



Meeting the Challenges of Chemical and Biological Weapons: Strengthening the Chemical and Biological Disarmament and Non-proliferation Regimes

OPEN ACCESS

Edited by:

Luca Corazzini,
Ca' Foscari University of Venice, Italy

Reviewed by:

Varoon Singh,
Ghent University, Belgium
Leandro Elia,
Marche Polytechnic University, Italy
Stefano Costanzi,
American University, United States

*Correspondence:

Lijun Shang
l.shang@londonmet.ac.uk

Specialty section:

This article was submitted to
Elections and Representation,
a section of the journal
Frontiers in Political Science

Received: 30 October 2021

Accepted: 07 February 2022

Published: 26 April 2022

Citation:

Edwards B, Novossiolova T,
Crowley M, Whitby S, Dando M and
Shang L (2022) Meeting the
Challenges of Chemical and Biological
Weapons: Strengthening the
Chemical and Biological Disarmament
and Non-proliferation Regimes.
Front. Polit. Sci. 4:805426.
doi: 10.3389/fpos.2022.805426

**Brett Edwards¹, Tatyana Novossiolova², Michael Crowley³, Simon Whitby³,
Malcolm Dando³ and Lijun Shang^{4,5*}**

¹ Department of Politics, Languages, and International Studies, University of Bath, Bath, United Kingdom, ² Centre for the Study of Democracy, Sofia, Bulgaria, ³ School of Social Sciences, University of Bradford, Bradford, United Kingdom, ⁴ School of Human Sciences, London Metropolitan University, London, United Kingdom, ⁵ Biological Security Research Centre, London, United Kingdom

In this report, we identify some of the key technical and political challenges currently facing the broader Chemical and Biological Weapon (CBW) regime- with a particular emphasis on major forthcoming diplomatic meetings. Most significantly the Ninth Review Conference of the Biological and Toxins Weapons Convention (1972) (BTWC) which will take place in 2022 and preparations for the Fifth Review Conference of the Chemical Weapons Convention (1993) (CWC), expected in 2023. This report is an output of an ongoing project, designed to stimulate thinking and discussion about these issues, within relevant stakeholder communities. The report provides an introduction to this issue area for the general reader before surveying key issues and developing a series of practical policy suggestions for further consideration.

Keywords: civil society, chemical and biological disarmament, non-proliferation regimes, Chemical Weapons Convention, Biological and Toxin Weapons Convention

INTRODUCTION

This report constitutes a key output of our ongoing project “Informing Policymakers of the Progress in Strengthening the Chemical and Biological Weapons Non-Proliferation Regime”. The project is driven by an interdisciplinary team of academics, who have each dedicated a significant proportion of their careers to this broader issue area. The key aim of the project, in keeping

with the long-standing tradition of academic and civil-society engagement in this space, has been to stimulate discussion and reflection of this issue, within relevant professional communities. We have done this to help ensure productive outcomes in two major forthcoming international treaty review conferences, specifically the 9th Review Conference of the Biological and Toxin Weapons Convention (BTWC) (2022) and the Fifth Review Conference of the Chemical Weapons Convention (CWC) (2023).

Work to date has centered on a number of key initiatives, which have involved input, collaboration and feedback from key stakeholders. Initially, we developed and presented a report on current issues facing the CWC and BTWC to the UK Parliament in late January 2021, we also presented our report to the general public via a webinar and educational video at the end of January 2021. During this process, we received ongoing feedback from a diverse range of stakeholders. This has contributed to the development of a working report draft text, which is a core output of our project. We plan to continue to update and re-issue this report to help relevant communities understand and keep up to date with key developments. This iterative approach has been advantageous, in as much as it has helped us refine and sharpen our understanding of current issues, build and maintain professional links which are essential to research in this area, and also sense-check our recommendations with relevant policy communities.

This report is presented structured as follows. In the next section we introduce the issue of global chemical and biological weapon prohibition. We then provide a brief history of the issue areas is provided. This leads then to the section 'Evolving Roles of Civil Society and the Broader CBW Regime' in which we provide an overview of the role of civil society in this issue area. This section serves to contextualize our project and its potential contribution. Key policy-relevant insights developed in our project are then presented. Finally, we lay out a series of conclusions and recommendations.

The Chemical and Biological Weapon Issue

Contemporary definitions of biological and chemical weapons relate to two distinctive but overlapping categories of weapons which are characterized by their mode of action against humans, their crops, livestock and the natural environment. At one end of the spectrum are biological weapons, which involve the use of pathogens. At the other end of the spectrum are chemical weapons which involve the use of poisons. These two categories are also understood to overlap, in as much as "toxins", typically produced by microbes and other organisms, are commonly understood to be fall within the scope of both categories.

The use of poison and disease as a weapon has a long history and such weapons have been understood to hold a distinctive moral character compared to conventional arms. Today these weapons are subject to a global legal and moral prohibition, as well as multilateral controls. The stigma of such weapons is due to several factors, this includes, but is not limited to—the horrific and lasting impacts of such weapons upon victims, the indiscriminate nature of such weapon systems on humans and the environment, the historic role of human experimentation and open-air field

trials in the development and testing of weapon systems, as well the Weapon of Mass Destruction proliferation risks associated with such systems. As a result, categorical prohibitions against the development, stockpiling and use of biological and chemical weapons in warfare have emerged at the global level—covering both existent and foreseen weapon systems. This then relates to a broad category of weapon systems, which have, or could be developed to serve a range of tactical and strategic functions.

Fundamentally tied to the emergence of this prohibition, have been several other interrelated security and humanitarian drives related to biological and chemical weapons, which are routed to various extents in the national security apparatus of states, and broader international civil-society— and are of particular relevance to this report. Most notably, non-proliferation, international criminalization as well as human-rights concerns related to those weapon systems employed as part of crowd control and riot control in policing contexts, such as tear gasses and riot control agents, are done so in a way that respects fundamental human rights.

We are currently at a pivotal moment in the history of the global prohibition against biological and chemical weapons. In recent years, the use of chemical weapons— most notably in Syria, but also as part of assassination and assassination attempts in the UK, Germany and Malaysia have reasserted a wide range of utilities which even mid-20th century weapon systems might be put to as contemporary tools of warfare and terror. The global pandemic has undoubtedly had many profound impacts, which will continue to resonate in this issue area for a long time. Indeed, it is difficult to imagine an aspect of the broader "web of prevention" against biological and chemical weapons which have not been touched by the effects of this event— from public health, disaster preparedness, export control and even the day-to-day practicalities of international diplomacy. More acutely, it is clear that this event, and global responses to it, will have inevitable impacts on global approaches to monitoring public health, and investigating infectious disease outbreaks. Debates about the source of the pandemic have also brought to broader public attention the issues of laboratory safety and transparency— and questions about the ethical limits of research which could pose either a direct threat to public health or a more indirect, proliferation concern. All these events have occurred in the context of other trends which are having incremental, as well as more profound impacts on this issue area. These not only impact upon the prospect of emergent chemical and biological weapon threats but also our collective abilities to respond to them.

It is well understood that advances in science and technology have profound impacts on global non-proliferation regimes. However, it is still worth a restatement that such advances will continue to have significant and often unanticipated shifts on the threat landscape. On an individual level, the availability of new technologies and techniques, potentially alter the risk-cost-benefit analysis of those who might pursue clandestine programmes. On a more systematic level, shifts in the economics and geography of innovation mean that our institutions struggle constantly to keep pace. For example, the increasing interchangeability of digital information and biological materials has unquestionable impacts on material focused control systems.

It is also clear that the frenetic and interrelated character of technological change means that governments and institutions need to take into account an increasingly wide range of areas of technological change— which could impact the development, characteristics, use, detection and response, to chemical and biological weapons.

In addition to changes brought about by developments in science and technology, the changing character of conflict is an important driver of change in this issue area. Throughout the 20th century, biological and chemical weapons were developed for a wide range of purposes. The specific needs of a given conflict, as well as more general trends in conflict, may lead to shifts in the calculations of states and nefarious actors, and result in actions that violate or otherwise weaken and undermine the categorical prohibitions against biological and chemical weapons and warfare. In response, there is a continued need for civil society and states to work to facilitate meaningful agreements to ensure the maintenance of the global prohibition of biological and chemical weapons. As we have noted previously, this requires the adoption of a pragmatic and holistic approach to the issue at hand. There is no single disarmament agreement, intervention point, or point of political consensus alone that can guarantee against the development and use of these weapons systems now and in the future. Instead, we must accept that the maintenance of the norm against biological and chemical weapons is an active process— with both political and technical problems often having to be solved repeatedly, and both personal and professional dedication required to help ensure the continued political relevance of international institutions and agreements which although often imperfect, are hard-won. This paper contributes to keeping the conversation going, by pointing to both realistic and practical steps which might be taken now, to help protect the norm against biological and chemical weapons for future generations.

