Rigid Structures, Evolving Threat

Preventing the Proliferation and Use of Chemical Weapons

AUTHORS
Rebecca K.C. Hersman
Suzanne Claeys
Cyrus A. Jabbari

A Report of the CSIS INTERNATIONAL SECURITY PROGRAM
Rigid Structures, Evolving Threat

Preventing the Proliferation and Use of Chemical Weapons

AUTHORS
Rebecca K.C. Hersman
Suzanne Claeys
Cyrus A. Jabbari

A Report of the CSIS International Security Program
About CSIS

Established in Washington, D.C., over 50 years ago, the Center for Strategic and International Studies (CSIS) is a bipartisan, nonprofit policy research organization dedicated to providing strategic insights and policy solutions to help decisionmakers chart a course toward a better world.

In late 2015, Thomas J. Pritzker was named chairman of the CSIS Board of Trustees. Mr. Pritzker succeeded former U.S. senator Sam Nunn (D-GA), who chaired the CSIS Board of Trustees from 1999 to 2015. CSIS is led by John J. Hamre, who has served as president and chief executive officer since 2000.

Founded in 1962 by David M. Abshire and Admiral Arleigh Burke, CSIS is one of the world’s preeminent international policy institutions focused on defense and security; regional study; and transnational challenges ranging from energy and trade to global development and economic integration. For eight consecutive years, CSIS has been named the world’s number one think tank for defense and national security by the University of Pennsylvania’s “Go To Think Tank Index.”

The Center’s over 220 full-time staff and large network of affiliated scholars conduct research and analysis and develop policy initiatives that look to the future and anticipate change. CSIS is regularly called upon by Congress, the executive branch, the media, and others to explain the day’s events and offer bipartisan recommendations to improve U.S. strategy.

CSIS does not take specific policy positions; accordingly, all views expressed herein should be understood to be solely those of the author(s).

© 2019 by the Center for Strategic and International Studies. All rights reserved.
Acknowledgments

The authors would like to thank all of those who graciously offered valuable feedback and recommendations at roundtables and meetings in Washington, D.C. and abroad. The authors would also like to thank Eric Brewer for his review of the document and constructive comments.

This research was made possible through the support of the United States Air Force Academy (USAFA) and the Center for Strategic and International Studies under agreement number FA7000-18-1-0008. The public release number is PA# USAFA-DF-2019-433. The U.S. government is authorized to reproduce and distribute reprints for governmental purposes notwithstanding any copyright notation herein. The opinions, findings, views, conclusions, or recommendations contained herein are those of the authors and should not be interpreted as necessarily representing the official policies or endorsements, either expressed or implied, of the USAFA or the U.S. government.
## Contents

**Executive Summary**  
1 | Introduction  
2 | The CW System of Restraint  
3 | Emerging Challenges to the CW System of Restraint  
   | Small-Scale and Limited Use  
   | Enforcement and Accountability  
   | New CW Acquisition Trends  
   | New and Emerging Agents  
   | Disinformation  
   | Open-source Investigation and Verification  
   | Lack of Knowledge or Interest in CW Across the “Quiet Middle” States  
   | North Korea: The Outlier State  
4 | Recommendations  
About the Authors  
Endnotes
Executive Summary

Background
Chemical weapons are back. Since 2012, the growing number and types of CW uses have increasingly challenged the anti-CW regime. Furthermore, the shifting security environment has revealed emerging challenges to and increased pressure points on the system of restraint, which shapes nations’ behavior and encourages restraint through several different, often mutually reinforcing mechanisms: taboos, lack of benefit, norms, and deterrence.

This study examines the evolving and changing nature of chemical weapons and how the system of restraint must adapt to ensure that the proliferation and use of chemical weapons do not reemerge as endemic features of the global security landscape. The study provides a framework for structuring the problem, identifies gaps and challenges, and puts forward options for improving the global effort to prevent the proliferation and use of these weapons.

Small-Scale and Limited Use
Traditionally, the presence of costly, industrial-scale military CW programs—such as those possessed by the United States and Russia prior to joining the CWC and used extensively by Iraq during the Iran-Iraq War and against the Kurds of Iraq—animated the international system and drove international efforts to ban and eliminate these weapons. Today, with the glaring exception of North Korea, industrial-scale, battlefield-oriented CW programs have largely vanished and with them much of the prospect of large-scale, state-on-state chemical warfare. Unfortunately, CW use is making a comeback, albeit generally in small-scale and limited-use scenarios, including assassinations, special operations, and insurgency/counterinsurgency. Such scenarios greatly complicate the system of restraint by challenging legal verification approaches given the small quantities needed; complicating deterrence with low use thresholds; increasing the perception of benefit or utility of such weapons to users; and eroding societal or moral costs associated with these weapons.

Enforcement and Accountability
Without an ability to hold violators accountable, neither threats nor rules can sustain a dissuasive power. National authorities and law enforcement provide vital accountability mechanisms, but recent investigations and prosecutions have shown mixed results. In Japan, Aum Shinrikyo members responsible for a CW terrorist attack in 1995 were ultimately convicted and given the death penalty, but the decades-long process reduced its deterrent value. In Malaysia, the most significant perpetrators of the assassination
of North Korean leader Kim Jong-un’s half-brother, Kim Jong-nam, with VX nerve agent evaded capture. The two captured perpetrators avoided prosecution or received a token sentence, a strong indication of political and diplomatic interference. In the United Kingdom, exceptional police work and emergency response minimized injury and led to rapid attribution and identification of perpetrators in the Novichok nerve agent Skripal attacks, but arrests and prosecution seem unlikely after perpetrators fled the country and their identities were revealed.

Internationally, the establishment of the Investigative and Identification Team (IIT) by CWC states parties demonstrated that the norm against CW use remains of value and is worthy of political investment, even in the face of costly obstructive efforts by Russia and its allies. Efforts to ensure that information is shared with the International, Impartial and Independent Mechanism, a UN initiative to investigate and prosecute crimes in Syria since 2011, will help to ensure that evidence is protected, and that investigative information can support future legal recourse for victims.¹

However, Russia’s persistent willingness to use its veto power to prevent accountability for CW use suggests that little recourse can be found there. In all likelihood, accountability for Syria’s CW use and other atrocities will only occur under the auspices of a broader national or international tribunal process in the future. While most aspects of treaty enforcement have focused on use, trends in acquisition and diversification of threat agents away from the traditional schedule agents will increasingly challenge the regime’s ability to enforce proliferation norms as well.

**NEW CW ACQUISITION TRENDS**

The majority of modern state and non-state CW programs do not require the production-scale facilities or large bulk quantities of agents or precursors of the past. Research and development-level (R&D) infrastructure that can be hidden in dual-use facilities and combined with on-demand surge capacity make small-scale CW capabilities sufficient for almost all scenarios. In addition, advances in R&D and production techniques enhance speed, precision, and ease of concealment. Advances in chemical science and engineering are also rapidly expanding relevant chemicals and compounds outside of the CW control regime. Over 100 million new chemical substances have been created since the establishment of the CWC Schedules of Chemicals, growing by about 15,000 substances per day.² Under the CWC, precursor trade is monitored and controlled, but 3 of the top 10 chemical-producing countries in the world—Russia, China, and Brazil—are outside of the control regime.³ Furthermore, back-integration—the process of synthesizing precursor chemicals from simpler, unregulated, or domestically available chemicals—has become easier to accomplish. Finally, diffuse procurement networks facilitate the ability to identify and deceive suppliers, especially with the growth of e-commerce options.

**NEW AND EMERGING AGENTS**

In addition to new technology, there are new and emerging agents, as well as old agents being used in new ways. Many such chemical agents—chlorine and other TICs, fentanyl, and other deadly pharmaceutically-base agents (PBAs), and Novichoks—are not fully included on the CWC schedules and can be transferred and used in ways that challenge or elude traditional verification and controls. For example, chlorine is too ubiquitous to control, and a significant number of actual and potential CW agents, like fentanyl, lie
outside of the CWC schedules. Following the Skripal attack, some Novichoks formulations were added to Schedule 1, but it is not clear if and how precursors to these agents can be regulated. In addition, PBAs, such as fentanyl, are a growing concern because they are easily produced, acquired, and weaponized and can be highly lethal. Fentanyl is 50 times more potent than heroin and, in drug-trafficking operations, is frequently mixed with heroin and cocaine or made into counterfeit pills.1 Fentanyl seizures have made headlines in recent years, with millions of lethal doses being confiscated in single drug busts. In August 2019, a three-state drug bust seized 30 kilograms of fentanyl—enough to kill roughly 14 million people.5

DISINFORMATION
Today, international efforts to prevent CW proliferation and use take place in an information warzone. The growing accessibility, maturation, and diffusion of online platforms and digital tools have democratized information but also contributed to easy manipulation and misuse, undermining credible and authoritative sources of information. While the CW system of restraint benefits greatly from a robust verification system, such verification-based arms control generally requires an ability to establish agreed facts and trust authoritative sources of information, including sensitive national information often from intelligence sources. Verification without an ability to validate and trust factual information is virtually impossible.

Syria, Russia, and state and non-state supporters have been particularly successful in their systematic attack of authoritative information and institutions. The attacks are meant to: deny the occurrence of events or actions perpetrated; misidentify the victims and targets; discredit or falsify the motives and identities of witnesses and responders; and elevate “authority figures,” who seek to promulgate counter-narratives through disinformation. While awareness of the disinformation challenge is growing, there is little consensus on the best ways to counter it; detailed, tit-for-tat responses often simply give more ammunition, while infrequent responses leave a vacuum to be filled.

OPEN-SOURCE INVESTIGATION AND VERIFICATION
Open-source intelligence (OSINT) analysts working independently or within NGOs, international governmental organizations, or other entities are rapidly expanding and increasingly sophisticated. OSINT analysts use techniques that were previously confined to intelligence or law enforcement communities working within classified information networks. OSINT products have substantially increased response time, public awareness, transparency, and accountability. However, with this rapid growth, efforts to protect and validate sources of analysis have struggled to keep up.

The arms control arena has reaped many benefits of OSINT analysis in monitoring and verification procedures, as the OPCW, IAEA, national governments, NGOs, and private citizens have increasingly benefitted from this independent, publicly available information over the last two decades. Credible analysis outside of national governmental controls can provide greater access, transparency, and independence, especially in terms of matters of compliance. However, this environment also enables the production and spread of counter-truth phenomena—sometimes called alternative facts—as hostile actors may seek to manipulate and attack the data, tools, and techniques used by OSINT analysts in hopes of degrading the reliability of OSINT work or manipulating outcomes.
LACK OF KNOWLEDGE OR INTEREST IN CHEMICAL WEAPONS ACROSS THE “QUIET MIDDLE” STATES

Following the establishment and entry into force of the CWC, the limited pre-existing knowledge and expertise about chemical weapons in much of the Global South declined precipitously. Only the wealthier states of NATO and some states in the Middle East and Asia maintained CW defense programs in anticipation of potential conflicts with CWC outliers. Even these national investments have declined steadily over time, resulting in a widespread lack of technical expertise in these countries. Arms control and nonproliferation experts have similarly shifted focus away from chemical weapons, both at the national level and across much of the nongovernmental space. Given the priority of nuclear nonproliferation, most countries place their limited arms control expertise in Geneva or Vienna, leaving representation at the OPCW at The Hague in the hands of their bilateral embassies. The lack of knowledge and expertise on chemical weapons across allies, partners, and organizations contributes to the presence of a “quiet middle” of countries that stay largely silent and on the sidelines regarding CW issues in international fora. This lack of expertise also heightens the vulnerability of these countries to the growing challenge of disinformation, information warfare, and conspiracy theories, which seek to sow doubt and mistrust in institutions and leaders.

NORTH KOREA: THE OUTLIER STATE

North Korea is one of four remaining countries yet to accede to the CWC and is believed to have the largest active CW stockpile in the world. It is also generally believed to be the only state that continues to value chemical weapons as a tool for battlefield warfighting in state-on-state conflict. It possesses the ability to threaten Seoul and its large vulnerable civilian population with chemical weapons from long-range artillery along the Kaesong Heights. North Korea possesses a wide range of blistering, blood, nerve, and choking agents and delivery systems, including artillery munitions, aerial vehicles, and ballistic missiles.6

The condition of the overall stockpile is uncertain, but the DPRK’s continued proliferation of CW expertise and equipment and its CW-based targeted assassination of Kim Jong-nam suggest significant capability, not only to produce chemical weapons on-demand in small scale but also to maintain its CW stockpile. Crisis, war, or diplomatic breakthrough could all produce urgent requirements to inspect, monitor, secure, remove, or destroy all or parts of the DPRK CW program. Planning and consultation with international organizations, key partners, and possibly China on the technical, operational, political, and legal challenges associated with chemical weapons is essential ahead of any crisis or opportunity. Treating chemical weapons as the lesser-included case under the rubric of denuclearization could lead to greater risk in crisis and missed opportunities in peacetime.

