinants in disease on information gathering and technology; and (*f*) would determine how best to handle the resulting genomic information in a secure way.

JASON concluded that personal genomics is technically mature but many challenges remain in interpreting the complex information through bioinformatics. JASON emphasized the DOD's potential leading role in advancing personal genomics, either as a major contributor or by having a limited role in research, to investigate aspects of special interest for the military that are not of general interest to the civilian sector.

In another development, Russia indicated that the Moscow-based International Science and Technology Center (ISTC), established in 1992, will close by 2014 or 2015.[101] The ISTC's mandate is to help ensure that scientists with dual-purpose expertise remain usefully employed rather than

[99] JASON, *The $100 Genome: Implications for the DoD* (Mitre Corporation: McLean, VA, Dec. 2010), p. 5.

[100] The report was declassified in 2010. JASON, *Microbial Forensics* (Mitre Corporation: McLean, VA, May 2009), p. 3.

[101] Brumfiel, G., 'Curtain falls on collaborative work', *Nature*, 4 Nov. 2010, p. 16.

conducting work in support of possible weapon programmes (e.g. biological weapon programmes) either domestically or abroad. In 1994–2009 Canada, the EU, Japan and the USA provided approximately $837 million to fund the centre.[102]

VI. Conclusions

Scientific and technological developments such as the increasing overlap between the chemical and biological sciences are a major challenge to the BTWC and the CWC and one that will be highly relevant in coming years. How states decide to meet this challenge will have consequences for the conventions, in either weakening or strengthening them, as well as for the security of states themselves.

The BTWC and CWC should enjoy universal membership and be fully implemented as a means to reduce the possibility for 'safe havens', where prohibited CBW activity could occur. The lack of progress in achieving universality for the BTWC is of particular concern in that it undermines efforts, together with those carried out under UN Security Council Resolution 1540, to raise barriers against chemical and biological terrorism. Exercises like ASSISTEX 3 reflect efforts by the parties to these conventions to help ensure that these regimes are relevant against threats from non-state actors.

The parties to the CWC must achieve a clearer understanding of the role of the convention in support of international peace and security once chemical weapon stockpiles are essentially destroyed sometime after 2012. Failure to do so risks undermining the perceived daily operational-level value of the regime. Determining what constitutes non-compliance with a convention obligation is a recurring theme that states must continue to actively and constructively address. Allegations of CBW use are of at least three main types: disinformation, misunderstanding and actual use. In order to maintain the international prohibition against CBW, states and other interested actors should continue to consider political and technical factors, such as a political inclination to see preferred outcomes and how they relate to degrees of scientific certainty from sampling and analysis of possible CBW degradation products.

[102] Brumfiel (note 101).