A Brief History of Chemical and Biological Warfare and Multilateral Attempts to Control Them

At the turn of the 20th century, it was already clear to those who had witnessed the rapid changes occurring on the battlefield that industrialization heralded new and terrible forms of weaponry—including a future in which poisons could be used at ever greater scales and efficiency. This was reflected for example, in attempts to limit the use of poisons and gases in a series of international agreements, including the International Declaration of the Brussels Conference (1874) as well as the First and Second Hague International Peace Conferences (1899 and 1907). Such concerns came to fruition during the First World War, with the development and widespread use of a wide range of chemical agents. During this conflict, initial experiments would also begin with biological weapons in several states, with both France and Germany establishing dedicated programmes (Goldblat, 1971). While this generation of weapons was primarily developed as a means to overcome the deadlock of trench warfare— other uses would be found for them following the armistice. Embryonic offensive biological programmes also continued to proliferate

during the interwar period. The most recent substantive review by Seth Carus identifies four states which are known to have had a program at some point during the interwar period— France, Italy, Japan and the Soviet Union. And also lists Hungary as a “probable” fifth state (Carus, 2017).

The destructive potentials of chemical and biological warfare were not lost on those involved in global disarmament and humanitarian institution drives in the intervening years between the First and Second World Wars. This was reflected in the inclusion of a “no-first use” agreement on both chemical and biological weapons in the Geneva Protocol (1925) which affirmed the condemnation of such weapons by the “civilized world”. While important in the history of the codification of the norm against biological and chemical warfare, the agreement was limited, in as much as it did not prevent the development and use of such weapons for retaliatory use, or against those not party to the agreement. In addition, reservations entered by states, as well as the failure of the US to ratify the treaty in this period, certainly served to undermine its credibility. As did continued CBW armament throughout the 1930s—as well as use, and allegations of use of chemical weapons in the wake of WW1. Chemical weapons would be used by both the Italians and Spanish to quell insurgencies during the interwar years. The British also employed improvised air dropped toxic smoke devices against Bolshevik forces in Northern Russia (Spiers, 2020). While then, the immediate impacts of these agreements are not clear-cut, disarmament drives in this period would provide both inspiration and legitimacy to disarmament drives which would once again take hold in the latter part of the 20th century.

During the Second World War, several states continued to expand their chemical and biological warfare capability— although the latter was to a much lesser extent. This translated to significant stockpiles of agents such as mustard and phosgene, and in Nazi Germany by the end of the war, production systems for newly developed nerve agents such as tabun and sarin. The UK also developed a large stockpile of anthrax cattle cakes for use against Germany. However, there were only a few isolated examples of the use or suspected use of chemical weapons in the European theater. The absence of large-scale use of chemical weapons in the western theater stemmed from a combination of ethical, practical as well as strategic considerations, as well as fear of retaliation in kind. However, in the Eastern theater, where China lacked either deterrent capability or defenses— Japan would engage in both biological and chemical warfare in Manchuria. In the immediate aftermath of the Second World War Russia and Western states continued to expand research and development of biological and chemical weapons, work which would also draw upon data from the Japanese and Nazi programmes. The first half of the 20th century witnessed the establishment of offensive development and production programmes, as well as an ever-growing list of agents refined and tested for use in conflict, including a new generation of nerve agents. It was also a period in which these agents became marked out, and distinguished from other forms of weapon in technical, ethical and doctrinal terms. Following the Second World War, programmes continued to proliferate, and there was a significant expansion of stockpiles,

as well as research and development into a wide range of agents with a broad range of purposes including incapacitation, area denial and assassination. This included significant work involving human research subjects, which was, and to a varying extent remains shrouded in secrecy.

The use of herbicidal weapons by the US in the 1950s and 1960's- including most notoriously the use of Agent Orange in Vietnam, would also serve to reassert the broader potentials of chemical and biological weapons as an environmental weapon (Krutzsch and Trapp, 2014). It was also during this period that broader public opposition to these weapons began to solidify in Western states. Disarmament drives led ultimately to the establishment of two distinctive fundamentally interrelated prohibition treaty regimes—which would become the centerpieces of broader drives toward global biological and chemical disarmament and non-proliferation—the Biological and Toxin Weapons Convention (1972) (BTWC) and the Chemical Weapons Convention (1993) (CWC). Drives toward comprehensive biological and chemical warfare prohibition treaties would also be supplemented by additional multilateral measures designed to deter the use and prevent proliferation. This includes most notably the UN Secretary General's mechanism, established in the 1980s to enable prompt investigations into chemical and biological weapon use. This is in addition to UN Security Resolution 1540 (2004) which recognized the proliferation of nuclear, chemical and biological weapons, as well as their means of delivery as a threat to international peace and security. This Resolution affirmed that the global threat posed by proliferation, created obligations upon states to refrain from, and prevent proliferation through domestic regulation, and also led to the establishment of a UN Committee (1540) to support progress in this area. This initial resolution would become the basis for further Security Council Resolutions, focused on reasserting states commitment, and supporting international co-operation in this area. In the two sections which follow, the history of the two centerpiece regimes, the BTWC, and CWC, are reviewed in further detail.

The Biological and Toxin Weapons Convention

While it is common to distinguish between biological and chemical weapons, it is worth noting at this point that there are significant overlaps between these two categories of weapons. As a result, certain weapon agents, the so-called “mid-spectrum” agents (Madsen, 2005) are today covered by both treaties- this includes naturally occurring toxins, such as ricin and botulinum toxins, and bioregulators. Indeed, such is this overlap, that at some points in history it was conceivable that a single CBW prohibition would emerge. However, during the later 1960s, a UK led initiative led to the decision to pursue two distinct treaties. The decision to pursue a biological weapon treaty first presented the pathway of least resistance- was political rather than technical in nature (Walker, 2016).

The BTWC was signed in 1972 and came into force in 1975. The text of the convention has fifteen articles, which are listed below (see **Figure 1**). Some articles are proscriptive, whereas others point to the need for positive actions to be taken by states. These articles have at various times, and various extents

become the basis of attempts to foster deeper and broader cooperation between states in this area. A key component of the functioning of the BTWC since its establishment has been periodic review conferences. Since the Convention entered into force in 1975, eight Review Conferences have been held in 1980, 1986, 1991, 1996, 2001/2002, 2006, 2011, and 2016. The Ninth Review was originally expected to take place in 2021, but this has been pushed back to 2022 because of the global pandemic. Major developments in the history of the BTWC are now briefly summarized- as it is useful for setting the scene for observations and recommendations made in the second part of this paper.

The evolution of the BTWC can be broken down into several distinct periods (Littlewood, 2018). The first period covers the Cold War from 1975 to 1990. During this time the treaty largely languished, even in the context of a series of allegations of treaty violations (Carus, 2015; Leitenberg, 2021). Most significant proved to be the Sverdlovsk anthrax leak (1979) which revealed, at least in part, the extent of Soviet biological warfare activities, which had continued to expand since the signing of the treaty. Even in this fractured context, however, incremental developments- most notably the agreement of further Confidence Building Measures (CBMs) in the 1980s, which were designed to increase state reporting of relevant information, demonstrated the continued utility of the treaty. The CBMs revolve around yearly reports produced by member states- which cover a wide range of issues, such as information on disease outbreaks, past programmes, relevant national legislation as well as relevant research and production facilities. In addition, another important diplomatic practice that became established in this period was the use of review conferences to seek, develop and acknowledge additional areas of agreement. These are reflected in the final Review Conference reports. Such agreements have proven fundamental to the development of and functioning of the treaty.

The second period spans 1991 to 2001, and during this time there were three key areas of development. The first was a failed attempt to strengthen the convention with the addition of a verification protocol. Since this time, states have been ostensibly split on the question of whether protocol negotiations should be revived. The negotiations collapsed due to a withdrawal of US support- due to its concerns about the effectiveness, and costs of such a verification system. This period was the source of a rift that ostensibly continues between states on the prospect and value of new protocol negotiations. The second key area of development was the uncovering of the extent of the Iraqi and South African programmes, as well as an acknowledgment by Russia of the previous non-compliance of the USSR with the BTWC. Finally, during this period, there were increasing levels of concern about sub-state acquisition of chemical and biological weapons. The third period starts in around 2000 and takes us up to the present day. In the context of the crises generated by the failure of states to negotiate the treaty protocol, an agreement emerged between states on the need for more regular meetings. This led to the establishment of what is known as Intersessional Processes. These processes, which were agreed at the 2002 Fifth Review Conference center on an annual Meeting of Experts, which feeds into an annual Meeting

Article I	Undertaking never under any circumstances to develop, produce, stockpile, acquire or retain biological weapons.
Article II	Undertaking to destroy biological weapons or divert them to peaceful purposes.
Article III	Undertaking not to transfer, or in any way assist, encourage or induce anyone to manufacture or otherwise acquire biological weapons.
Article IV	The requirement to take any national measures necessary to prohibit and prevent the development, production, stockpiling, acquisition or retention of biological weapons within a State's territory, under its jurisdiction, or under its control.
Article V	Undertaking to consult bilaterally and multilaterally and cooperate in solving any problems which may arise in relation to the objective, or in the application, of the BTWC.
Article VI	Right to request the United Nations Security Council to investigate alleged breaches of the BTWC, and undertaking to cooperate in carrying out any investigation initiated by the Security Council.
Article VII	Undertaking to assist any State Party exposed to danger as a result of a violation of the BTWC.
Article X	Undertaking to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and information for peaceful purposes.
Article XI	Right to propose amendments to the Convention.
Article XII	Requirement to review (5 years after treaty comes into force) developments relevant to the purposes and operation on the convention- including scientific and technological developments
Article XIII	Right of a state to withdraw from the convention, in the event of extraordinary events which have 'jeopardised the supreme interests of its country'.
Article XIV	Processes of Signature, ratification and accession