Recommendations

ADAPTING THE CW REGIME TO NEW REALITIES

▪ Enhance and amend the regime to address small-scale, limited quantity/limited use, newer, and improvised agents. The treaty’s verification system must be adapted to account for new realities and include new additions to the schedules.

▪ Reframe the mission of the CWC. The mission of the CWC should address how to manage chemical threats to security instead of focusing exclusively on preventing the reemergence of chemical weapons.
• **Improve and support OPCW laboratories to improve technical capabilities and resources for diagnostic purposes.** This will require sustained investment by states parties and a commitment to complete the new Centre for Chemistry and Technology as scheduled.

• **Reform the Australia Group (AG) to cover additional agents and reduced-quantity challenges for existing agents.** The AG must expand its efforts to not only consider approaches to more dual-use agents but also to innovations that might provide greater accountability for rapidly expanding online suppliers that operate in or through their countries.

• **Consider establishing an Additional Protocol to the CWC.** An Additional Protocol could seek improved control and verification of the newer agents, improvised agents, and smaller quantities which fall outside of current declaration and verification requirements.

**IMPROVING ACCOUNTABILITY AND ENFORCEMENT**

• **Look beyond traditional arms control to build the legal basis for accountability for CW use.** It is essential that arms control and humanitarian/war crimes communities work collaboratively to maximize national and international prosecutorial pathways.

• **Build and support national capacities for enforcing CW norms.** This must include efforts to raise national technical and forensic capacities for diagnostics and chain of custody. Targeted capacity-building efforts through the Global Partnership, European Union, and U.S.-based cooperative threat reduction programs could pay big dividends.

• **Protect access and security of evidence repositories, including reports, forensic evidence (including samples), and witness and victim testimonials.** These repositories will be attacked and sabotaged, but there will also be efforts to limit the availability of legitimate legal proceedings outside of the UN Security Council.

• **Leverage open-source analysis when feasible and accurate.** In order to leverage civilian capabilities, there must be guidelines and best practices developed for open-source verification. Open-source analysis is absolutely legitimate for legal enquiry and in many cases may be admissible as evidence, so finding ways to support and strengthen rather than censor the information is essential.

**ADAPTING DETERRENCE APPROACHES**

• **Identify tailored deterrence measures that can be applied proportionately and repeatedly.** The United States, along with its partners and allies, must develop a menu of possible punitive, pre-coordinated responses, such as detailed sanctions or penalties. If done ahead, tailored responses to specific behaviors can be developed to shape future behaviors rather than to simply be punitive.

• **Coordinate national responses and synchronize actions.** These actions should complement and support or enhance international institutional responses using various forms of accountability, including legal, sanctions/economic, political, and military actions.

• **Investigate and expose every credible case.** Selectively engaging with cases encourages risk-taking by users; certainty is more dissuasive than severity in most cases. Consequences in all cases are important, but not all consequences must be military in nature.
REDUCING BENEFIT AND UTILITY TO USERS

▪ Improve civilian, military, and international capacity and cooperation by working collaboratively across the military and civilian sectors. New agents will force the international community to up its game in terms of detecting, protecting, analyzing, diagnosing, treating, and attributing CW threats. This requires collaboration between local law enforcement and first responders with international partners to improve detection, protection, and treatment in the event of an attack.

▪ Enhance capacities for response and attribution across the alliance, in partner countries, and in international institutions. Domestic responders, especially those in countries that may not have highly advanced or sophisticated chemical defense expertise, must be better equipped to safely recognize and treat these types of chemical agents.

▪ Build and enhance capabilities to investigate and attribute CW events. Enhance national and international technical and operational investigative and response capacities. Novichoks are more demanding from a technical perspective, so it is essential to have adequate defense and response capabilities.

▪ Ensure that domestic responders can be better equipped to safely recognize and treat these types of chemical agents. This is especially important for those in countries that may not have highly advanced or sophisticated chemical defense expertise. The Skripal attack and Kim Jong-nam's assassination demonstrate that even when these weapons are used for targeted violence, they can have much broader impacts for responders, medical providers, law enforcement, and others. Moreover, all these cases demonstrate that the economic and societal costs can far exceed the impact in terms of fatalities. Responses need to create perceptions that benefits will be denied, not enhanced.

PREPARING FOR ARMS CONTROL IN AN ERA OF GREAT COMPETITION

▪ Contest in the face of noncompliance. CW use is a manifestation of hybrid warfare, and while it is important to find areas for cooperation among states, contesting in the face of noncompliance is essential. Contestation in these arenas is simply part of the broader competitive environment. Using the rules and procedures in the CWC to press compliance reinforces norm resilience and reduces the risk of conflict or crisis at higher levels of escalation.

▪ Do not value the institutions (or treaties) beyond their purpose. The CWC offers the benefits of multilateralism: all stakeholders have a role and a vote. As a result, countries like Russia and the United States pay much higher costs for walking away, which means losing the ability to shape outcomes from within. This only works, however, if countries understand the stakes, remain committed to the Treaty’s core requirements, and exercise their rights through the treaty’s procedures and mechanisms.

PREPARING AND CONTESTING THE INFORMATION BATTLEGROUND

▪ Engage a sustained, multilateral counter-disinformation campaign. Call out disinformation where it is observed and counter it with facts to support the rules-based order by repeatedly issuing consistent, verifiable information. Anticipate attacks and develop responses to disinformation challenges that are aggressive, collective, asymmetric, and rapid and that can be readily deployed when needed.
• **Fill the research and analysis gap.** Rigorous, data-driven research and analysis is desperately needed to detect and recognize disinformation, understand why it’s effective, and appreciate how it can best be stopped and countered. Disinformation will be a persistent feature of multilateral diplomacy and arms control for the foreseeable future. It is time to take it much more seriously.

• **Focus on noncompliance in messaging.** There is quite a bit of disagreement on appropriate strategies, but the focus must be kept on noncompliance. Detailed responses sometimes give adversaries more to pick apart, but not responding enough leaves a vacuum that is filled by other narratives. Techniques of repeatedly issuing consistent information seem useful.

**PREPARING FOR CW CONTINGENCIES**

• **Plan and prepare for the North Korean CW challenge.** The technical, operational, legal, and political hurdles associated with the North Korean CW program require dedicated planning and preparation. In conflict, North Korea could determine that chemical weapons are more usable than its nuclear weapons and consider their employment early to weaken resolve in South Korea.

• **Engage critical partners and allies on the DPRK CW problem and planning for chemical disarmament.** A North Korean decision to abandon its chemical weapons is not impossible, either as part of a comprehensive denuclearization agreement or perhaps independent of one. Regardless, such an effort would be technically complex, dangerous, and expensive. It is essential to anticipate these scenarios, identify critical capability gaps, build partnerships, and address challenges in advance to be able to respond to future crises or opportunities involving these weapons.

**BROADENING AND ENGAGING THE INTERNATIONAL COMMUNITY**

• **Provide greater education opportunities and training within and outside of The Hague.** This includes offering opportunities in national capitals, security discussions, partnerships, and alliances (e.g., NATO) and through consortium outreach to address a fundamental lack of knowledge and expertise across many countries.

• **Awaken the “quiet middle.”** There is a huge number of nonvoting and abstaining countries in the OPCW that should be tapped into by improving their understanding of the stakes of CW procurement and use and providing more education and awareness on the facts to move states off the sidelines. It is vital to raise states’ comfort levels with contested outcomes by reiterating that in the face of evolving yet persistent CW threats, using the tools of the treaty in support of compliance is a sign of resilience, not failure.

• **Protect and defend the anti-CW norms and the institutions that support them.** Every participating state bears a responsibility to stand up for the legitimacy, objectivity, and credibility of the anti-CW regime, including the OPCW. Attribution and the pursuit of compliance are central to the treaty’s viability over time—arms control appeasement will ultimately fail.
1 | Introduction

Chemical weapons are back. Today, old actors are employing new forms of chemical weapons, and new chemical weapons (CW) states are employing them in new ways. Meanwhile crude forms of chemical weapons have fallen within the reach of non-state actors. The willingness of some state and non-state actors to use or acquire chemical weapons appears to have increased, and the potential for state or non-state actors to field CW capabilities is growing rapidly. Unless the international nonproliferation regime can adapt to address the threat of chemical weapons, these concerning trends will almost certainly intensify in the foreseeable future as proliferation networks and emerging technologies with CW implications mature.

This study examines the evolving and changing nature of chemical weapons and how the system of restraint—comprised of norms, taboos, deterrence, and denial of benefit—must adapt to ensure that the proliferation and use of chemical weapons do not reemerge as endemic features of the global security landscape. This study provides a framework for structuring the problem, identifies gaps and challenges, and puts forward options for improving global efforts to prevent the proliferation and use of these weapons.

The Evolving CW Landscape

By 2010, the establishment and entry into force of the Chemical Weapons Convention (CWC), the declaration and elimination of most known CW programs, including those of Iraq and Libya, and a sustained period of nonuse of chemical weapons had driven concern about chemical weapons to a few esoteric corners. In the years following the CWC’s entry into force in 1997, the use of such weapons all but disappeared. At the same time, chemical weapons also remained largely beyond the skills and interests of non-state actors, and the improvised chlorine devices used on occasion by insurgents in Iraq were deemed more nuisance than threat. Even as late as 2012, some analysts considered emerging CW use in the Syrian Civil War to be a post-CWC historical anomaly and remained skeptical of the continued relevance of chemical weapons as tools of state warfare, especially in light of further CW disarmament progress by Iraq and Libya. As the number of CW states steadily declined, the CWC was seen as being in the final technical stage of implementation, and some countries began questioning the sustainability of the Organization for the Prohibition of Chemical Weapons (OPCW), the implementing body of the treaty. It appeared that chemical weapons had been successfully managed and controlled through a robust international system of treaties, laws, and cooperative arrangements that led to a near universal disarmament of this class of weapon.
Unfortunately, this optimistic view has proven unwarranted. Syrian use of chemical weapons persisted even as the Assad regime joined the CWC and the international community embarked on a large-scale effort to remove and destroy Syria’s declared CW stockpiles and facilities. Since 2015, the number and types of CW attacks have increased, with at least 336 documented cases in Syria alone. While the overwhelming preponderance of uses have occurred throughout the Syrian conflict, CW attacks have occurred in three other countries—Iraq, Malaysia, and the United Kingdom—for a variety of purposes and involving a variety of agents.

The prospect of large-scale, state-on-state chemical warfare has continued to fade, but states have pursued and employed chemical weapons for a variety of tactics and strategies, including counterinsurgency, assassination, coercion, terror, collective punishment, and signaling. Even more alarming, such use has not been confined to states operating outside of the CWC. Rather, states party to the CWC, specifically Syria and Russia, have used and enabled use of chemical weapons despite being treaty adherents. Small-scale, high-impact use of chemical weapons has been used to suppress internal conflicts, intimidate or eliminate political adversaries, and engage in gray zone conflict in ways that challenge the ability of countries to respond effectively.

Syria illustrates a case of improvised state-use as a tool of civilian terror, while Russia demonstrates state-use by a major power as a gray zone tool of hybrid warfare. Additionally, non-state actors have developed and used “military agents” (specifically sulfur mustard, though it is unlikely as pure as traditional military-grade sulfur mustard agent) and chlorine with a range of improvised delivery systems. The Islamic State demonstrated that access to territorial safe havens, facilities, and personnel could be leveraged into more advanced chemical agent and delivery capabilities, and the group used these weapons in targeted military or insurgent operations rather than in classic terrorist attacks.

CW users have also employed significant improvisation—in terms of agents, munitions, delivery systems, and concepts of operation—even when more traditional options were available. Such improvisation is a hallmark of the evolving utility and application of chemical weapons to contemporary conflicts, using methods as disparate as chlorine barrel bombs and perfume bottles filled with thousands of lethal doses of advanced military agent. Meanwhile, international organizations, such as the United Nations and the OPCW, have shown little ability to enforce obligations or hold perpetrators accountable. Moreover, the little progress made has required a shift to more contentious forms of diplomacy and resulted in the collapse of consensus within the OPCW Executive Council. Finally, chemical agents that fall outside of the traditional schedule of military agents—such as chlorine and other toxic industrial chemicals (TICs), fentanyls and other incapacitants and opioids, and Novichoks—are demonstrating growing potential for use, while advances in chemical engineering and rapidly expanding global supply networks promise to make weaponized chemicals increasingly accessible.

All of these trends suggest that chemical weapons remain a persistent and evolving challenge to the global nonproliferation system, with implications and lessons that stretch far beyond the relatively obscure niche these weapons generally occupy.
This evolving landscape suggests that the traditional concepts, tools, and institutions that comprise the anti-CW regime must also evolve and adapt to prevent the proliferation and use of these weapons. A 2018 CSIS report, Restoring Restraint: Enforcing Accountability for Users of Chemical Weapons, describes how the global system “shapes nations behavior” and “encourages restraint through several different, often mutually reinforcing mechanisms: taboos, lack of benefit, norms, and deterrence.” Each of these mechanisms simultaneously plays a role and helps inform how the international community must work to prevent the proliferation and use of chemical weapons.

The system of restraint provides a framework for structuring the problem, identifying gaps and challenges, and hopefully developing options to improve our ability to prevent the proliferation and use of chemical weapons. It also seeks to enhance accountability and enforcement when prevention fails by better understanding how and where to apply tools of enforcement and compliance.

This evolving landscape suggests that the traditional concepts, tools, and institutions that comprise the anti-CW regime must also evolve and adapt to prevent the proliferation and use of these weapons.

<table>
<thead>
<tr>
<th>Taboos</th>
<th>Norms</th>
</tr>
</thead>
<tbody>
<tr>
<td>The moral, societal, or political costs associated with CW proliferation and use are so high that restraint is the natural outcome.</td>
<td>The institutionalized laws and rules that prohibit or control CW proliferation and use are sufficient to encourage and reward restraint.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lack of Benefit</th>
<th>Deterrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>The tactical, operational, and strategic benefits of chemical weapons are so low that restraint is the natural outcome.</td>
<td>The expected punitive response to CW use or proliferation imposes costs that far exceed any potential benefits such that restraint is encouraged.</td>
</tr>
</tbody>
</table>
**Norms**

Norms emanate from a system of recognized and institutionalized laws and rules designed to shape behavior and encourage restraint through legal, political, and sometimes military carrots and sticks. Norms may be legally or politically binding and informal in character, but they are clearly defined, broadly recognized, and generally underpinned by formal structures and obligations. Most actors or states conform to these rules or laws because they value credibility or legitimacy in the system, value the restraining effects of these rules on the behavior of others, or fear the costs of enforcement of those rules or laws.

Chemical weapons face one of the most robust normative structures in the international system—a web of national and international laws and regimes that spans more than 100 years and includes a comprehensive ban in a nearly-universal treaty. The underpinnings of these norms stem from the Hague Conventions of 1899 and 1907. These conventions formalized an international attempt to limit chemical agents in warfare and prevent “the use of projectiles” designed to diffuse poison gases. The Geneva Protocol, established in 1925 in the wake of World War I, took it a step further and was the first major push to ban chemical weapons in conflict. While an important first step, the Geneva Protocol did not prohibit the production, research, or stockpiling of chemical (and biological) weapons. Furthermore, the U.S. Senate failed to ratify the Geneva Protocol; however, numerous U.S. presidents pledged to abide by the agreement anyway.

As a result, the international community created the Chemical Weapons Convention (CWC). The CWC entered into force in 1997 and is one of the first international treaties to provide for the comprehensive ban and subsequent elimination of an entire category of weapons. Encompassing almost the entire international community, with 193 states parties, the CWC bans the development, production, transfer, and use of chemical arms, as well as the declaration and elimination of all existing CW stocks and related materials and infrastructure. The number of states outside of the regime, including CW-possessors, has dwindled since the CWC entered into force, and currently only North Korea, Egypt, South Sudan, and Israel remain outside the CWC, though Israel is at least a signatory. Moreover, CW-possessors who were slow to join the treaty and of particular concern to the international community, namely Iraq and Libya, are now adherents. Accessions of member states and verified declarations help reinforce the CW nonproliferation regime, but the “outlier” status of some states remains cause for alarm. Israel and Egypt remain gridlocked in acceding to the CWC, with willingness to renounce chemical weapons being historically tied to regional weapons of mass destruction and conventional threat perceptions, as well as increasingly linked to negotiations on a Middle East WMD-free zone.

The CWC incorporates a robust verification system implemented by the OPCW. The OPCW is responsible for reviewing states parties’ declarations, inspecting and monitoring facilities, providing technical support to member states, and evaluating matters of verification and compliance. It has traditionally utilized a consensus-based decisionmaking structure and left matters of enforcement and accountability under the purview of the UN Security Council (UNSC). However, if a state is found to be in noncompliance, the goal of the treaty is to bring the state back into compliance as quickly as possible and establish a path for remedial actions. This can occur through the OPCW,
or the OPCW can refer the matter to the UNSC. The UNSC can authorize an investigation to determine attribution, authorize the use of military force under Chapter VII of the UN Charter, impose international sanctions, or call for additional actions. Attribution and the pursuit of compliance are central to the CWC’s viability over time. This traditional division of responsibility and decisionmaking shifted in the wake of continued CW use by the Syrian regime and its political protection from Russia, a permanent member of the UNSC.

To address gaps in the CWC, additional processes and mechanisms were established to help prevent the spread of CW-related materials. One such organization is the Australia Group (AG), which was established to ensure that exports of certain chemicals, biological agents, and dual-use chemical and biological manufacturing facilities and equipment do not contribute to the spread of chemical and biological weapons. This voluntary group does not have any legally binding obligations and currently consists of 41 country participants and the European Union. AG mechanisms include national control laws and procedures; Common Controls Lists (precursors, equipment, agents, and organisms); guidelines for industry to assist in identifying potential CW equipment transactions; and information-sharing among members when suspicious inquiries are received, cases are denied, or information suggests possible international procurement for untoward purposes.

In addition to the AG, the UNSC adopted UNSCR 1540 in April 2004 under Chapter VII of the United Nations Charter. The resolution requires all states to criminalize and enforce measures against WMD proliferation to and by non-state actors and is legally binding to all UN member states. Unlike the CWC, UNSCR 1540 also controls the equipment and technology associated with scheduled chemicals, not just the scheduled chemicals themselves. Implementation of UNSCR 1540 has faced some challenges, particularly a lack of capacity and resources at the national level and is scheduled to be reviewed in 2021.

Finally, norms against CW use are woven extensively throughout international humanitarian and war crimes law. Indeed, the use of chemical weapons is widely seen as prohibited even under customary international law. In addition, the CWC’s robust verification system, supported by related national and international export control systems, ensures these norms restrain proliferation and use.

However, Syria and Russia have not met significant consequence for their continued violation of the treaty from within the institution, a highly corrosive outcome for these norms and their restraining value. But the normative mechanism faces external threats as well. Both state and non-state actors that operate outside of the treaty, such as North Korea and the Islamic State, face little normative restraint. Also, while the treaty’s central prohibitions on the possession and use of chemical weapons encompass any chemical agent used as a deadly weapon, the growing number of chemical agents and precursors that lie outside of the existing control and verification schedules (e.g., chlorine, novachuks, and pharmaceutical-based agents (PBAs)) further complicates the effectiveness of the system, especially in terms of restraining proliferation. Repeated small-scale, limited use of chemical weapons has also tested response thresholds and complicated responses. Repeated use effectively raises costs for responders and lowers costs for users, which leads to a deterioration of the normative structure. Altogether, while the normative structure designed to restrain CW use and proliferation remains strong, the challenges are growing in number and complexity.
Lack of Benefit

Potential users and proliferators of chemical weapons are also restrained through a perception that these actions fundamentally lack benefit or utility in terms of meeting desired objectives. If an actor believes chemical weapons have no utility or functionality, then the motivation for use is low and restraint is a natural outcome. Lack of benefit often results from the natural obsolescence of weapons and warfare as one class or type of weapon is replaced with another more effective, less costly weapon. The history of warfare is littered with tools and weapons that lost their perceived benefit—horses, sling shots, and (for the most part) chemical weapons intended for large-scale, force-on-force warfare. Furthermore, enhanced CW defenses or protection offer additional ways of reinforcing perceived lack of benefit, leading to what some call deterrence by denial.

However, it is impossible to deny the benefits of CW use if their utility to the adversary is fundamentally misunderstood. Projected bias and unchallenged assumptions about the utility of chemical weapons have led to a serious underestimation of utility for counterinsurgency, special operations, intimidation and coercive gray zone or hybrid tactics, as well as large-scale civilian terror operations. This faulty analysis has been fostered by a tendency to evaluate the efficacy of chemical use solely in terms of direct lethality or tactical impact rather than as a psychological weapon of terror, collective punishment, intimidation, or messaging.

Moreover, repeated small-scale chemical attacks may be more effective in terms of psychological impact on the targeted population than larger, more spectacular events that grab the global headlines. In the case of Syria, the role chemical weapons play in combined chemical and conventional military operations has also been underappreciated. Syria’s approach appears to challenge the belief that chemical weapons have become militarily obsolete and suggests that their utility remains high, especially when used in combination with conventional weapons or when implemented primarily as tools of hybrid or psychological warfare, especially during internal conflicts.

Some analysts and commentators have dismissed, diminished, and in some cases flat out denied or doubted CW use, claiming it “does not make sense,” further contributing to the skepticism about the facts of CW use. Discounting the “logic” of CW use based on misperceptions of benefit to the user can also foster proponents of false flag conspiracy theories and other disinformation tactics. This turns the facts upside down, allowing false “logic” to discredit actual chemical attacks, while unsubstantiated conspiratorial claims flourish without scientific or investigative corroborating evidence. Furthermore, this logical “discounting” of CW use encourages the international community, especially the “quiet middle” group of states, which seeks to stay on the sidelines, not to call out instances of use or to not call out against this trend loud enough. For example, when Russia sought to co-lead the OPCW investigation into its own attack on Sergei Skripal in 2018, 6 countries voted in favor and 17 abstained from the proposal, largely based on the excuse that Russia’s role in the attack did not “make sense.”

Deterrence

Deterrence encourages restraint when an actor can convince an adversary that punitive response to an action, in this case the use or proliferation of chemical weapons, will
produce costs that exceed any benefits. Effective deterrence relies on the existence of a mutually understood, credible threat. The recipient of the threat must know it exists, believe it is credible, and believe the costs of testing the threat are far higher than the benefits of proceeding with the action. Deterrence can and must be enforced, but such enforcement will only contribute to future restraint if the costs are sufficient to decisively shape the cost-benefit analysis. In many cases, this involves the imposition of punishment by force, but it can also be punishment through economic, political, or other means. Above all, attribution is critical to deterrence: a threat cannot be enforced if the perpetrator cannot be identified.

Historically, deterrence has not been a strong feature in the CW system of restraint. In the case of Syria, the deterrence threats that existed, such as the infamous Obama redline, lacked appreciation of the utility of the weapons and credibility with the user. The 2017 airstrikes on Syria did not seem to produce a meaningful deterrent effect. The second round of more punitive air strikes undertaken by the United States, the United Kingdom, and France in 2018 seemed more effective, but it is less clear if this resulted from the strike’s deterrent value or other factors, such as the war’s overall turn to Assad’s favor. Regardless, when considering that the Assad regime used chemical weapons as many as 336 times over the last seven years, it seems clear that deterrence threats were poorly applied and largely ignored. Indeed, for Syria the benefits of advancing the regime’s operational gains on the ground trumped the political or even military price to be paid for chemical weapons use time and again, rendering deterrence of very limited restraining value.

The case of Novichok use in Salisbury may turn out to be the more interesting deterrence case. In the aftermath of Russia’s Novichok attack on the Skripals, Russia was surprised by the interpretation of the attack as a violent infringement on national sovereignty and the synchronized expulsions of Russian personnel. The response was clear and strong, especially given the number of countries willing to act quickly and in concert. Even if the tools were asymmetric, they sent a clear deterrence message. The general impression is that Russia may have miscalculated the costs of the attack, which appear to have exceeded the perceived benefit. Compared to the deterrence picture in Syria, the multilateral response to the Skripal incident forms an important juxtaposition.

The Syria case exposes another serious challenge to deterring CW use: repeated limited or small-scale use. In these scenarios, benefit accumulates over time with each successive CW use. As a result, even when a particular use event has triggered a punitive response, this response is shaped entirely by the “last” use rather than the accumulated benefit of all prior instances of use. Our traditional deterrence tool kit assumes an adversary behaves like a mass murderer—dramatic, visible, and attributable. Yet CW use seems to be following a different playbook: a serial killer approach, which uses selective, targeted use to achieve its coercive or punitive goals. Small-scale or limited use also complicates the attribution process by making it more difficult to investigate and assess.