FIGURE 1 | Key provisions of the BTWC (Walker, 2016).

of States Parties. There have been four Intersessional Processes since then: the first round from 2000 to 2005 was primarily a rescue mission intended to maintain the process of dialogue; the second from 2007 to 2010 being characterized as an attempt to revitalize the BTWC. A key area of progress was the formal establishment of an Implementation Support Unit, to support the day-to-day administration of the treaty. The third ran from 2012 to 2015 and the outputs demonstrated broad consensus on the importance of the treaty, and the need to develop it- but lacked meaningful consensus on practical steps to be taken. The fourth Intersessional Process 2017–2021 focuses on five thematic areas. This includes cooperation and assistance for promoting the peaceful use of the life sciences; review of scientific and technological advances; national implementation; preparedness and assistance in case of alleged use of biological weapons; and institutional strengthening. It is yet unclear as to the extent this process will feed into practical outcomes at the forthcoming review conference. One area which is likely to feature most prominently is revisiting the prospect of a verification protocol. A second area is international cooperation, under the auspices

of Article X- and in particular issues around export control. Both issues have traditionally been divisive, and for this reason, it must be hoped that progress in other areas does not become contingent on these aspects of negotiation. Other areas, which appear at least, to offer the prospect for agreement amongst states are the science and technology reviews and the current shortcomings in meager resources for the Implementation Support Unit. On the latter point, it is worth noting that the Implementation Support Unit provides administrative support and assistance across a wide range of areas including the organization of BTWC meetings, national implementation support and assistance, Confidence-Building Measures, universalization, information exchange, implementation of decisions and recommendations of the Review Conference. It currently performs these tasks on an annual budget of approximately 1.4 M Euro (1 M dollars) which was agreed in 2011. It is also reliant on only three permanent staff. While was considerable support for further augmentation of this body at the Eighth Review Conference (2016), states failed to reach an agreement on the issue- with the budget remaining essentially unchanged. It seems reasonable to

expect an augmentation in real terms at the forthcoming Review Conference. It is also reasonable to expect incremental progress across the other topic areas covered during the intersessional process—including support of national implementation as well as assistance response and preparedness.

The Chemical Weapons Convention

Following the entry into force of the BTWC in 1975, there were ongoing efforts to overcome the challenges of negotiating a chemical weapon prohibition treaty, which would span almost two decades. All the while, a significant number of states would continue to develop and stockpile chemical weapons. Chemical weapons were also used with devastating effects during the Iraq-Iran war (1980–1988), which included the Halabja massacre, which was perpetrated by Iraq against the Kurdish city of Halabja in 1988. Negotiations of the chemical weapon prohibition treaty would center on a range of issues, most notably the scope of the ban, the character and extent of on-site verification activities in relevant facilities, the recourse of state in the case of suspected non-compliance, as well as the structure and administration of the treaty implementation body- which would eventually be named the Organization for the Prohibition of Chemical Weapons (OPCW).

In 1993, a final text of the CWC was agreed and the scope and character of the prohibition regime finally came into sharp focus. The text of the CWC treaty, is much longer than that of the BTWC, comprising of a preamble, some 24 articles and three annexes. For the purposes of this paper, it is worth highlighting six key dimensions.

The first relates to the establishment of the scope of the chemical weapon prohibition, and the commitment to never, under any circumstances develop, produce, acquire, stockpile or transfer chemical weapons—and to destroy any extant chemical weapons and production facilities. This includes an expansive definition of what constitutes a chemical weapon, under which all toxins, precursor chemicals, and for-purpose delivery technologies are regarded as chemical weapons, “*unless they have been developed, produced or used for purposes which are not prohibited*” (Krutzsch et al., 2014).

The second relates to the requirement for States Parties to implement relevant domestic regulation—to prevent the acquisition, development, use or transfer of chemical weapons by anyone.

The third relates to the scope and operation of the multilateral disarmament verification system—which focuses on the destruction of existing chemical weapons and production facilities and ensuring against the diversion of chemical production facilities for prohibited purposes. An entire technical annex is devoted to these tasks- as have a substantial proportion of the OPCW’s resources.

The fourth relates to the key components of the treaty organization, tasked with managing the implementation of treaty provisions, including principles and mechanisms for handling disputes and situations of suspected or confirmed non-compliance. This includes the Conference of the State Parties, which is the principal plenary body of the organization. The Executive Council, which is made up of 41 elected States Parties,

each elected for 2 years by the Conference of State Parties. The final key organ of the OPCW is the Technical Secretariat, which assists both the Conference of State Parties and Executive Council in carrying out their respective functions.

It has always been apparent that the CWC would need to adapt to change. To this end, review and adaptation make up a final key dimension of the treaty and the treaty organizations operation. This includes a review conference held every 5 years to comprehensively examine the operations of the Convention and determine the strategic direction of its implementing body, the OPCW. A summary of the history of the focus and outcomes of these review conferences is useful in this paper as a means to sketch how the treaty system has and continues to evolve- as well as for thinking about likely outcomes at the forthcoming review conference in 2023.

The shifts in focus within the conferences, in part reflected the maturing of a treaty document, into a fully functioning treaty body, as well as a general shift in attention from the expensive issue of chemical weapon stockpile destruction in the first two review conferences to other pressing issues. At each Review Conference, discussions and agreements cover a range of issues of relevance to the convention. However, each review conference has differed in terms of which issues have been most central in diplomacy as well as the broader international context it has occurred in. In both the First Review Conference (2003) and Second Review Conference (2008) the issue of timely destruction of existing chemical stockpiles, as well as verifications methods were of particular importance (Chemical Weapons Convention Archive, 2022). By the Third Review Conference of 2013, some 80% of declared stocks had been destroyed- and the regime continued to evolve in the direction of a post chemical weapon destruction world (Zanders, 2013). Another notable dimension of the Third Review conference was the increased level of civil-society participation- with non-governmental organizations allowed to speak to the delegates in an informal plenary session for the first time. The review conference was event also impacted by emerging claims about chemical weapon use in Syria. These emerging concerns were the beginnings of a turbulent time in the context of the CWC and international diplomacy more generally—something which was reflected at the Fourth Review Conference (2018) (Guthrie, 2018).

The Evolving Roles of Civil Society and the Broader CBW Regime

This section aims to outline the wide range of civil-society groups which have impacted the history of the CBW control regime and the different types of roles they have played in different periods of the regimes. The term “civil-society” is very broad, encompassing a range of types of actors, who can be organized and function in a wide range of ways, and according to distinctive norms about both the broader public and state institutions. In the CBW context, there has been a long history of civil society engagement, which tends to be characterized as “Western, expert, technical, and quiet” (Revill et al., 2021). Academics have played a prominent and sustained role within civil society in this space- supplemented by a range of other commentators, experts, observers involved in non-profit organizations with

a significant number of individuals who have worked on the treaties since, or even before their formal negotiation. There has been significant continuity within the ongoing engagement of several individuals and centers with CBW issues stretching back as far as the late 1960s. Many individuals within this broader civil society community work on both treaties. However, it is worth noting that their engagement has been distinctive in each case, reflecting the differing institutional norms of the BTWC, and CWC treaty systems.

Concerning the BTWC, civil society has played a pivotal role in problem definition, agenda setting and goal setting. They also provide expertise to policymakers and diplomats, other global society actors, the media, and the public. At times, although to a lesser extent, aspects of the community have also engaged in public advocacy, lobbying. It is clear, however, that this engagement, has, and will continue to evolve along with the conventions—with civil society playing an increasingly recognized role for example in open-source monitoring (Lentzos, 2017). Civil society has also been able to deliver statements at review conferences and intersessional meetings. The format, organization and level of coordination have varied over the years—most recently, a single collective civil-society statement was made, which reflected the impacts of the pandemic on the organization of that meeting. Such engagement has continued to reinforce and validate civil society engagement to that convention. Not least in the area of disarmament education, which has been a central focus in our project.

In the CWC context, civil society has also played and continues to play an important role—in a wide range of areas. As in the BTWC, academics and other independent technical experts have played a significant role in supporting the negotiation, review, and implementation of the CWC. In addition, there is an active civil society community involved in the areas of open-source monitoring and verification. Historically, official interactions between civil society were more restricted, as compared to the BTWC context. However, the Third Review Conference of 2013 marked a turn of the organization toward greater public and stakeholder engagement. This was accompanied by amendments in the procedure, which allowed for greater civil-society access to conference documentation, as well as to address plenary sessions (Crowley et al., 2018). It is unclear how ongoing disagreements in the context of OPCW will impact civil-society engagement in the longer term—however, civil society will continue to play a pivotal role in encouraging substantive agreements on topics of central importance to our project, which is now discussed in further detail. It is in this turbulent context that we seek to make pragmatic recommendations to stimulate further thinking and discussion.