Finally, deterrence is even more problematic when applied to the proliferation, rather than use, of chemical weapons. While the Obama redline explicitly threatened a punitive response to the transfer of chemical weapons and their use, in practice this was understood to be limited to transfers involving non-state actors that could directly threaten partner states in the region, not state-to-state transfers. Among other problems,
verifying and attributing such transfers is extremely difficult and may not rise to a level of consequence required for a credible deterrence threat. Along these lines, no such threats have been issued to North Korea with respect to its assistance to the Syrian CW program. When it comes to proliferation prevention, thresholds may be too difficult to define and perpetrators too difficult to identify for punitive deterrence to be credible.

Taboos

Taboos exist when an action is perceived to carry such high moral, societal, or political cost (internal or external) that self-restraint is the natural outcome. Taboos tend to build over time as leaders internalize the potential risks and are most effective when perceptions are more universally held and globally understood. In addition, taboos naturally become fragile when violations do not result in the anticipated costs and the user’s legitimacy with essential stakeholders does not suffer.

In general, taboos have had limited restraining value in terms of CW use, and where such taboos have existed, they have been temporary and regional in effect. Some believe the physical and psychological damage inflicted by weaponized chemicals during World War I built a sense of taboo around these weapons in Europe, and in the lead up to World War II, strong legal and moral restraints stigmatized chemical weapons. At the same time, scientific research demonstrated that chemical weapons yielded effects that many considered “beyond the pale” of reversible or tolerable circumstances.

The Stockholm International Peace Research Institute attributed the nonuse of battlefield chemical weapons in World War II to three major factors: (1) deterrence; (2) “a general feeling of abhorrence on the part of governments for the use of CB [chemical/biological] weapons, reinforced by the pressure of public opinion and the constraining influence of the Geneva Protocol”; and (3) a lack of military counter-CW preparedness. However, the taboo clearly did not extend to the extensive use of gas chambers throughout the Holocaust or the repeated use of chemical weapons in the Middle East in the late-1980s and in recent years. Syria could be exploiting other actors’ and targets’ perceptions of chemical weapons by breaking the taboo, challenging the restraining mechanism within the system, testing adversarial redlines for direct conflict, and signaling the regime’s intention to use all possible means to prevail.

The CW taboo is undermined by many actors, both state and non-state, that lack understanding or have bad information on CW use, effects, and impacts on the system or that see such threats as unimportant. Further, the growing impunity surrounding chemical weapons—the ability to use without severe internal or external penalty—is fostered by the lack of political, moral, and societal costs associated with their use.
3 | Emerging Challenges to the CW System of Restraint

Today’s shifting security environment has revealed emerging challenges to and increased pressure points on the ways in which norms, taboos, denial of benefit, and deterrence might restrain future CW proliferation and use.

**Small-Scale and Limited Use**

Chemical weapons traditionally involved costly, industrial-scale military programs—such as those possessed by the United States and Russia prior to joining the CWC and used extensively by Iraq during the Iran-Iraq War and against the Kurds of Iraq. Such programs animated the international system and drove efforts to ban and eliminate these weapons. Today, with the glaring exception of North Korea, industrial-scale, battlefield-oriented CW programs have largely vanished and with them went much of the prospect of large-scale, state-on-state chemical warfare. However, this class of weapon has proven far more resilient than anticipated, evolving and adapting in applicability to contemporary conflicts and suggesting that chemical weapons may have a more enduring appeal in other scenarios. Unfortunately, CW use is making a comeback, albeit generally in small-scale and limited-use scenarios, including insurgency/counterinsurgency, assassinations and special operations, and non-state actor use.

**INSURGENCY/COUNTERINSURGENCY**

The use of chemical weapons for insurgency and counterinsurgency purposes in internal state scenarios is not a new development but rather one that has re-emerged over the last two decades since sporadic appearances during the Cold War. The earliest known case occurred during the North Yemen Civil War (1962-1970), when Egypt provided support to republican rebels in their revolution against the monarchy of Imam Muhammad al-Badr. With Soviet-supplied warplanes, Egypt deployed sulfur mustard-filled artillery and phosgene-filled barrel bombs against royalist military and civilian targets. Elsewhere, proxy forces were accused of using Soviet-supplied chemical weapons with a variety of delivery systems—aerial bombs, artillery, booby traps, and spray tanks mounted on aircraft and helicopters—in Laos and Cambodia, then under Vietnamese control, against resistance forces and civilians. Furthermore, the Soviet Union was assessed to have systematically used chemical weapons in counterinsurgency operations against civilians and mujahedin
Beginning in the early-2000s, reports of insurgent procurement or use of chemical-fused improvised explosive devices began to appear. Insurgents in Iraq began using chlorine as a weapon in hybrid attacks with vehicle-borne improvised explosive devices in 2004 and attempted to use other lethal agents as well. Insurgents in Afghanistan reportedly tried to follow suit, though some observers state that crude chemicals were used more as a tool for disruption in efforts to evade reconnaissance or capture. 

**Unfortunately, CW use is making a comeback, albeit generally in small-scale and limited-use scenarios, including insurgency/counterinsurgency, assassinations and special operations, and non-state actor use.**

Prior to 2012, CW use by the Syrian regime was once viewed as unthinkable or unlikely by some experts who viewed Assad’s CW program solely as a strategic insurance policy vis-à-vis Israel. CW use has now proven to be a strategic tool of counterinsurgency, terror, and collective punishment. In one of the most lethal instances of CW use in history, with a magnitude and scale not seen since the Iran-Iraq War, the Syrian regime killed roughly 1,400 civilians with sarin nerve agent in Ghouta in August 2013, crossing President Obama’s redline on CW use in conflict and inspiring an extensive international effort to eliminate Syria’s CW program. These international efforts reduced the Assad regime’s capacity to use chemical weapons dramatically but did not fundamentally eliminate their value or utility in the civil war—a value or utility that could be achieved with very low quantities of agent and improvised munitions.

By mid-2014 and continuing for the next five years, Syria continued to incorporate chemical weapons, particularly chlorine, into its counterinsurgency battleplan. Over the course of that period, the Syrian regime used small-scale chemical attacks in conjunction with conventional strikes on hundreds of occasions in its efforts to reclaim territory that had fallen under opposition control. Two incidents proved particularly deadly and prompted international response. On April 4, 2017, the Syrian Armed Forces employed sarin in Khan Shaykhun, killing approximately 100 people and injuring hundreds more, the deadliest CW incident since the 2013 Ghouta attack. CW incidents in Syria temporarily declined through the next year after unilateral military strikes by the United States against Syrian military targets, an effort that received widespread international backing. However, in April 2018, allegations of chemical use by the Syrian regime again emerged in Douma, with 50 killed and hundreds wounded. Initial reports suggested that chlorine and a nerve agent were used in the attack, but the OPCW later reported that it was unable to find any evidence of the use of nerve agents. Hours after the attack, Israel conducted airstrikes against a military airfield hosting Iranian military personnel and belonging to the Syrian Arab Air Force, to which CW attacks in Syria are often attributed. Within a week, U.S., UK, and French forces conducted a series of strikes against Syrian government facilities purportedly linked to CW activities.
Since then, CW use has noticeably declined, although it is difficult to know whether this relative nonuse reflects a new calculus on the utility of the weapons or the reality that they are simply no longer necessary, as the Syrian government has consolidated its gains in the war and largely broken the back of the insurgents. Furthermore, recent reports indicate that Syria once again used chemical weapons in May 2019, this time with chlorine-filled rockets near Latakia Province, suggesting that Syria’s cost-benefit analysis is driven overwhelmingly by tactical warfighting factors rather than more strategic or political tradeoffs associated with deterrence.\textsuperscript{42} Throughout its more than seven-year war, Syria has effectively used chemical weapons to secure its operational and psychological objectives while largely confounding the international community’s ability to respond, due to limited-scale attacks, improvised agents and munitions, and combined chemical and conventional operations. Syria’s impunity has been enabled by the protection offered by Russia, its patron and benefactor. It is less clear how a state without such protection might fare in a future conflict if it used chemical weapons.

**ASSASSINATIONS AND SPECIAL OPERATIONS**

On February 13, 2017, Kim Jong-nam—a half-brother to Kim Jong-un—was killed in Malaysia’s Kuala Lumpur International Airport by VX nerve agent. He was approached separately by two women who both wiped an oily substance on his face and disappeared.\textsuperscript{43} He was dead 20 minutes later, in what is widely seen as an assassination plot ordered by the Kim Jong-un and led by special operations units under his control.

In another CW-related assassination plot, an advanced nerve agent was used in the United Kingdom in March 2018, this time perpetrated by Russia. On March 4, 2018, a former Russian intelligence officer, Sergei Skripal, and his daughter were contaminated with Soviet-developed Novichok agent in an assassination attempt by Russia’s intelligence services.\textsuperscript{44} Timely and effective treatment led to the fairly miraculous recovery of the Skripals, but the secondary and tertiary psychological, environmental, economic, and political impacts of this plot have persisted at the local, national, and international levels.\textsuperscript{45} The attempt is widely believed to have been carried out by members of the Russian Military Intelligence Service—known as the GRU—a Russian government agency.

A recent article hints that special operations units, such as the one deployed for the Skripal poisoning, could be more active than originally believed. The article alleges there is an elite unit within the Russian intelligence system that is skilled in subversion, sabotage, and assassination.\textsuperscript{46} According to press reports, the group, known as Unit 29155, has been operational for the last decade but previously unknown to Western intelligence. It appears that the unit is mobilized in instances of hybrid-warfare and is believed to be responsible for the destabilization campaign in Moldova, the poisoning of an arms dealer in Bulgaria, a thwarted coup in Montenegro, and the attempted assassination of the Skripals.\textsuperscript{47} The existence of this unit appears consistent with the covert and special operations capabilities of Russia, but it is possible that North Korea or possibly even Iran and China have similar capabilities. Furthermore, Russian special operations forces are believed to have used a fentanyl derivative as an incapacitant against insurgent hostage-takers at a Moscow theater in 2002.\textsuperscript{48} That fentanyl attack, which killed about 50 insurgents and at least 117 hostages, suggests that Russia developed capabilities and concepts of operation to use chemical and pharmaceutical-based agents (PBAs) for limited-use scenarios that skirt the riot control exceptions embedded in the CWC.\textsuperscript{49}
NON-STATE ACTOR USE
The first major acts of CW terrorism by a non-state actor, Aum Shinrikyo, in 1994 and 1995, compounded international concerns over the risks of WMDs. The doomsday cult, led by Shoko Asahara, released toxins into five crowded trains near the Kasumigaseki station in Tokyo on March 20, 1995. The attack killed 13 people and injured at least 5,500 more. The Aum Shinrikyo attacks demonstrated high degrees of technical expertise and motivations to acquire and use chemical weapons but were foiled due to negative internal group dynamics and general incompetence in evading law enforcement. Nevertheless, many observers believe that inept and ineffective domestic law enforcement procedures and oversight allowed the group to survive and thrive, despite an abundance of indicators suggesting a high likelihood of future CW terrorism. Moreover, Aum Shinrikyo's 1994 and 1995 sarin and VX nerve agent attacks in Japan represented a significant juncture in the CW environment: the development and use of military-grade CW agents by non-state actors. That said, the long pause in non-state actor CW use following the attacks and the relative ineffectiveness of chlorine based IEDs in Iraq from 2004 to 2015 contributed to a degree of complacency about the prospects of non-state actor CW use.

The Islamic State's rapid development and use of chemical weapons in Syria and Iraq as part of a broader campaign to establish and hold a caliphate in the region provided a rude reawakening to the non-state actor CW threat. Starting in 2015, the Islamic State was alleged to have used chemical weapons in both Syria and Iraq. The Islamic State used undistilled, or less pure than military-grade, sulfur mustard-filled artillery shells on several occasions in Syria and Iraq since 2015. It appears that the Islamic State used its territorial control, particularly in areas like Mosul University, to support a CW development program for limited quantities of vesicants (Levinstein sulfur mustard) and chlorine, with a wide-ranging set of improvised devices, munitions, and delivery systems. Furthermore, no available information appears to suggest that the Islamic State has utilized chemical weapons since its territorial losses in Iraq and the Levant.

Since the Aum Shinrikyo attacks of the mid-1990s, the international community has not seen traditional terrorist use of chemical weapons outside of areas of armed internal conflict. The Islamic State and Iraqi insurgents have typically used chemical weapons as more of a warfighting tool. That said, some factors raise fears that such uses could become more common in the future. The highly publicized attacks in recent years and the disruption these attacks caused may inspire renewed interest. Additionally, new and emerging technologies will continue to lower barriers to acquisition for these actors, thus making them more appealing.

IMPLICATIONS
Small-scale and internal-use scenarios greatly complicate the system of restraint by challenging legal verification approaches given the small quantities needed, complicating deterrence with low use thresholds, increasing the perception of benefit or utility of such weapons to users, and eroding the societal or moral costs associated with these weapons. The normative architecture surrounding chemical weapons was built on the assumption that chemical weapons would be manufactured by states using a limited set of precursors for use in state-on-state conflicts on the battlefield. However, as these cases of internal counterinsurgency, assassination, special operations, and nonstate actor use show, the
instances of use that have occurred largely fall outside of traditional state-on-state conflict scenarios. Small-scale and limited use also complicates the attribution process by making it more difficult to investigate and assess.