POLICY REVIEW FINDINGS

In the remainder of this paper, we provide an updated summary of our rolling commentary on developments in the field of CBW disarmament. This is followed by a presentation of

the key recommendations developed as part of our project. The most recently published version of the summary and recommendation was published in January 2021 (Shang et al., 2021) and this represents an updated version of that text, which take into account major developments related to the CWC. The recommendations are arranged around key topics, for both the BTWC and CWC how we have identified and organized these topics reflect the distinctive character of these regimes, our interaction with the diplomatic and broader disarmament community, as well as core competencies within the current research team.

Biological and Toxin Weapons Convention Cooperation and Assistance

Under Article X of the BTWC, States Parties have the right to enjoy the “fullest possible exchange of equipment, materials and scientific and technological information” (Assistance Cooperation under the BWC, 2020) of biological agents and toxins for peaceful purposes. States Parties have reached additional understandings and agreements relating to Article X during previous Review Conferences (Assistance Cooperation under the BWC, 2020). At the Eighth Review Conference, member countries of the Global Partnership (Canada, 2017a) gave a detailed account of such projects, and the UK (UK, 2019a) has given an overview of its contributions. At the Seventh Review Conference States Parties agreed to create a database system, established and administered by the BTWC, to facilitate requests for and offers of exchange of assistance and cooperation among States Parties (BWC Assistance and Cooperation Database). In the current Intersessional Process 2017–2021, approaches and concepts for strengthening Article X of the Convention are considered under the topic Cooperation and Assistance, with a Particular Focus on Strengthening Cooperation and Assistance under Article X (MX1). At the last discussion on this topic, convened online in December 2020, a wide range of activities were discussed. Additionally, the US set out a strategy (USA, 2020a) for better implementation of the database including a 3-step process to increase the number of annual reports regarding cooperation and assistance obligations, turning the database into a more comprehensive and useful tool, and via an initiative supported by both the US and India, the creation of a position within the Implementation Support Unit to support cooperation.

Review of Science and Technology Under the BTWC

Article I of the BTWC bans “microbial or other biological agents, or toxins, whatever their origin or method of production” that “have no justification for prophylactic, protective or other peaceful purposes” (Science and Technology under the BWC). This is known as the General Purpose Criterion and seeks to promote the legitimate uses of life sciences. The rapid progress of life sciences and related fields over the past few decades raises multifaceted security challenges to the operation of the Convention, not least because the same advances (e.g., genome editing) that contribute to combating disease might also facilitate the development of sophisticated biological and toxin weapons. In the current Intersessional Programme 2017–2021, approaches for reconciling the benefits and biological security risks of novel

life sciences advances are considered by the annual Meeting of Experts on Review of Developments in the Field of Science and Technology Related to the Convention (MX2). The joint impact of several factors such as technological convergence, growing interest in citizen science, and the increased availability and accessibility of scientific information has been identified as an area of particular concern to the BTWC (UK, 2018a). The effective management of the security implications of novel technologies requires a flexible combination of governance approaches that extend beyond regulation, as well as sustained dialogue and engagement between scientific and security communities (UK, 2018c, 2019c; Austria, 2020; USA, 2020b). Possible measures for strengthening the review process of science and technology within the Convention include the establishment of a designated scientific advisory body; the identification and development of appropriate methodologies, frameworks, and tools for risk assessment; and the implementation of the Tianjin Biosecurity Guidelines for Codes of Conduct for Scientists which set out ten elements for promoting the norms of responsible science (China et al., 2021; UK, 2021; USA, 2021a).

National Implementation of the BTWC

Article IV of the BTWC requires that States Parties “take any necessary measures”, in accordance with their national context and circumstances, to ensure the full and effective national implementation of all provisions of the Convention (National Implementation of the BWC, 2020). States Parties should also designate a National Contact Point responsible for coordinating national implementation activities and international exchange and cooperation within the BTWC. To promote transparency and reduce doubts and ambiguities under the Convention, States Parties have agreed on the exchange of Confidence Building Measures (CBMs) (BWC Electronic CBMs Portal, 2018; Confidence Building Measures, 2020). The CBMs are submitted annually and cover six thematic areas, including current biodefence activities, disease outbreaks, key life sciences publications, national biosecurity legislation and other measures, past offensive activities, and vaccine production facilities. In the current Intersessional Process 2017–2021, approaches, and measures for promoting national implementation and transparency are considered by the annual Meetings of Experts on Strengthening National Implementation (MX3). Health security, relevant export and import controls, and management of the security implications of life science advances are core elements of the effective national implementation of the BTWC. Integrated national approaches for strengthening biological security provide an essential framework for the development, implementation, and refinement of policies, measures, and actions designed to enhance prevention, detection, preparedness, and response capacities (UK, 2018b; USA, 2019). Fostering biological security awareness among life science stakeholders is vital to promoting common understanding and cross-sectorial cooperation (Ukraine et al., 2017). To keep pace with ongoing developments in the biotechnology sector, the CBMs must be regularly updated. This includes, for example, the need for declaring vaccine production facilities in a State Party’s territory irrespective of whether such facilities are licensed by their

Government or by that of another State (The Netherlands et al., 2017; Sweden et al., 2019). Voluntary peer-review transparency exercises that complement the BTWC CBMs process can facilitate national implementation and help instill a culture of trust among States Parties through experience sharing (Belgium, 2021).

Assistance, Response, and Preparedness Under the BTWC

Disease outbreaks can have significant consequences and put a serious strain on States’ capacity to adequately respond to biological threats, as evidenced by the ongoing COVID-19 pandemic. Article VII of the BTWC provides a mechanism for States Parties to request and receive assistance in case they have been exposed to biological weapon use (Assistance Response Preparedness under the BWC, 2020). The effective operationalisation of this Article constitutes an essential element of the process of countering biological threats regardless of their origins and ensuring the integrity of the international norm against the misuse of life sciences. In the current Intersessional Process 2017–2021, approaches and concepts for strengthening Article VII are considered by the annual Meetings of Experts on Assistance, Response and Preparedness (MX4). There are multiple practical, legal and other complex logistical and operational challenges to the implementation of Article VII (Canada, 2017b). Proposals to address these include developing standardized procedures for requesting assistance, setting up an assistance database for strengthening preparedness and response to the use of biological or toxin weapons, and establishing nationally-operated rapid response biomedical teams that could be delegated to a roster maintained by the BTWC and deployed in the event of a public health emergency (Russian Federation UK, 2018; South Africa, 2018; UK, 2018d; India France, 2021). There is a need for a generic international plan for a coordinated response by Member States, the UN and the wider UN system (e.g., WHO, OIE, UN FAO, INTERPOL) that takes into account the experience of previous international health emergency response operations (UK, 2019b; Revill et al., 2021). Measures to improve national and international capabilities for preparedness and response to biological attacks include promoting cross-sectorial training, enhancing public-private cooperation, and strengthening the United Nations Secretary General’s Mechanism for Investigation of Alleged Use of Chemical and Biological Weapons (UNSGM) (Portugal, 2019; Germany, 2021; USA, 2021b).

Institutional Strengthening of the Convention

Since the failure of the Protocol negotiations in 2001–2002, division has persisted between States Parties on the contested subject of the institutional strengthening of the Convention with discussion (BWC MX5, 2019) focusing on the “benefits and challenges” of two types of approaches, namely a comprehensive approach and one relying on incremental steps based on the adoption of individual measures. Thus, the issue of verification continues to lack consensus amongst States Parties. A December 2020 online meeting on institutional strengthening (MX 5) reflected previous discussions on this topic and noted

the highly dynamic environment in which the Convention exists, and the range of stakeholders involved. Proposals have included the creation of a multilateral coordination body based upon the BTWC, enhancing the role and capacity of the BTWC Implementation Support Unit, and strengthening the Intersessional Programme of Work after the Ninth Review Conference (BTWC/MX.5–Informal Webinar, 2020). A range of possible mechanisms for strengthening different aspects of the BTWC is also considered within the other Meetings of Experts. These include the establishment of a standing body for the review of science and technology, the development of a BTWC code of conduct for life scientists, and the provision of practical mechanisms for experience sharing, such as the creation of searchable databases and a platform for peer-review exercises and experience exchange.

Chemical Weapons Convention Syria

In 2013, a limited multilateral consensus was reached on the Syrian chemical weapon issue. This resulted in the accession of Syria to the CWC and the destruction of most of its chemical weapon capability. Subsequently, two key issues have emerged. First, there are accusations that Syria has retained an aspect of its chemical weapon capability—and this comes in the context of gaps, inconsistencies, and discrepancies in Syria's declarations to the OPCW Declaration Assessment Team (2022). The second issue concerns the continued systematic use of chemical weapons by the Syrian government—including the use of chemical warfare agents as well industrial toxic chemicals such as chlorine. These attacks are well-documented by the OPCW Fact-finding Mission in Syria, which has confirmed several chlorine attacks which took place between 2014 and 2018, the presence of nerve agents at an undeclared government facility, as well as the use of nerve agents in Khan Skaykhun (2017) (OPCW Fact-Finding Mission, 2022). Further investigations by the OPCW-UN Joint Investigation Mechanism and the OPCW Investigation and Identification Team have attributed responsibility for specific attacks—identifying the airbases (OPCW-UN, 2016) and specific units involved therein (OPCW, 2017). There have been several unilateral and multilateral actions against Syria including sanctions and air strikes against CW-linked facilities. Russia and Syria continue to deny that Syria has ever used chemical weapons or retains a capability. The UK has made it clear that it will continue to place pressure on Syria through the UN Security Council and OPCW (Ministry of Defence and Goldie, 2020)—similar statements and actions have been undertaken by many States in this regard. There is a need for sustained plurilateral State support for a wide range of investigatory, archival, and criminal mechanisms to ensure those responsible for the Syrian chemical attacks and other violations of the chemical weapons prohibition regime are identified and held accountable.

Novichoks

The use of Novichok chemical agents in the poisoning in the UK of Sergei and Yulia Skripal (2018) and Russia of Alexei Navalny (2020) has led to allegations that Russia maintains a

chemical weapon programme. These incidents have motivated actions against Russia as well as attempts to strengthen the global chemical weapon prohibition regime. During the Cold War, the Soviet Union developed a new family of chemical weapon agents referred to in the west as “Novichoks” (Russian for “newcomer”). With the coming into force of the CWC in 1997, the development, production, transfer, stockpiling and use of chemical weapons was comprehensively prohibited by the CWC. However, while these Novichoks were covered by the scope of the prohibition they were not listed in the Schedules of restricted chemicals which possessor States should declare (Costanzi and Koblenz, 2019). This omission reflected a desire to prevent this issue from becoming a sticking point during the negotiation of the emerging Convention—this ambiguity would remain a politically sensitive albeit marginal issue (OPCWSAB, 2011). The Novichok poisoning of the Skripals in Salisbury reasserted the need to address this ambiguity. And in June 2020, following a protracted negotiation, the CWC schedules were amended to include the agent involved (Conference of the States Parties, 2019). These agents were also added to shared export control lists designed to prevent the proliferation of these agents between states (Statement by Australia Group Chair., 2020).

Later that year, the OPCW Technical Secretariat confirmed that an agent with similar structural characteristics to those added in the recent schedule amendment was used in the poisoning of Alexei Navalny (OPCW, 2020). This has led to a joint statement by 56 CWC States Parties re-asserting their confidence in OPCW findings, the seriousness of this incident, and reiterating the need for Russian cooperation and transparency (Albania et al., 2020). In addition, the UK asserted that there was “no plausible explanation for Mr Navalny's poisoning other than Russian involvement and responsibility” and called on Russia to fully declare its Novichok programme to the OPCW (Ministry of Defence and Goldie, 2020). A view echoed by several other States—and reflected in recent EU sanctions against Russian individuals implicated in the attack (European Union, 2020). Most recently, the UK, with the support of 44 other countries, triggered a consultation, co-operation and fact-finding process. This process, which is covered under Article IX(2) of the CWC, is a formal, but essentially co-operation based, mechanism whereby one state can request clarifications from another state about concerns. It is then one of the less intrusive mechanisms available to States within the Convention. The proposal was also framed openly by the UK to avoid accusing Russia of violating the CWC directly. It is reflective of the fraught nature of CWC diplomacy at the moment, not only that this proposal was rejected outright by Russia, but that this rejection was also accompanied by a string of counter-accusations (Meier and Kelle, 2021). These incidents have reiterated the importance of intelligence sharing, international investigative and criminal procedures as well as OPCW routine declaration and verification processes (Costanzi and Koblenz, 2020; Interview with John Hart, 2020). In addition, fact that the agent used in the Navalny case was “similar to” but not specifically listed in the current schedule annex suggests a further amendment to the schedules is needed.

Central Nervous System-Acting Chemicals

The development, possession and use of weapons employing toxic chemicals are prohibited under the CWC (Chemical Weapons Convention, 2020). However, whether this prohibition also applied to law enforcement use of certain agents that act on the central nervous system (CNS) remained the subject of debate. Certain States have explored development, purportedly for law enforcement purposes, of weapons employing such chemicals, for use against individuals and, in aerosolised form, against groups. In October 2002, Russia used CNS-acting chemicals against armed Chechen separatists holding 900 hostages in a Moscow theater. Although the bulk of the hostages were freed, more than 120 were killed by the still undisclosed chemical agents.¹ State interest in these weapons has continued despite the grave dangers to health, and risks of their use in human rights violations and armed conflict (Crowley and Dando, 2014; Crowley, 2015b, 2018b). And there is growing disquiet that rapid advances in relevant chemical and life sciences will be harnessed to their development. The Royal Society has warned of “active interest in performance degradation applications of neuroscience for both military and law enforcement purposes” and highlighted “indications of interest among a number of States in the development and use of incapacitating chemical agents” (The Royal Society, 2012). A 2014 survey by Bradford University documented research potentially applicable to the study or development of these weapons, notably Russian computer modeling of “calmative” employment against groups of individuals in enclosed spaces and exploration of potential CNS-acting chemical agent interaction with human receptor sites; as well as Chinese manufacture and promotion of CNS-acting weapons targeting individuals, and their possession by Chinese security forces (Crowley and Dando, 2014). In 2019 and 2020, during meetings of the UN Conference on Disarmament and the OPCW, the US raised concerns that both Iran and Russia were conducting research into CNS-acting agents that was inconsistent with the CWC and was “for offensive purposes” (US, 2019; Manso, 2020; United State, 2020). In recent years there have been concerted attempts by a group of CWC States, led by Australia, Switzerland, and the US, to clarify that “under the CWC the aerosolized use of CNS-acting chemicals is inconsistent with law enforcement purposes” (Albania, 2020). In March 2021 the OPCW Executive Council formally recommended that the forthcoming 26th Conference of States Parties (CSP-26) “decide that the aerosolised use of CNS-acting chemicals is understood to be inconsistent with law enforcement purposes as a “purpose not prohibited” under the Convention” (OPCW Executive Council, 2021).

On 1 December 2021, CSP-26 adopted a Decision to effectively outlaw the aerosolized use of CNS-acting chemical agents for law enforcement purposes. The Decision also noted that “munitions and devices specifically designed to cause death or other harm” through the release of aerosolised CNS-acting chemicals would

“constitute a “chemical weapon,”² and consequently should be declared and verifiably destroyed. While the Decision was framed as an “understanding” of the States Parties, it could not be agreed by consensus and was consequently adopted following a roll call vote. Although 85 countries supported the Decision, 10 States (including China, Iran and Russia) voted against it and a further 33 States abstained.³

In addition to the contested nature of its adoption, aspects of the Decision are ambiguous or limited.⁴ Whilst the Decision addresses “CNS acting chemicals”, there is no definition of this phrase, nor an indication of the range of chemicals that would be covered by it. The Decision is specifically restricted to CNS-acting chemicals and therefore future law enforcement weapons that use toxic chemicals (including pharmaceutical chemicals, toxins and bioregulators) that act on other human physiological processes would not be covered by this prohibition. The Decision is further limited in the scope of the means of delivery addressed. It explicitly prohibits only aerosolized CNS weapons, excluding other delivery mechanisms such as law enforcement CNS dart guns. The Decision further restricts application to “munitions and devices specifically designed to cause death or other harm” and therefore the use of general purpose munitions and delivery devices such as air blowers and aerosol delivery systems may not be covered.

In summary, although this Decision is a major advance in constraining weaponised use of CNS-acting chemicals, its full implications will only become apparent as States Parties further clarify outstanding areas of ambiguity in the text and attempt to implement it. Consequently, the permissibility under the CWC of research, development and use of law enforcement weapons employing pharmaceutical chemicals, toxins and bioregulators, is likely to remain unclear and contested.

Riot Control Agents

Riot control agents (RCAs)—notably including tear gases and pepper sprays—are defined by the CWC as “any chemical not listed” in one of three Schedules of restricted chemicals that can produce “rapidly in humans sensory irritation or disabling physical effects which disappear within a short time following termination of exposure” (Chemical Weapons Convention, Article II.7, 2020). Their use as a “method of warfare” is prohibited under the CWC (Chemical Weapons Convention, Article I.5, 2020). The Convention, however, permits the use of such chemicals for “law enforcement including domestic riot control purposes,” (Chemical Weapons Convention, Article II.9, 2020) provided they are used in “types and quantities” consistent with such purposes (Chemical Weapons Convention, Article II.1.a, 2020). RCAs are employed around the world for law enforcement purposes, notably for controlling or dispersing crowds as well as for facilitating arrest and restraint

¹Although Russia has to date refused to fully identify the CNS-acting chemicals employed to end the Moscow theater siege, analysis by the UK's Defense Science and Technology, anesthetics, carfentanil and remifentanil. (Riches et al., 2012).

²Organisation for the Prohibition of Chemical Weapons, “Decision: Understanding regarding the aerosolised use of central nervous system-acting-chemicals for law enforcement purposes” (CWC Conference of States Parties, 26th Session, 2021).