**Enforcement and Accountability**

Ultimately, both norms and deterrence will lose their restraining value without enforcement of the rules or threats that comprise them. Without an ability to hold violators accountable, neither threats nor rules can sustain their dissuasive power. Unfortunately, effective accountability has proven difficult in terms of both the international response to CW use by Syria and the national law enforcement efforts in Japan, Malaysia, and even the United Kingdom.

**INTERNATIONAL ENFORCEMENT: CW USE BY THE ASSAD REGIME**

No situation has been more confounding than the sustained use of chemical weapons by the Syrian regime and its enablement and protection by Russia, even after Syria joined the CWC in 2013. Removal operations were still underway in 2014 when the first reports emerged from open-source analyses and within the OPCW and United Nations of chlorine-filled barrel bombs being dropped from helicopters in contested battlespaces in Syria. Many of these alleged incidents occurred in areas where OPCW and UN investigators could not be ensured safe access for on-site inspections, as paramilitary forces for or against the Syrian regime were fighting in these locations. After the OPCW announced that Syria's declared CW arsenal was destroyed, CW use continued, with countless chlorine attacks and at least one incident involving the use of sarin nerve agent. Throughout the conflict, accountability and enforcement of the Syrian regime's CW use, both from norms and deterrence perspectives, have been particularly elusive.

Regarding the enforcement of international and treaty-based norms against Syria's use of chemical weapons, the results are mixed. On one hand, the international community has largely failed to impose genuine accountability, including justice for the victims of these and many other war crimes in this horrific conflict. Syria's compliance with the CWC after joining in 2013 remains highly problematic, especially in light of Russia's role as enabler and protector. And yet, even in the face of persistent violations and the active enablement by Russia of Syria's defiant behavior, the CWC and OPCW, in conjunction with the United Nations, have shown considerable organizational innovation and persistence in their efforts to improve Syria's compliance with and accountability to its international obligations. These efforts include the OPCW Declaration Assessment Team (DAT), established in 2014 to resolve possible gaps and inconsistencies in the Syrian declaration. The DAT, consisting of a team of experts from the Technical Secretariat, has made at least 18 visits to Syria, held meetings with Syrian authorities, visited former CW sites, and taken numerous samples which continue to suggest gaps, inconsistencies, and discrepancies in Syria's declaration.

The OPCW also established a Fact-Finding Mission (FFM) in 2014 to investigate alleged use of chemical weapons in Syria. The FFM's mandate is limited to confirming CW use, not to attributing use of such weapons to an actor, and has confirmed at least 16 cases of CW use since its inception. In order to attribute CW use, a Joint UN-OPCW Investigative Mechanism (JIM) was established pursuant to UNSCR 2235 in 2015. The JIM was given
a one-year mandate to determine if any of the cases investigated by the FFM could be attributed. It ultimately attributed seven incidents—four attributed to the Syrian regime and three to the Islamic State. The JIM concluded that the Syrian government was responsible for chlorine barrel bomb attacks in Talmenes in April 2014, Qmenas in March 2015, and Sarmin in March 2015. The JIM also concluded that the Syrian Armed Forces were responsible for sarin attacks in Khan Shaykhun on April 4, 2017. The JIM further concluded that the Islamic State used sulfur mustard-filled mortars in Marea in August 2015 and twice in Um Housh in September 2016. The JIM mandate expired in November 2017 when Russia vetoed further extension.

In addition, a French-initiated multilateral effort, the International Partnership Against Impunity for the Use of Chemical Weapons, was established in January 2018 to enhance, support, and share information documenting CW use, strengthen states’ capacities to prosecute CWC violators, and publicly report entities assisting Syria in CW production. Most recently, the Investigation and Identification Team (IIT) was established in June 2018, following the incidents of CW use in the United Kingdom and Syria, pursuant to a special session of the CWC Conference of States Parties. Despite strong objections by Russia, Iran, and their allies, the special session decided to establish an attribution mechanism to identify perpetrators and enablers of CW use in Syria based on incidents of use identified by the FFM or not previously reported by the JIM. At this time, the IIT has identified nine cases in Syria to investigate, but the Syrian government has refused to grant visas since the creation of the IIT. Despite this, Director-General Fernando Arias of the OPCW indicated that the IIT will be releasing its first report in the coming months.

**NATIONAL ENFORCEMENT EFFORTS: JAPAN, MALAYSIA, AND THE UNITED KINGDOM**

Domestic prosecutions also have a problematic enforcement and accountability record. The Aum Shinrikyo terrorist attack, Kim Jong-nam’s assassination at Malaysia’s Kuala Lumpur International Airport, and the attempted assassination of Sergei Skripal in the United Kingdom show how challenging it can be to successfully prosecute CW attacks. The murder trials of Aum Shinrikyo members who perpetrated sarin nerve agent attacks, which killed over a dozen people on Tokyo’s subway and injured thousands more, were bogged down by appeals for years, with the final seven suspects being executed a full 23 years after the attack. In the case of Kim Jong-nam’s assassination trials, murder charges were dropped entirely, and no North Koreans were held accountable—likely an attempt by the Malaysian government to return to positive bilateral relations with the Kim regime. The United Kingdom’s police investigation and an independent effort by open-source analysts identified the perpetrators of the Skripal attack, but arrests and prosecution seem unlikely because the perpetrators fled the country.

Aum Shinrikyo Trial: The trial of the leader of the Aum Shinrikyo cult, Shoko Asahara, lasted almost eight years and stretched into 257 hearings. The perpetrators of the attack repeatedly appealed convictions, and it was not until July 6, 2018, 23 years after the 1995 attack, that seven members of the cult, including Asahara, were executed in Tokyo for their crimes. Despite disavowing violence in 2000, Aum Shinrikyo exists today, has over 1,000 members, and continues to display Asahara’s videos and books prominently.

Kim Jong-nam’s Assassination and the Malaysia Trial: Following Kim Jong-nam’s assassination in Kuala Lumpur’s airport, an investigation was launched. Several
individuals allegedly involved in the plot fled the country and evaded capture, but the two women who delivered the VX agent—Doan Thi Huong of Vietnam and Siti Aisyah of Indonesia—were arrested and initially charged with murder. Both women claimed they were unknowingly groomed by North Korean agents who led them to believe they were participating in a Japanese YouTube prank show. Eventually, the charge against Aisyah was dropped entirely, while Huong faced only a charge of “purposely causing injury” by employing “dangerous means” and was sentenced to just three years and four months in jail, of which she served only a single month. In the end, it seems Malaysia favored a speedy settlement and a return to good relations with Pyongyang over demanding accountability for the attack, especially since much of the public seemed persuaded that the two women had been duped. A UN report seems to back up this claim by charging multiple Malaysian companies with assisting North Korea in violating an arms embargo and sanctions. In addition to the UN report, a 2017 Reuters report found North Korea-linked firms were running an arms network in Malaysia. It is likely that restoration of North Korea-Malaysia relations was facilitated by a swift conclusion of the trial.

UK Skripal Police Investigation: In the months following the original incident in Salisbury, a second, accidental poisoning of two additional people occurred in Amesbury, UK on June 30, 2018. The victims came into contact with a small perfume bottle containing a toxic chemical, resulting in the death of one victim and leaving the other victim seriously ill. The Defence Science and Technology Lab, which had previously identified the substance used in the Skripal incident as Novichok, identified the chemical in the bottle as a Novichok nerve agent identical to that used in the Skripal poisonings. At the request of the UK government, the OPCW conducted an independent investigation of the incident, and on September 4, 2018 the OPCW concluded their investigation and confirmed the UK government’s assessment. Upon confirmation by the OPCW, the United Kingdom formally linked the Amesbury incident to the assassination attempt on the Skripals. The police investigation revealed the arrival of two men into the United Kingdom from Russia, traveling under the aliases Alexander Petrov and Ruslan Boshirov. An investigative report by Bellingcat identified the two men as Anatoliy Chepiga and Alexander Mishkin and alleged there was a third person, Denis Sergeev, responsible for coordinating the operation. Images place the two suspects in the vicinity of the Skripal’s home on the day of the attack. Furthermore, lab tests revealed trace presence of Novichok in the hotel room the suspects were staying in. UK intelligence identified the suspects as officers in the Russian Military Intelligence Service (GRU).
Despite this identification and the extensive supporting evidence, the suspects fled the United Kingdom and are believed to be back in Russia, which does not permit the extradition of Russian nationals. As a result, the United Kingdom has issued a European arrest warrant that would allow for the suspects’ arrests if they were ever to travel outside of Russia. In a briefing to the UNSC, the United Kingdom’s Permanent Representative to the United Nations, Ambassador Karen Pierce, condemned Russia’s involvement in the incidents and interference in the ongoing investigations being conducted by the UK police and Crown Prosecution service. Nevertheless, formal prosecution of the suspects will likely remain elusive.

**IMPLICATIONS**

The difficulties of establishing accountability for chemical weapons through international mechanisms, especially given challenges within the UNSC, suggest that national systems for prosecution and accountability will remain essential. However, it seems evident that many drawbacks of international sources of accountability are also shared by national systems, namely that both are susceptible to political interference. Institutions established by the international community, such as the JIM, have been stymied by Russia and China, who benefit in shielding Syria from punishment or simply do not want to be held accountable themselves.

Domestic prosecution processes, especially when occurring in countries with close relations to CW-using states, are similarly vulnerable to interference, as was likely the case in Malaysia. And while Indonesian and Vietnamese diplomats played a large role in diminishing the charges the defendants faced, it is likely the Malaysian government saw a speedy conclusion of the trial as the best way to normalize relations with North Korea. Such events underscore the challenge of holding CW perpetrators accountable when political ties take priority over justice. While the perpetrators of the CW attack in Japan were eventually brought to justice, the decades-long process is concerning. In the United Kingdom, impressive police work identified the perpetrators, but the individuals could not be held accountable due to Russia’s protection and intervention. Another concern at the national level is the capacity of local entities to investigate and attribute CW events, especially in smaller, less capable countries. Technical and legal capacity-building efforts would not only improve prospects for national accountability but would also have knock-on effects in terms of supporting international attribution and accountability efforts.

**New CW Acquisition Trends**

The majority of modern state and non-state CW programs do not require the production-scale facilities or large bulk quantities of agents or precursors seen in the past. Research and development-level (R&D) infrastructure, which can be more easily hidden in dual-use facilities and combined with on-demand surge capacity, is sufficient for almost all scenarios. In addition, advances in R&D and production techniques enhance speed, precision, and ease of concealment, particularly in the areas of microfluidics, additive manufacturing, and artificial intelligence. Furthermore, back-integration—the process of synthesizing precursor chemicals from simpler, unregulated or domestically available ones—has become easier to accomplish. All the while, diffuse procurement networks facilitate the ability to identify and deceive suppliers, especially with the growth of e-commerce options.
ADVANCES IN R&D
Industry and academia have contributed to the development of emerging technologies which make R&D of traditional and perhaps novel agents and precursors easier and less detectable. Microfluidics technology, including microreactors, can enable more concealed chemical processing by reducing requirements for larger-scale equipment, allowing for more precise chemical analysis or synthesis and enabling safer conditions for the processing of hazardous chemicals. Additive manufacturing has fewer implications for the CW domain but can nevertheless enable more accessible or sophisticated production of microreactors and traditional chemical processing components. Conversely, artificial intelligence (AI) has vast implications for the CW domain, allowing for more efficient or novel procurement techniques, as well as enabling microreactors to process chemicals more efficiently or synthesize entirely new chemicals. Furthermore, AI can be used to better identify or deceive supplier targets and others involved in overt and clandestine procurement networks or can be used to better analyze chemicals processed in microreactors and synthesize novel CW agents or precursors.

BACK-INTEGRATION
Back-integration, or synthesizing precursor chemicals from simpler ones that are not regulated or from ones that are readily available from domestic sources, has been a concern for the counter-proliferation community since its use by the Iraqi regime in the 1980s and 1990s. Today’s limited use requirements and complex procurement techniques, however, make back-integration of chemical precursors for research and development of CW agents potentially more accessible and desirable, particularly in terms of avoiding detection. Additionally, the near-exponential proliferation of novel chemicals and growing maturation and diffusion of CW-enabling technologies almost certainly enhance opportunities for back-integration and reduced footprints. The availability of chemical precursors determines opportunities for back-integration, and sophisticated procurement techniques, as well as a maturing global chemical industry, almost certainly expand such opportunities. While uncontrolled chemicals can be substituted for controlled ones, or precursors can be produced from simpler and uncontrolled substances, purchasing small quantities from multiple sources could also serve as a valuable technique for circumventing export controls on precursors. However, if actors plan to use chemical weapons for small-scale use, it may be unnecessary to acquire large quantities of precursors.