³CWC coalition, “26th Session of the Conference of the States Parties (CSP-26)” (2021); www.cwccoalition.org/csp26-summary/

⁴For further discussion see: Crowley and Dando (2022).

of individuals. However, they have been frequently misused for serious human rights violations, most commonly in non-custodial settings to restrict, intimidate, or punish those participating in public protest the world over; and also in the prisons, detention centers or police stations of certain countries to ill-treat individuals (Crowley, 2015b). A recurring medical concern has been their use in excessive quantities in the open air or in confined spaces, including hospitals, prisons, homes, and even automobiles, where the targeted individuals cannot disperse. In such situations, serious injury or death can result from the toxic properties of the chemical agents or from asphyxiation. This is particularly true for the old, young, or sick (Crowley, 2015b). These long-standing concerns have been exacerbated during the COVID-19 pandemic. Medical professionals have highlighted the danger that RCAs could raise COVID-19 risk to individuals by increasing respiratory tract susceptibility to infection (American Thoracic Society, 2020). Furthermore, RCA-induced sneezing, coughing and increased mask removal exacerbate the threat of contagion, as does the breakdown of social distancing caused by RCA-induced disorientation and crowd panic. Such effects, clearly relevant to the policing of public assemblies, are exacerbated further if RCAs are used in confined spaces, notably prisons and other places of detention (Omega Research Foundation, 2020).

RCA Means of Delivery

The current situation could dramatically worsen as a result of contemporary development, marketing, and subsequent deployment of systems capable of delivering significant amounts of RCA over wide areas or extended distances. In addition to potential misuse for collective ill-treatment or punishment of crowds, such “wide-area” RCA delivery mechanisms could be employed as “force multipliers” in conjunction with firearms, making lethal force more deadly on a large scale. Although nominally developed for law enforcement, they may also be incorporated into military arsenals, and subsequently used in armed conflict in contravention of the CWC. In 2018, the OPCW Scientific Advisory Board warned that availability of certain systems “opens up the possibility that they could be filled intentionally with alternate types of chemicals including CWAs [chemical warfare agents] or CNS [central nervous system]-acting compounds” (OPCW-SAB, 2018). These concerns are exacerbated by current weak trade controls that could result in acquisition and misuse by nonstate actors, including terrorist organizations. Bradford University and the Omega Research Foundation have documented continuing development and promotion of “wide area” RCA delivery mechanisms, including indoor dispersion devices, external area denial devices, multiple projectile launchers, large-caliber projectiles, and delivery mechanisms mounted on remote weapons systems, unmanned ground vehicles, and drones (Crowley, 2013, 2015a, 2018a; MC, 2019). To date, widespread deployment has not been documented. But we may now be at a tipping point—where proliferation, use and misuse may be beginning—as witnessed by the Israeli security force use of commercially available

drones against mass Palestinian protests along the Israeli-Gaza strip border in April and May 2018. These drones were documented flying above the crowds dropping tear gas projectiles onto people below, in some cases against peaceful protestors, bystanders, journalists and field medical facilities (Al Jazeera, 2018; Greenwood and Zaqqout, 2018; UN Human Rights Council, 2019).

CONCLUSIONS AND RECOMMENDATIONS

It is evident that the international chemical and biological disarmament and non-proliferation regimes need to be strengthened so that they function as a wide-ranging integrated system of governance measures. There could be an opportunity to make progress in strengthening the regimes if sufficient political attention can be maintained on the issue in the run-up to the Ninth Review Conference of the BTWC in 2022 and the Fifth Review Conference of the CWC in 2023. Specifically, with regard to the BTWC, States Parties must promote the full and effective implementation of the Convention by enhancing its institutional capacity, developing compliance mechanisms, and establishing a systematic process for assessing the security risks and benefits of life science advances. With regard to the CWC, every effort should continue to be made to ensure the stability, unity and effective functioning of the OPCW, and consequently to achieve solutions reached by consensus, wherever possible. However, where consensus is not possible, like-minded States, must continue to employ the OPCW’s decision-making mechanisms to ensure progress is made in directly addressing all instances of development and use of chemical weapons, wherever and in whatever form they take. Failure to do so risks weakening international confidence in the OPCW and undermining the absolute global prohibition on chemical weapons of all kinds. In regard to the particular issues that have been discussed in this report, it is recommended that the following proposals are considered by States Parties to the BTWC and CWC.

With Regard to the BTWC

- State Parties should promote the peaceful uses of life sciences through cooperation and assistance under the Convention. States Parties should further develop and enhance the implementation of the BTWC Cooperation Database.
- States Parties should ensure that the security implications of life sciences research are effectively assessed and managed in an agreed review process. The full and effective implementation of the Tianjin Biosecurity Guidelines for life scientists can strengthen the review process of relevant scientific and technological advances.
- State Parties Should promote the full and effective national implementation of the BTWC by improving the system of Confidence Building Measures (2020), enhancing stakeholder engagement with the Convention, and strengthening the utility of Peer Review Exercises.

- State Parties Should promote the implementation of an integrated approach to countering the threat of deliberate disease. Strengthening international coordination, cooperation, and capacity building under the BTWC can advance global health security and prevent the hostile misuse of life sciences.
- State Parties should consider possible approaches and measures for the institutional strengthening of the Convention. It is essential that an Intersessional Programme of Work is agreed at the Ninth Review Conference in 2021 and that the mandate and resources of the Implementation Support Unit are expanded.

With Regard to the CWC

- There is no single pathway to justice in regard to the use of chemical agents in Syria. There remains a need for sustained plurilateral State support for a wide range of investigatory, archival and criminal mechanisms which will ensure that those who have breached the global chemical weapon prohibition are identified and held accountable.
- States must support intelligence sharing, international investigative and criminal procedures in relation to recent uses of Novichoks and support OPCW expert review and updating of CWC verification schedules and declaration processes to address challenges posed by this group of agents.
- All CWC States Parties should fully implement the CSP-26 Decision on aerosolised CNS-acting chemicals, specifically prohibiting all such use in law enforcement, and reporting and verifiably destroying existing agent stockpiles and means of delivery intended for such purposes. Given previous State research into and/or development of CNS-acting weapons employing pharmaceutical chemicals, toxins and bioregulators, and the danger that biotechnological developments will facilitate the search for, or development of, new types of candidate CNS-acting agents, it is important that the implementation of the Decision is not restrictive in scope of CNS-acting chemicals covered. The OPCW should establish implementation guidance defining “CNS-acting chemicals”, and clearly demarcating between such chemicals and riot control agents (RCAs), whose use is permitted for law enforcement purposes.

REFERENCES

- Al Jazeera (2018). Israeli Drone Targets Journalists. Available online at: <https://www.aljazeera.com/news/2018/11/12/gaza-protests-all-the-latest-updates>
- Albania et al. (2020). *The 25th Session of the Conference of State Parties to the CWC*. Available online at: <https://www.opcw.org/sites/default/files/documents/2020/12/Joint%20statement%20v1%20%28FINAL%29%20%281%29.pdf>
- Albania, et al. (2020). *25th Conference of States Parties to the Chemical Weapons Convention on the Aerosolized Use of CNS-acting Chemicals for Law Enforcement*. Available online at: <https://www.opcw.org/sites/default/files/documents/2020/11/CSP-25%20CNSAC%20Co-Sponsors%20Joint%20Statement.pdf>
- American Thoracic Society (2020). *Tear Gas Use During COVID-19 Pandemic Irresponsible; Moratorium Needed, Says American Thoracic Society*. Available online at: <https://www.thoracic.org/about/newsroom/press-releases/journal/>

- All CWC State Parties must ensure that use of riot control agents for law enforcement purposes is consistent both with international human rights law and the Chemical Weapons Convention, cognisant of the increased health risks due to COVID-19.
- All CWC State Parties should collectively establish an OPCW process to determine those RCA delivery mechanisms that are prohibited under the Chemical Weapons Convention and develop guidance on appropriate use of permitted RCA delivery mechanisms.

The conclusions and recommendations also reflect an organic synthesis of the perspectives of contributing authors. While there is a broad consensus on all issues among contributors, none of these above recommendations should be taken to reflect the view of any individual listed author. These recommendations continue to evolve in light of developments in this area, as well as ongoing work of the authors. We intend to produce a follow-up updated report in early 2022.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

FUNDING

The publication of this paper is funded through a London Metropolitan University SPF grant.

ACKNOWLEDGMENTS

We are very grateful for the advice and suggestions provided by the editorial team and reviewers of this paper.