EXPANDED PROCUREMENT NETWORK
Currently, trade involving the identified precursors for chemical weapons is monitored and controlled under the Australia Group, but 3 of the top 10 chemical-producing countries in the world—Russia, China, and Brazil—are outside of the control regime. Furthermore, determined states, and perhaps even non-state actors, are increasingly enabled through overt and clandestine procurement techniques with an expanding multitude of points to deceive suppliers, host governments of suppliers, intermediaries enabling transport or finance of procurement, customs and border authorities, law enforcement authorities, and intelligence services. Proliferators can co-opt, manipulate, and even acquire suppliers, which are becoming more globally diffuse and easy to identify given the emergence of online directories. E-commerce sites have also expedited the process for identifying target suppliers. In addition, proliferators have more means and ways available to them to evade authorities that may be monitoring the export and import
of dual-use goods, such as export control authorities or border controls and customs. Similarly, a wide variety of intermediaries—shippers, insurers, and financiers—may be deceived or co-opted by malign actors seeking to evade detection of transportation or finance of such goods. Intelligence services and law enforcement agencies tasked with proactively identifying illicit procurement activities and related entities are challenged enough. Even if illicit activity is detected, timely response and interdiction operations can be hampered by innovative transportation “cloaking” techniques, such as disabling or spoofing air or naval identification signals.

**IMPLICATIONS**

As CW users shift concepts of use toward small-scale and limited-use scenarios, the footprint and production capacity needed to develop chemical weapons shrinks. Advances in chemical science and engineering are also rapidly expanding the number of relevant chemicals and compounds outside of the CW control regime. There have been over 100 million new chemical substances created since the establishment of the CWC Schedules, and this figure grows by about 15,000 substances per day. In terms of verification, the AG only controls for chemical reaction vessels as small as 100 liters, or capable of producing batches weighing around 220 pounds. Vessels slightly below that size would be more than enough to enable a small-scale program that would completely avoid detection if a determined actor back-integrates with unregulated or domestically available chemicals. Furthermore, advances in CW R&D and production may start occurring below verifiable levels or where controls may not apply.

---

Over 100 million new chemical substances created since the establishment of the CWC Schedules, and this figure grows by about 15,000 substances per day.

**New and Emerging Agents**

In addition to new technology, there are new and emerging agents as well as old agents being used in new ways. Many such chemical agents—chlorine and other toxic chemicals, fentanyl and other deadly PBAs, and Novichoks—are not fully included on the CWC Schedules and can be transferred and used in ways that challenge or elude traditional verification and controls.

**OLD AGENTS, NEW USES**

Traditional chemical warfare agents are being used in improvised or sophisticated delivery forms, while toxic industrial chemicals are also being used in improvised forms. Traditional scheduled chemicals that have been used include the nerve agents sarin and VX used by Syria and the DPRK government, respectively. Additionally, chlorine and other crude chemicals have widely been used in recent years by both state and non-state actors, particularly by the Syrian government and by the Islamic State. CW use by the Syrian regime for counterinsurgency purposes mostly entailed the use of chlorine, which is highly accessible and does not require a sophisticated or large-scale program to be weaponized. Moreover, it is highly likely that no more than a few dozen tons of chlorine were used in the course of hundreds of attacks. The Syrian government used nerve agent on only a few occasions, and these instances
likely involved no more than a few hundred pounds of agent. The ability to use crude techniques for tactical or operational effect is not limited solely to the agents but also applies to innovation in delivery systems to make effective use of cheap and plentiful munitions. The Syrian government’s use of chlorine choking agent and sarin nerve agent appears to have been delivered through improvised aerial barrel bombs, rockets, and grenades. Similarly, the Islamic State appears to have used chlorine with improvised explosive devices and filled improvised rockets and mortar munitions with undistilled sulfur mustard.

NOVICHOK AGENTS
Nonproliferation concerns regarding the possible existence of Soviet-developed Novichok agents and Russia’s possible retention of this capability have existed since the 2008 publication of Vil Mirzyanov’s State Secrets: An Insider’s Chronicle of the Russian Chemical Weapons Program. Still, open-source information on Novichok agents was, and remains, relatively scarce, despite the recent use of a Novichok agent and the recent addition of some of these agents to the CWC Schedules in January 2019. Nevertheless, it has widely been understood that Novichoks are a more lethal group of military-grade nerve agents than most other nerve agents listed in military CW programs, such as VX. Novichoks are new agents only in a relative sense, being developed within the past 30 years, whereas other nerve agents have existed for over half a century. However, the recent use of Novichok in the United Kingdom marks the first confirmed instance of its use and opens the door to speculation of other past uses in alleged Russia-sponsored assassinations. Through a combination of luck, technical expertise, and proximity, the United Kingdom successfully identified the agent, treated the patients, and attributed the attack remarkably quickly. Had a variety of circumstances been different or had the attack occurred in a country with less sophisticated CW defense expertise, events could have unfolded far differently, with more contamination, more fatalities, and delayed identification and attribution.

PHARMACEUTICAL-BASED AGENTS
There is a longstanding history of state actors considering PBAs for law enforcement purposes, and some have recently been accused of developing such agents for chemical warfare or CW use, to include special operations-type functions. Russia and Iran have been accused since at least the 1990s of developing or retaining a latent capacity to develop agents that affect the central nervous system (CNS) for CW purposes. There is evidence Iran is producing CNS-acting PBAs for offensive purposes, which could include the synthetic opioid agent fentanyl and analogues, such as carfentanil. Furthermore, both Russia and China are suspected by some to be weaponizing PBAs, such as fentanyl derivatives, for CW purposes.
Despite these longstanding concerns, it is with the advent of the opioid crisis and the enormous illicit trafficking of fentanyl agents as part of international drug trade that PBAs have now surfaced as a greater national security concern. Fentanyl seizures have made headlines in recent years, with millions of lethal doses being confiscated in single drug busts. In August 2019, a three-state drug bust seized 30 kilograms of fentanyl—enough to kill roughly 14 million people. In January 2019, U.S. Customs and Border Protection officers announced the largest seizure of fentanyl in U.S. history, approximately 254 pounds, enough to kill tens of millions of people, traveling from Mexico to the Area Port of Nogales, Arizona. This seizure was nearly twice the size of the previous record seizure of 118 pounds of fentanyl in May 2018 and a similar-sized seizure arriving from China in the Area Port of Philadelphia, Pennsylvania in June 2018. The seizures of fentanyl in this quantity reveal how easily these substances have been trafficked into and throughout the United States since at least 2016.

These fentanyl derivatives, such as carfentanil, have extraordinary toxicity rates, and very small doses can result in intentional or unintentional fatalities. Fentanyl is 50 times more potent than heroin and, when trafficked, is frequently mixed with heroin, cocaine, or made into counterfeit pills. Additionally, some derivatives are readily accessed in large quantities in illicit markets and fairly easily delivered by terrorists through aerosolization. Though aerosolization of fentanyls is a rather sophisticated process, policymakers and CW experts have increasingly begun to consider the potential risk that PBAs such as fentanyl and its derivatives could be used as CW agents and are now reportedly considering developing countermeasures and antidotes for such attacks. Additionally, some recent reports show military and intelligence communities are using new techniques, including artificial intelligence, satellite imagery, and big data processing to map networks of production and distribution of these substances and hopefully constrain illicit supply networks. Nevertheless, other reports show that orders can still be placed electronically and even shipped through regular mail to purchasers.

**IMPLICATIONS**

Since the CWC Schedules were established, concerns have been raised that some CW agents are not included and that many facilities producing precursors, or precursors to precursors, are not subject to sufficient verification. Moreover some chemicals, such as chorine, are too ubiquitous to control, while a significant number of actual and potential CW agents, such as fentanyls, lie outside of the CWC Schedules and have important dual-use functions. Following the Skripal attack, some Novichok formulations were added to Schedule 1, but it is not clear if and how to regulate the precursors to these agents. This issue only seems destined to grow as more chemicals enter the global market coming from an ever-expanding list of production facilities and suppliers. Rapid introduction of new chemicals into the international supply chain and dual-use purposes of materials such as chlorine and PBAs suggest that new approaches will be needed to control CW proliferation.

In response to concerns regarding the dual usage of PBAs and CNS-acting chemicals, the United States, Australia, Switzerland, and 19 other co-sponsors submitted an initiative for consideration by the OPCW Executive Council. The initiative argues that there is no safe way to aerosolize CNS-acting chemicals for law enforcement purposes. Additionally, once aerosolized, CNS-acting chemicals are potentially as lethal as some Schedule 1
chemicals. Therefore aerosolization should be treated as a weaponization of PBAs and should be prohibited under the treaty. This proposal reflects the kind of innovations that are necessary as the pace and scale of modern innovation in chemistry and chemical engineering increasingly outstrip traditional control mechanisms, which rely on inventory or catalogue approaches rather than purpose-based approaches that focus on how chemicals can or will be used. Furthermore, state accountability efforts should emphasize effective security and safety cultures as much as control and accounting efforts.

**Disinformation**

Today, international efforts to prevent CW proliferation and use take place in an information war zone. The growing accessibility, maturation, and diffusion of online platforms and digital tools have democratized information but also contributed to easy manipulation and misuse while undermining credible and authoritative sources of information.

Misinformation is the spread of false information, regardless of intent to mislead, and can be used to fuel conspiracy theories and larger disinformation campaigns. Conspiracy theories are beliefs that covert groups are responsible for deceptive plots involving events or trends that are unexplained, suffer from ambiguities, or have a standard explanation and accompanying set of information. Disinformation is propaganda, or the deliberate manipulation of narrative or facts. Disinformation campaigns often amplify conspiracy theories and prey on areas where misinformation or lack of information may exist. While these counter-truth phenomena are not new, they are becoming more prevalent as a result of increasingly accessible, mature, and diffuse digital networks, platforms, and tools.

Today’s information ecosystem has obvious benefits for those seeking to access and disseminate accurate information but the tremendous ability of various actors to wittingly or unwittingly contribute to misinformation, conspiracy theories, and disinformation has made navigating this space increasingly difficult. Moreover, the challenges of conspiracy theories and disinformation are increasingly mainstreamed into the business of bilateral and multilateral diplomacy and arms control. In the chemical weapons arena, attacks on information and evidence and the institutions tasked with utilizing such tools to ensure accountability have sought to discredit and politicize the work of the OPCW, the French-led Partnership for Impunity, and national authorities and non-state actors working to curb the proliferation and use of chemical weapons. Furthermore, individuals are increasingly targeted and threatened in the information environment, including first responders, analysts working in NGOs or independently, and the victims of CW attacks themselves.