2020/tear-gas-use-during-covid-19-pandemic-irresponsible-moratorium-needed-says-american-thoracic-society.php

Assistance Response and Preparedness under the BWC (2020). Available online at: <https://www.un.org/disarmament/biological-weapons/assistance-response-preparedness>

Assistance and Cooperation under the BWC (2020). Available online at: <https://www.un.org/disarmament/biological-weapons/assistance-and-cooperation>

Austria, et al. (2020). *Biorisk Management Standards and Their Role in BTWC Implementation*. Available online at: <https://undocs.org/BWC/MSP/2020/MX.2/WP.2>

Belgium, et al. (2021). *An Exchange Platform for Voluntary Transparency Exercises: Terms of Reference*. Available online at: <https://undocs.org/en/BWC/MSP/2020/MX.3/wp.4>

BTWC/MX.5–Informal Webinar (2020). Available online at: https://meetings.unoda.org/section/bwc-mx-2020-mx5_webinar/

- BWC Assistance and Cooperation Database. Available online at: <https://bwc-articlex.unog.ch/>
- BWC Electronic CBMs Portal (2018). Available online at: <https://bwc-ecbm.unog.ch/>
- BWC MX5 (2019). *Report of the 2019 Meeting of Experts on Institutional Strengthening of the Convention*. Available online at: <https://undocs.org/BWC/MSP/2019/mx,0.5/2>
- Canada, et al. (2017a). *International Activities of Global Partnership Member Countries related to Article X of the Biological and Toxin Weapons Convention*. Available online at: <https://undocs.org/BWC/MSP/2017/WP.17>
- Canada, et al. (2017b). Responding to Deliberate Biological Release: The Requirements for Effective, Coordinated International Action. Available online at: <https://undocs.org/BWC/MSP/2017/WP.20>
- Carus, S. (2015). 'The History of Biological Weapons Use: What We Know and What We Don't', *Health Security*, p. 239–45. Available online at: <https://doi.org/10.1089/hs.2014.0092>
- Carus, S. (2017). 'A Century of Biological-Weapons Programs (1915–2015): Reviewing the Evidence', *The Nonproliferation Review* 24, 139. doi: 10.1080/10736700.2017.1385765
- Chemical Weapons Convention Archive (2022). *There is a useful archive on these early review conferences available at 'Document Archive.'* Available online at: <https://cwc.fas.org/document-archive> (accessed January 27, 2022).
- Chemical Weapons Convention, Article I.5. (2020). Available online at: <https://www.opcw.org/chemical-weapons-convention/articles/article-i>
- Chemical Weapons Convention, Article II.1.a. (2020). Available online at: <https://www.opcw.org/chemical-weapons-convention/articles/article-ii-definitions-and-criteria>
- Chemical Weapons Convention, Article II.7. (2020). Available online at: <https://www.opcw.org/chemical-weapons-convention/articles/article-ii-definitions-and-criteria>
- Chemical Weapons Convention, Article II.9. (2020). Available online at: <https://www.opcw.org/chemical-weapons-convention/articles/article-ii-definitions-and-criteria>
- Chemical Weapons Convention. (2020). Available online at: <https://www.opcw.org/chemical-weapons-convention>
- China, Pakistan, and Brazil. (2021). *The Tianjin Biosecurity Guidelines for Codes of Conduct for Scientists*. Available online at: <https://undocs.org/en/BWC/MSP/2020/MX.2/WP.6>
- Conference of the States Parties. (2019). Technical change to schedule I(a) of the annex on chemicals to the chemical weapons convention. Available online at: <https://www.opcw.org/sites/default/files/documents/2019/11/c24dec04%28e%29.pdf>
- Confidence Building Measures (2020). Available online at: <https://www.un.org/disarmament/biological-weapons/confidence-building-measures>
- Costanzi, S., and Koblentz, G. (2019). Controlling Novichoks after Salisbury: revising the chemical weapons convention schedules. *Nonproliferation Rev.* 26, 599–612. doi: 10.1080/10736700.2019.1662618
- Costanzi, S., and Koblentz, G. (2020). 'Updating the CWC: How We Got Here and What Is Next', *Arms Control Today*, Available online at: <https://www.armscontrol.org/act/2020-04/features/updates-cwc-we-got-here-what-next>
- Crowley, M. (2013). Drawing the Line: Regulation of 'Wide Area' Riot Control Agent Delivery Mechanisms under the Chemical Weapons Convention, University of Bradford/Omega Research Foundation. Available online at: <https://omegaresearchfoundation.org/publications/regulation-agent-delivery-mechanisms-under-cwc-april,-2013>
- Crowley, M. (2015a). Tear Gassing by Remote Control: The Development and Promotion of Remotely Operated Means of Delivering or Dispersing Riot Control Agents. *University of Bradford/Omega Research Foundation/Remote Control Project*. Available online at: <https://omegaresearchfoundation.org/publications/tear-gassing-remote-control-december-2015>
- Crowley, M. (2015b). *Chemical Control: Regulation of Incapacitating Chemical Agent Weapons, Riot Control Agents and their Means of Delivery*. Basingstoke: Palgrave Macmillan. p. 378.
- Crowley, M. (2018a). "Development and Hostile Use of Toxic Chemical Means of Delivery and Dispersal" in *Preventing Chemical Weapons: Arms Control and Disarmament as the Sciences Converge*, Crowley M, Dando M, and Shang L (eds.). *Royal Society of Chemistry*. p. 332–380.
- Crowley, M., et al. (2018b). Preventing chemical weapons as sciences converge. *Science*. 6416, 753–755. <https://doi.org/10.1126/science.aav5129>
- Crowley, M., and Dando, M. (2014). *Down the Slippery Slope: A Study of Contemporary Dual-Use Chemical and Life Science Research Potentially Applicable to Incapacitating Chemical Agent Weapons*. University of Bradford and University of Bath. Available online at: <https://biochemsec2030dotorg.files.wordpress.com/2013/08/down-the-slippery-slope-final-web.pdf>
- Crowley, M., and Dando, M. (2022). "Central nervous system weapons dealt a blow." *Science*. 375, 153–154. doi: 10.1126/science.abn5621
- Crowley, M., McLeish, C., and Revill, J. (2018). "Chapter 20: The Role of Civil Society in Combating the Development, Proliferation and Use of Chemical Weapons", in *Preventing Chemical Weapons*, p. 580–618. Available online at: <https://doi.org/10.1039/9781788010092-00580>
- European Union (2020). *Official Journal of the European Union, L341, 63, 15*. Available online at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L:2020:341:TOC>
- Germany (2021). Strengthening Capacities in Responding to and Preparing for the Deliberate Use of Biological Weapons: Lessons Learned from UNSGM Table Top Exercise 2020 and Outlook to the Capstone Field Exercise. Available online at: <https://undocs.org/BWC/MSP/2020/MX.4/WP.5>
- Goldblat, J. (1971). *Disarmament Negotiations*. Almqvist & Wiksell. Available online at: <https://www.sipri.org/publications/1971/cb-disarmament-negotiations-1920-1970>
- Greenwood, F., and Zaqqout, O. (2018). 'Drones Don't Wear Uniforms. They Should', *Foreign Policy*. Available online at: <https://foreignpolicy.com/2018/05/22/drones-dont-wear-uniforms-they-should/>
- Guthrie, R. (2018). *CWC Review Conference Report*. Available online at: <https://www.cbw-events.org.uk/CWCRC-4-11.pdf>
- India and France (2021). *Proposal for the Establishment of a Database for Assistance under Article VII of the Biological and Toxin Weapons Convention: Specific Pending Issues and Way Forward for the Operationalization of the Proposal*. Available online at: <https://undocs.org/en/BWC/MSP/2020/MX.4/WP.3>
- Interview with John Hart (2020). 'After Navalny's Poisoning, What's the Future of Chemical Weapons?'. Available online at: <https://www.institutmontaigne.org/en/blog/after-navalny-poisoning-whats-future-chemical-weapons>
- Krutzsch, W., Myjer, E., and Trapp, R. (2014). *The Chemical Weapons Convention: A Commentary*. Oxford University Press. p. 72–76.
- Krutzsch, W. E., and Trapp, R. (2014). *The Chemical Weapons Convention: A Commentary*. Oxford University Press. p. 7, 11. 2 51, 55–6, 79, 82–3.
- Leitenberg, M. (2021). False Allegations of Biological-Weapons Use from Putin's Russia. *The Nonproliferation Rev.* 1–18. <https://doi.org/10.1080/10736700.2021.1964755>
- Lentzos, F. (2017). *Civil Society and the Bwc: Finding a Way Forward*. Available online at: <http://www.filippalentzos.com/wp-content/uploads/2018/03/Civil-society-and-the-BWC-report-final.pdf>
- Littlewood, J. (2018). "Chapter 4: The Biological and Toxin Weapons Convention", in *Preventing Chemical Weapons*. p. 78. Available online at: <https://doi.org/10.1039/9781788010092-00069>
- Madsen, J. (2005). *Bio Warfare and Terrorism: Toxins and Other Mid-Spectrum Agents*. Army Medical Research Inst of Chemical Defense Aberdeen Proving Ground Md.
- Manso, J. (2020). *US Permanent Representative to the OPCW, 25th Conference of the States Parties to the Chemical Weapons Convention*. Available online at: https://www.opcw.org/sites/default/files/documents/2020/11/CSP%2025%20national%20statement_final.pdf
- MC (2019). Contemporary Development, Promotion and Use of Remote Control Riot Control Agent Delivery Mechanisms: Challenges for Effective State Regulation, the 10th European Symposium on Non-Lethal Weapons. Brussels, Belgium: Royal Military Academy. Available online at: <https://omegaresearchfoundation.org/publications/contemporary-development-promotion-and-use-remote-control-chemical-irritant-delivery>
- Meier, O., and Kelle, A. (2021). *The Navalny Poisoning: Moscow Evades Accountability and Mocks the Chemical Weapons Convention*, *Bulletin of the Atomic Scientists (blog)*. Available online at: <https://thebulletin.org/2021/10/the-navalny-poisoning-moscow-evades-accountability-and-mocks-the-chemical-weapons-convention/>

- Ministry of Defence and Goldie, B. (2020). Baroness Goldie Speech at 25th Conference of States Parties to the Chemical Weapons Convention. Available online at: <https://www.gov.uk/government/speeches/baroness-goldie-speech-at-25th-conference-of-states-parties-to-the-chemical-weapons-convention>
- National Implementation of the BWC (2020). Available online at: <https://www.un.org/disarmament/biological-weapons/national-implementation>
- Omega Research Foundation (2020). *Position Paper: Lowering the Risk – Curtailing the Use of Chemical Irritants during the COVID-19 Pandemic*. Available online at: <https://omegaresearchfoundation.org/publications/lowering-risk-curtailing-use-chemical-irritants-during-covid-19-pandemic>
- OPCW (2017). Technical Secretariat First Report by the OPCW Investigation and Identification Team pursuant to para. 10 of Decision C-SS-4/Dec.3 “Addressing the Threat from Chemical Weapons Use”. Ltameneh, Syrian Arab Republic. Available online at: <https://www.opcw.org/sites/default/files/documents/2020/04/s-1867-2020%28e%29.pdf>
- OPCW (2020). *Featured Topic Case of Mr Alexei Navalny*, Available online at: <https://www.opcw.org/media-centre/featured-topics/case-mr-alexei-navalny>
- OPCW Declaration Assessment Team. (2022). Available online at: <https://www.opcw.org/declaration-assessment-team>
- OPCW Executive Council (2021). *96th Session*, Decision: Understanding regarding the aerosolised use of central nervous system-acting chemicals for law enforcement purposes.
- OPCW Fact-Finding Mission. (2022). Available online at: <https://www.opcw.org/fact-finding-mission>
- OPCWSAB (2011). *Report of the Sixteenth Session of the Scientific Advisory Board*. Available online at: https://www.opcw.org/sites/default/files/documents/SAB/en/sab-16-01_e.pdf
- OPCW-SAB (2018). *Report of the Scientific Advisory Board on Developments in Science and Technology for the 4th Review Conference of the Chemical Weapons Convention, RC-4/DG.1, 21–30*. Available online at: https://www.opcw.org/sites/default/files/documents/CSP/RC-4/en/rc4dg01_e.pdf
- OPCW-UN (2016). *Fourth Report OPCW-UNJIM of the Joint Investigation Mechanism*. Available online at: https://www.un.org/ga/search/view_doc.asp?symbol,S/2016/888
- Portugal (2019). *Investigating Alleged Use of Biological Agents against Agriculture Livestock and the Natural Environment: A Practical Approach*. Available online at: <https://undocs.org/en/BWC/MSP/2019/WP.4>
- Revill, J., Borrie, J., Saunders, E., and Lennane, R. (2021). Preparing for Success at the Ninth Biological and Toxin Weapons Convention Review Conference | UNIDIR. p. 32. Available online at: <https://www.unidir.org/publication/preparing-success-ninth-biological-and-toxin-weapons-convention-review-conference-0>
- Riches JR, Read RW, Black RM, Cooper NJ, Timperley CM. (2012). Analysis of clothing and urine from Moscow theatre siege casualties reveals carfentanil and remifentanil use. *J Anal Toxicol.* 36, 647–56. doi: 10.1093/jat/bks078
- Russian Federation and UK (2018). *Core Elements for an Effective Article VII Response*. Available online at: <https://undocs.org/BWC/MSP/2018/WP.6>
- Science and Technology under the BWC. Available online at: <https://www.un.org/disarmament/biological-weapons/science-and-technology>
- Shang, L., Novosiolova, T., Crowley, M., Edwards, B., Whitby, S., and Dando, M. (2021). *Biological and Chemical Security after COVID-19: Options for Strengthening the Chemical and Biological Weapons Disarmament and Non-Proliferation Regimes*. Project Report. Huntingdon: B&H Digital Print.
- South Africa (2018). Provision of Assistance to a State Party That Has Been Exposed as a Result of a violation of the Convention. Available online at: <https://undocs.org/en/BWC/MSP/2018/MX.4/WP.4>
- Spiers, E. (2020). *War: A History of Chemical and Biological Weapons*, Second Expanded Edition. Reaktion Books. p. 70–79.
- Statement by Australia Group Chair. (2020). Available online at: <https://www.dfat.gov.au/publications/minisite/theaustraliagroupnet/site/en/statement-by-the-australia-group-chair-addition-of-novichok-precursor-chemicals-to-the-australia-group-control-list.html>
- Sweden et al. (2019). *Confidence Building Measure G – Declaration of Vaccine Production Facilities: Identifying Additional Relevant Facilities*. Available online at: <https://undocs.org/BWC/MSP/2019/MX.3/wp.4>
- The Netherlands et al. (2017). *Confidence Building Measure G-Declaration of Vaccine Production Facilities: Potential for Missed Reporting of Relevant Facilities*. Available online at: <https://undocs.org/bwc/msp/2017/wp.6>
- The Royal Society, (2012). *Brain Waves Module 3: Neuroscience, Conflict and Security*. Available online at: https://royalsociety.org/media/royal_society_content/policy/projects/brain-waves/2012-02-06-bw3.pdf
- UK (2018a). *Genome Editing: Addressing Implications for the Biological and Toxin Weapons Convention*. Available online at: <https://undocs.org/en/BWC/MSP/2018/MX.2/WP.4>
- UK (2018b). *Strengthening National Implementation: The UK Biological Security Strategy*. Available online at: <https://undocs.org/en/bwc/msp/2018/mx.3/wp.4>
- UK (2018c). *Genome Editing: Addressing Implications for the Biological and Toxin Weapons Convention*, Available online at: <https://undocs.org/en/BWC/MSP/2018/MX.2/WP.4>
- UK (2018d). *The United Kingdom Public Health Rapid Support Team Concept*. Available online at: <https://undocs.org/en/BWC/MSP/2018/MX.4/WP.2>
- UK (2019a). *Report Implementation of Article X of the Biological and Toxin Weapons Convention*. Available online at: <https://undocs.org/en/bwc/msp/2019/mx.1/wp.5>
- UK (2019b). *Core Elements for an Effective Article VII Response: The Need for an International Coordinating Body*. Available online at: <https://undocs.org/BWC/MSP/2019/MX.4/WP.6>
- UK (2019c). *Biological Risk Assessment and Management: Some Further Considerations*. Available online at: <https://undocs.org/en/bwc/msp/2019/mx.2/wp.6>
- UK (2021). *Biological Risk Assessment and Management: A Need for Guiding Principles and Frameworks*. Available online at: <https://undocs.org/en/bwc/msp/2020/mx.2/wp.3>
- Ukraine et al. (2017). *Awareness-Raising, Education and Outreach: Recent Developments*. Available online at: <https://undocs.org/bwc/msp/2017/wp.22>
- UN Human Rights Council (2019). *Report of the Detailed Findings of the Independent International Commission of Inquiry on the Protests in the Occupied Palestinian Territory*. Available online at: https://www.ohchr.org/EN/HRBodies/HRC/RegularSessions/Session40/Documents/A_HRC_40_74_CRP2.pdf
- United State (2020). *Compliance with the Convention on the Prohibition of the Development, Production, Stockpiling, and Use of Chemical Weapons and on Their Destruction (Condition (10)(C) Report) (2020)*. Available online at: <https://www.state.gov/wp-content/uploads/2020/06/2020-10C-Report-Unclassified-Version-for-H.pdf>
- US (2019). *Statement by Assistant Secretary Yleem D. S. Poblete at the 2019 Session of the UN Conference on Disarmament*. Available online at: <https://geneva.usmission.gov/2019/03/19/statement-by-assistant-secretary-poblete-at-the-conference-on-disarmament/>
- USA (2019). *Strengthening National Implementation: The United States National BioDefense Strategy*. Available online at: <https://undocs.org/bwc/msp/2019/mx.3/wp.1>
- USA (2020b). *Approaches Governance for Scientific and Technological Advances in the Life Sciences Relevant to the Biological and Toxin Weapons Convention*. Available online at: <https://undocs.org/BWC/MSP/2020/MX.2/WP.1>
- USA (2021a). *A Scientific and Technological Advisory Process for the Biological and Toxin Weapons Convention*. Available online at: <https://undocs.org/BWC/MSP/2020/MX.2/WP.7>
- USA (2021b). *Lessons Learned in International Cooperation and Assistance from an Agricultural Incident*. Available online at: <https://undocs.org/BWC/MSP/2020/MX.4/WP.4>
- U. S. A. (2020a). *Working Together Strengthen the Implementation of Article X of the Convention*. Available online at: https://meetings.unoda.org/section/bwc-mx-2020-mx1_webinar/
- Walker, J. (2016). *Britain and Disarmament: The UK and Nuclear, Biological and Chemical Weapons Arms Control and Programmes 1956-1975*. Routledge. p. 5. Adapted from United National website. Available online at: <https://www.un.org/disarmament/biological-weapons/>
- Zanders, J. P. (2013). *The Future of the CWC in the Post-Destruction Phase | European Union Institute for Security Studies*. Available online at: <https://www.iss.europa.eu/content/future-cwc-post-destruction-phase>

Author Disclaimer: The views presented in the paper are those of the authors alone.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in

this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Copyright © 2022 Edwards, Novosiolova, Crowley, Whitby, Dando and Shang. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.