Arms control, especially chemical arms control, is beginning to exist in a post-truth world, where trust in the accuracy and reliability of information across the online ecosystem is increasingly under fire. Manipulated journalism and image-centric memetic content (including pictures, icons, lyrics, and catchphrases) have greatly contributed to misinformation and inflammatory fiction, such as conspiratorial narratives regarding
vaccines and chemtrails, and are increasingly prevalent across arms control and other international security communities.\textsuperscript{117} Disinformation campaigns have spread their propaganda through a wide variety of popular social platforms with huge volumes of content, including Twitter, Facebook, Instagram, YouTube, Vine, Gab, Meetup, VKontakte, LiveJournal, Reddit, Tumblr, Pinterest, and Soundcloud.\textsuperscript{118} The volume of deceptive content and its perceived reliability is simultaneously increased by the development of a “cross-platform media mirage,” in which disinformation campaigns may build multiple interlinked brands across different platforms to host original content and make false narratives or content appear more authentic.\textsuperscript{119} Content within these apps and websites are further made to appear reliable when disseminated on social platforms through the use of click farms, paid advertising, false personas, botnets, and newsbots.\textsuperscript{120} Human-operated or automated accounts are also known to engage influencers, media, and regular people to function as human assets, some wittingly but most unwittingly, in further disseminating disinformation and misinformation and amplifying conspiracy theories.\textsuperscript{121}

Syria, Russia, and other state and non-state supporters use these methods to undermine or wield adverse influence, sometimes in the CW domain. Many have reported on Russia’s disinformation tactics and tropes, and such methods and narratives appear to have been mimicked by its allies, such as Syria and Iran.\textsuperscript{122} Some sources specifically describe how the Russian government and its supporters, and possibly the Syrian and Iranian government and government-affiliated sources, have engaged in disinformation campaigns specifically within the CW domain. These findings indicate that sources utilize online platforms and synthetic tools to systematically attack credible information, accounts, and evidence by denying the occurrence of events or actions perpetrated, misidentifying the victims and targets, and discrediting or falsifying the motives and identities of witnesses and responders.\textsuperscript{123}

Another study focused on Russian counternarrative messaging on Twitter in the aftermath of Syrian CW attacks in Douma in 2018.\textsuperscript{124} The study assessed that synthetic accounts, in the form of trolls, bots, and cyborgs (automated accounts that are periodically operated by a human), attempted to defame Western institutions to discredit their claims about Syrian CW use. The content of the synthetic accounts suggests that jihadists were the perpetrators of the attacks and that escalation—specifically through nuclear means—would result from Western retaliatory actions. The accounts preyed on Western religious and cultural sympathizers as well.\textsuperscript{125} These counternarratives not only were found on fake websites and propaganda websites with manipulated journalistic content but also were propagated through some Western sources.\textsuperscript{126} They affected the discourse of not only general users but also politicians and other influencers as well; reputable voices can become enablers of these false and misleading narratives, whether wittingly or not.\textsuperscript{127}

Disinformation, misinformation, and conspiracy theories are easily propagated and increasingly mainstream. While there is consensus that it is a serious problem, there is disagreement on appropriate strategies to counter the threat. The reach of false information and counternarratives is growing beyond general users of online platforms to affect the discourse and positions of reliable sources. Strategies for addressing the threat waver between contrasting views. On one hand, there is the belief that detailed responses give more ammunition to counter-truth phenomena. On the other is the idea that infrequent responses leave a vacuum for disinformation to fill. The European
Union devised one counter-disinformation campaign in 2015 dubbed the “EUvsDisinfo” campaign. While it has directly addressed over 6,000 cases of propaganda and counternarratives, the campaign received criticism over alleged interference with free media, an inability to keep pace with disinformation, and the assignment of blame to unwitting propagators of disinformation. At a time where one counter-disinformation response can be outmatched with thousands of additional disinformation activities, pessimism over effective response strategies may prevail.

**IMPLICATIONS**

The implications of disinformation are enormous. From deepfakes to the weaponization of social media, the ability to undermine confidence in governments and institutions has never been higher. This is evident in the way the anti-vaccine disinformation campaign has been linked to a renewed outbreak of measles in the United States. Disinformation attacks have aggressively sought to discredit and politicize the work of the OPCW and the French-led Partnership, as well as governments, authorities, and non-state actors working to curb the proliferation and use of chemical weapons. Moreover, disinformation campaigns deny accountability or even recognition of the victims of CW attacks.

Disinformation activities have historically been used as a form of hybrid warfare and are used today as part of gray zone conflict strategies. These campaigns are capable of creating and reinforcing tribalism within target audiences, whether that means general consumers of online content or influencers and politicians tasked with responding to the threats. Counter-truth phenomena have hampered response activities at various levels, from the highest level within multilateral fora and alliances to the lowest level within first response and early warning and alert activities. Additionally, if actors—both state and non-state—lack understanding or have bad information on CW use, the effects and impacts on the system of restraint and the susceptibility to counternarratives will persist. As a result, information operations are capable of protecting CW perpetrators and sustaining CW use.

Furthermore, while the CW system of restraint benefits greatly from a robust verification system, such verification-based arms control generally requires an ability to establish agreed-upon facts and to trust authoritative sources of information, including sensitive national information often from intelligence sources. Verification without an ability to validate and trust factual information is virtually impossible. Going forward, the weaponization of social media combined with deepfake technology will further blur lines between fact and fiction.

**Open-source Investigation and Verification**

Open-source intelligence (OSINT) analysts working independently or within NGOs, international governmental organizations, or other entities are rapidly expanding and increasingly sophisticated. OSINT analysts use techniques such as linkage analysis, social network analysis, and ground and satellite imagery analysis that were previously confined to intelligence or law enforcement communities working within classified information networks. Such data, tools, and methods are increasingly democratized, and OSINT products have substantially increased response time, public awareness, transparency, and accountability. The democratization of information, expansion of social media, and sheer amount of data available today has allowed OSINT to flourish.
and in some cases compete with nationally-controlled information sources. In terms of event investigation, reconstruction, and attribution, few open-source entities have been more impactful than Bellingcat.

Following the CW attack in Douma, Syria on April 7, 2018, Bellingcat launched an open-source investigation into the events. The report was published on April 11, just four days later, and detailed the events of the attack using videos, pictures, and graphics that concluded that it was highly likely that a gas cylinder, likely filled with chlorine gas, was dropped from a helicopter originating from a Syrian air base. As a result of their OSINT efforts during the Syrian conflict, Bellingcat has become involved with the International Criminal Court’s Technology Advisory Board and has also received interest from the International, Independent and Impartial Mechanism (IIIM) on Syria. In addition to investigations in Syria, Bellingcat’s research aided in the identification of the perpetrators of the Skripal attack in the United Kingdom and supported the government’s assertion that Russia was involved in the attack. The success of Bellingcat and many other OSINT organizations has resulted in the creation of workshops and training sessions designed to teach up-and-coming analysts how to do similar analysis.

Though these efforts and organizations have had many positive impacts, there are also serious concerns regarding how OSINT is vetted and validated. While most organizations and analysts produce OSINT to aid national and international efforts to enforce accountability, malign actors have also begun to manufacture “OSINT” to validate their conspiratorial counter claims. The Russian government has begun to issue satellite images of bombings in Syria, while government-backed media outlet RT has launched a “digital verification” blog, modeled on Bellingcat. The rapid growth of the field has left it vulnerable and open to distortion and misuse. Furthermore, efforts to protect and validate sources of analysis, such as peer review processes, training standards and qualifications, sharing of best practices, and standard confidence assessment measures have struggled to keep up.

IMPLICATIONS
The arms control arena has reaped many benefits of OSINT analysis in monitoring and verification procedures, as seen in the work of the OPCW, IAEA, national governments, NGOs, and private citizens over the last two decades. The democratized information environment has made OSINT more practical and valuable than ever before, improving the efficiency and capacity of arms control fora, especially the OPCW. Credible analysis outside of national governmental control can provide greater access, transparency, and independence, especially in terms of matters of compliance. However, this environment also enables the production and spread of counter-truth phenomena, as hostile actors may seek to manipulate and attack the data, tools, and techniques used by OSINT analysts in hopes of degrading the reliability of their work or manipulating their outcomes. OSINT analysts are also frequent targets of highly personalized disinformation attacks. Such attacks can become highly threatening, putting individual analysts at risk and exposing data and analysis to manipulation or tampering.

Lack of Knowledge or Interest in CW Across the “Quiet Middle” States
Following the establishment and entry into force of the CWC, what little national knowledge and expertise about chemical weapons that previously existed among much
of the Global South declined precipitously. Only the wealthier nations of NATO and some
nations in the Middle East and Asia maintained CW defense programs in anticipation of
potential conflicts with CWC outliers. Even these national investments have declined
steadily over time, resulting in a widespread lack of technical expertise in these countries.
Arms control and nonproliferation experts have similarly shifted focus away from
chemical weapons, both at the national level and across much of the nongovernmental
space. Given the priority of nuclear nonproliferation, most countries place their limited
arms control expertise in Geneva or Vienna, leaving representation at the OPCW in The
Hague in the hands of their bilateral embassies.

Additionally, too many states appear unwilling or disinterested in taking an active role in
stemming the use of chemical weapons, in part because a lack of expertise and knowledge
about the weapons and their effects facilitates a pattern of disengagement. If dozens
of OPCW member states continue to abstain, multilateral accountability will become
increasingly challenging and the credibility and viability of the existing regime will suffer.
On the other hand, nations more capable of CW investigation and response will in turn be
more engaged and knowledgeable in international fora.

**IMPLICATIONS**

The lack of knowledge and expertise on chemical weapons across allies, partners, and
organizations contributes to the presence of a “quiet middle” of countries that stays
largely silent and on the sidelines regarding CW issues in international fora. This lack of
expertise also heightens the vulnerability of these countries to the growing challenge of
disinformation, information warfare, and conspiracy theories that seek to sow doubt and
mistrust in institutions and leaders.

**North Korea: The Outlier State**

North Korea is one of the four remaining countries yet to accede to the CWC and is
believed to have the largest CW stockpile in the world. It is generally believed to be the
only state that continues to value chemical weapons as a tool for battlefield warfighting in
state-on-state conflict. Notably, it possesses the ability to threaten Seoul’s large, vulnerable
civilian population with chemical weapons from long-range artillery along the Kaesong
Heights.\(^{137}\) Moreover, serious proliferation concerns remain with regard to North Korea’s
willingness to assist other states’ CW procurement efforts, including the Syrian regime.\(^{138}\)
The confluence of these alarming attributes makes North Korea an enduring challenge to
the CW system of restraint.

North Korea’s significant CW capability is believed to date to at least the 1980s. Its
CW program was believed to be spurred by former North Korean leader Kim Il-sung’s
“declaration of chemicalization” in 1961, which initiated the establishment of an
indigenous dual-use chemical industry.\(^{139}\) A few years after Kim Il-sung declared the
development of chemical and bacteriological weapons in 1980, supported by Soviet
scientists, some analyses estimated that North Korea had produced approximately
250 metric tons of chemical warfare agents.\(^ {140}\) Since around 2010, most analyses have
consistently estimated that North Korea retains a stockpile of 2,500 to 5,000 metric tons
of agent.\(^ {141}\) It is widely believed that North Korea received foreign assistance in the form
of expertise, mostly from the Soviet Union, in its quest to develop its program.\(^ {142}\) Some
sources indicate that foreign suppliers were utilized to procure precursors as well, as recently as within the last two decades.\textsuperscript{143}

Official sources from Japan, South Korea, and the United States and reports from non-governmental organizations assess that North Korea possesses a wide range of agents, including blistering, blood, nerve, and choking agents, and delivery systems, including artillery munitions, aerial vehicles, and ballistic missiles.\textsuperscript{144}

Most analyses have judged North Korea’s CW capability as rather rudimentary, in the form of unitary munitions, or volatile chemical agents that are toxic on their own and do not require mixing with other agents.\textsuperscript{145} Moreover, many have assessed it as aging and degrading, mostly as a consequence of deployment in unitary form or decreased resources due to sanctions pressures. Additionally, this may be due to the realized lack of benefit given CW preparedness in the 1991 Gulf War and the comparative utility of North Korea’s growing nuclear weapons capability.\textsuperscript{146} However, recent revelations on North Korean CW proliferation and use stemming from the Kim Jong-nam’s assassination with VX nerve agent have challenged some of these judgements. North Korea’s continued proliferation of CW expertise and equipment and its CW-based targeted assassination of Kim Jong-nam illustrate a significant capability to not only produce chemical weapons on demand in small scale but also maintain or even revitalize its CW stockpile and arsenal.

Notably, should denuclearization or other international agreements ever lead to the potential disarmament of the North Korean CW program, the magnitude and danger of such an effort should not be underestimated. Lessons learned from Iraq, Syria, and Libya point to the extraordinary risk, complexity, and cost associated with accomplishing such an effort safely and reliably. Poor storage conditions, deteriorating infrastructure, and a lack of maintenance may make such weapons less reliable from a warfighting perspective, but they also make these capabilities much more difficult from an arms control and disarmament perspective.

From a proliferation perspective, North Korea and Syria have had a long-standing military relationship on developing conventional and unconventional weapons, and the UN Panel of Experts (POE) has documented many examples in recent years of their relationship in the CW domain.\textsuperscript{147} Concerns of North Korean assistance to Syria’s CW program existed long before Syria’s accession to the CWC.\textsuperscript{148} However, between 2014 and 2018, North Korean entities and affiliates have been caught cooperating with or directly assisting Syria in the procurement of chemical weapons in nearly 20 incidents.\textsuperscript{149} Nearly 10 shipments of CW-related equipment going from North Korea to Syria have been interdicted in this period, and many North Korean individuals, ranging from defense officials to diplomats to
undercover corporate representatives, have been identified as facilitating transactions or providing CW expertise to Syria.\textsuperscript{150}

Perhaps the most disconcerting aspect of North Korea’s CW program, separating it from all other cases of procurement and use since the Iran-Iraq War, is that it appears to remain intended for state-on-state conflict and battlefield use. Analyses have consistently concluded that North Korea would use chemical weapons on the Korean Peninsula in the early stage of ground conflict or as a retaliatory measure in the event of perceived regime upheaval.\textsuperscript{151} Reports indicate that North Korea conducts regular exercises with CW defensive equipment to simulate operations in a contaminated environment and that it has deployed CW-filled munitions for short-range use at the inter-Korean border and for long-range use to attack populations or forces inside South Korea.\textsuperscript{152} Continued CW defense exercises, proliferation of expertise and equipment, and demonstrated use of recently developed agent suggest North Korea’s capability and resolve to use CW remains unabated.

**IMPLICATIONS**

Crisis, war, or diplomatic breakthrough could all produce urgent requirements to inspect, monitor, secure, remove, or destroy all or parts of the DPRK CW program. Planning and consultation with international organizations, key partners, and possibly China on the technical, operational, political, and legal challenges associated with chemical weapons is essential ahead of any crisis or opportunity. Treating chemical weapons as the lesser-included case under the rubric of denuclearization could lead to greater risk in crisis and missed opportunities in peacetime.
4 | Recommendations

Today’s shifting security environment coupled with the evolving nature of CW threats has revealed gaps and weaknesses in the system of restraint—norms, taboos, deterrence, and denial of benefit—designed to limit the proliferation and use of chemical weapons. Unless the international nonproliferation regime can adapt to address the threat of chemical weapons, these concerning trends will almost certainly intensify in the foreseeable future as proliferation networks and emerging technologies with CW implications mature. These recommendations offer the international community options for improving global efforts to prevent proliferation and further use of chemical weapons.

Adapting the CW Regime to New Realities

Enhance and amend the regime to address small-scale, limited-quantity/limited-use, newer, and improvised agents. The treaty’s verification system must be adapted to account for new realities and include new additions to the schedules. Adding some Novichok agents to Schedule 1 chemicals (the most dangerous and highly controlled chemicals) was a positive first step, but more additions will probably be needed. A step-by-step process to weigh the costs and benefits of these is essential.

Reframe the mission of the CWC. The mission of the CWC should address how to manage chemical threats to security instead of focusing exclusively on preventing the reemergence of chemical weapons.

Improve and support OPCW laboratories to improve technical capabilities and resources for diagnostic purposes. It is essential to raise standards and capabilities of OPCW-designated laboratories in terms of the chain of custody, investigatory standards, and new techniques and procedures, as well as improved security and protection against cyberattacks, tampering, and disinformation. This will require sustained investment by states parties and a commitment to complete the new Centre for Chemistry and Technology as scheduled.

Reform the Australia Group (AG) to cover additional agents and reduced-quantity challenges for existing agents. The AG includes a more select group of participants, which may facilitate the usefulness of the forum but also means the dominant CW suppliers exist outside of the group. The AG must expand its efforts to not only consider approaches to more dual-use agents but also to innovations that might provide greater accountability for rapidly expanding online suppliers that operate in or through their countries.
Consider establishing an Additional Protocol to the CWC. The CWC lacks meaningful “carrots” for many states to engage in higher levels of transparency, control, and compliance since there are few benefits in terms of safely and securely accessing the peaceful uses of chemical science, technology, and commerce. An Additional Protocol could seek improved control and verification of the newer agents, improvised agents, and smaller quantities which fall outside of current declaration and verification requirements. States that commit to higher standards could in turn receive greater safe and secure access to commercial opportunities afforded by chemical science and technology. Through such a protocol, participating states could agree to additional voluntary and challenge inspections and other measures while also gaining more favorable access to technical assistance, preferential commerce, and information sharing.

**Improving Accountability and Enforcement**

**Look beyond traditional arms control to build the legal basis for accountability for CW use.** It is essential that the arms control and humanitarian/war crimes communities work collaboratively to maximize national and international prosecutorial pathways.

**Build and support national capacities for enforcing CW norms.** National authorities will always be the accountability pathway of first resort. It is vital to make better use of national tools and authorities, especially in coordination and collaboration with law enforcement entities across governments. This must include efforts to raise national technical and forensic capacities for diagnostics and chain of custody. Targeted capacity-building efforts through the Global Partnership, European Union, and U.S.-based cooperative threat reduction programs could pay big dividends.

**Protect access to and security of evidence repositories, including reports, forensic evidence (including samples), and witness and victim testimonials.** These repositories will be attacked and sabotaged, but there will also be efforts to limit the availability of legitimate legal proceedings outside of the UNSC. Be mindful of the unintended consequences of burying evidence.

**Leverage open-source analysis when feasible and accurate.** Open-source analysis and evidence repositories will play an increasingly vital role in accountability. Work remains to better understand and support the relationship between these efforts and national law enforcement so that open-source disclosures and public confirmations of individual perpetrators do not impede effective arrest and prosecution. Furthermore, in order to leverage civilian capabilities, there must be guidelines and best practices developed for open-source verification. Open-source analysis is absolutely legitimate for legal enquiry.
and in many cases may be admissible as evidence, so finding ways to support and strengthen rather than censor the information is essential.

**Adapting Deterrence Approaches**

**Identify tailored deterrence measures that can be applied proportionately and repeatedly.** The United States, along with its partners and allies, must develop a menu of possible pre-coordinated punitive responses, such as detailed sanctions or penalties. If done ahead, tailored responses to specific behaviors can be developed to shape future behaviors rather than to simply be punitive.

**Coordinate national responses and synchronize actions.** These actions should complement and support or enhance international institutional responses using various forms of accountability, including legal, economic (sanctions), political, and military actions.

**Investigate and expose every credible case.** Selectively engaging with cases encourages risk-taking by users; certainty is more dissuasive than severity in most cases. Consequences in all cases are important, but not all consequences must be military in nature. The United Kingdom’s tailored nonresponse to the Skripal attack suggests nonmilitary tailored deterrence has a role to play.

**Reducing Benefit and Utility to Users**

**Improve civilian, military, and international capacity and cooperation by working collaboratively across the military and civilian sectors.** New agents—Novichoks and fentanyl especially—will force the international community to improve its capacity in terms of detecting, protecting, analyzing, diagnosing, treating, and attributing CW threats. This requires collaboration between local law enforcement, first responders, and international partners to improve detection, protection, and treatment in the event of an attack.

**Enhance capacities for response and attribution across the alliance and in partner countries and international institutions.** Domestic responders, especially those in countries that may not have highly advanced or sophisticated chemical defense expertise, must be better equipped to safely recognize and treat these types of chemical agents. Some of these capabilities are far too expensive for smaller countries, but on-demand diagnostics, technical cooperation agreements, and surge capacities can improve preparedness and response.

**Build and enhance capabilities to investigate and attribute CW events.** Enhance national and international technical and operational investigative and response capacities. Novichoks are more demanding from a technical perspective, so it is essential to have adequate defense and response capabilities. The United Kingdom’s ability to quickly identify the agents, treat the victims, and persuasively develop conclusions about the attribution of the attack proved highly effective and may have a dissuasive impact on future Novichok use, since it is not clear that the agents can be used in a nonattributable fashion. That said, few countries have the technical capacity to detect and respond to these threats in a similar fashion.

**Ensure that domestic responders can be better equipped to safely recognize and treat these types of chemical agents.** This is especially important for those in countries that may
not have highly advanced or sophisticated chemical defense expertise. The Skripal attack and Kim Jong-nam's assassination demonstrate that even when these weapons are used for targeted violence, they can have much broader impacts for responders, medical providers, law enforcement, and others. But the Aum Shinryko attack produced similar insights many years earlier. We should not have to keep relearning lessons on the importance of domestic response and law enforcement. Moreover, all these cases—Malaysia, Skripal, Aum Shinryko, and even Amerithrax (the anthrax attack in United States)—demonstrate that the economic costs and societal costs can far exceed the impact in terms of fatalities. Responses need to create the perception that benefits will be denied, not enhanced.

Preparing for Arms Control in an Era of Great Competition

Contest in the face of noncompliance. CW use is a manifestation of hybrid warfare, and while it is important to find areas for cooperation among states, contestation in the face of noncompliance is essential. Contestation in these arenas is simply part of the broader competitive environment. Using the rules and procedures in the CWC to press compliance reinforces norm resilience and reduces the risk of conflict or crisis at higher levels of escalation.

Do not value the institutions (or treaties) beyond their purpose. Threats by Russia and others to walk away from the CWC in response to growing compliance concerns has some countries questioning whether reducing conflict in the CWC Executive Council and prioritizing consensus is necessary to preserve the treaty. Such approaches risk reducing the treaty to a “paper tiger” while doing little to eliminate discord and tensions overall. The CWC offers the benefits of multilateralism: all stakeholders have a role and a vote. As a result, countries like Russia and the United States pay much higher costs for walking away, which means losing the ability to shape outcomes from within. This only works, however, if countries understand the stakes and exercise their rights through the treaty's procedures and mechanisms.

Preparing and Contesting the Information Battleground

Engage a sustained and multilateral counter-disinformation campaign. Call out disinformation where it is observed, and counter it with facts to support the rules-based order by repeatedly issuing consistent, verifiable information. Do not wait to react. Anticipate attacks and develop responses to disinformation challenges that are aggressive, collective, asymmetric, and rapid and that can be readily deployed when needed.

Fill the research and analysis gap. Rigorous, data-driven research and analysis is desperately needed to detect and recognize disinformation, understand why its effective, and appreciate how it can best be stopped and countered. Case studies to capture insights and lessons learned are also needed. In the wake of the Skripal attack and subsequent Russian disinformation campaign, the United Kingdom's Foreign and Commonwealth Office put out videos that attempted to explain and counter the false narratives. These efforts are a start, but far more data and analysis are needed. Disinformation will be a persistent feature of multilateral diplomacy and arms control for the foreseeable future. It is time to take it much more seriously.
Focus on noncompliance in messaging. There is substantial disagreement on appropriate strategies, but the focus must be kept on noncompliance. Detailed responses sometimes give adversaries more to pick apart, but not responding enough leaves a vacuum that is filled by other narratives. Techniques of repeatedly issuing consistent information seem useful.

Preparing for CW Contingencies

Plan and prepare for the North Korean CW challenge. The technical, operational, legal, and political hurdles associated with the North Korean CW program require dedicated planning and preparation. In conflict, North Korea could determine that chemical weapons are more usable than its nuclear weapons and deploy them early to weaken resolve in South Korea.

Engage critical partners and allies on the DPRK CW problem and plan for chemical disarmament. A North Korean decision to abandon its chemical weapons is not impossible, either as part of a comprehensive denuclearization agreement or perhaps independent of one. Regardless, such an effort would be technically complex, dangerous, and expensive. It is essential to anticipate these scenarios, identify critical capability gaps, build partnerships, and address challenges in advance in order to respond to future crises or opportunities involving these weapons.

Broadening and Engaging the International Community

Provide greater educational opportunities and training within and outside of The Hague. This includes offering opportunities in national capitals, security discussions, and partnerships and alliances (e.g., NATO) and through consortium outreach to address a fundamental lack of knowledge and expertise across many countries.

Awaken the “quiet middle.” There is a huge number of nonvoting and abstaining countries in the OPCW that should be tapped into by improving understanding of the stakes of CW procurement and use to move states off the sidelines. It is vital to raise states’ comfort levels with contested outcomes by reiterating that in the face of evolving yet persistent CW threats, using the tools of the treaty in support of compliance is a sign of resilience, not failure.

Protect and defend the anti-CW norms and the institutions that support them. Every alliance member bears a responsibility to stand up for the legitimacy, objectivity, and credibility of the anti-CW regime, including the OPCW. Attribution and the pursuit of compliance are central to the treaty’s viability over time. Arms control appeasement, on the other hand, will ultimately fail.
About the Authors

Rebecca Hersman is director of the Project on Nuclear Issues and senior adviser for the International Security Program. Ms. Hersman joined CSIS in April 2015 from the Department of Defense (DOD), where she served as deputy assistant secretary of defense for countering weapons of mass destruction (WMD) since 2009. In this capacity, she led DOD policy and strategy to prevent WMD proliferation and use, reduce and eliminate WMD risks, and respond to WMD dangers. Ms. Hersman was a key leader on issues ranging from the nuclear security summit to the elimination of Syria’s chemical weapons to the global health security agenda. She served as the DOD’s principal policy advocate on issues pertaining to the Biological Weapons Convention, Chemical Weapons Convention, Nuclear Non-Proliferation Treaty, and Cooperative Threat Reduction Program. Prior to joining the DOD, Ms. Hersman was a senior research fellow with the Center for the Study of Weapons of Mass Destruction at the National Defense University from 1998 to 2009. Her primary projects focused on the role of the DOD in mitigating the effects of chemical and biological weapons attack, concepts and strategies for eliminating an adversary’s WMD programs, and proliferation issues facing the United States. Ms. Hersman also founded and directed the WMD Center’s Program for Emerging Leaders, an initiative designed to shape and support the next generation of leaders from across the U.S. government with interest in countering weapons of mass destruction. Ms. Hersman previously held positions as an international affairs fellow at the Council on Foreign Relations, a special assistant to the undersecretary of defense for policy, and a member of the House Armed Services Committee professional staff. She holds an MA in Arab studies from Georgetown University and a BA from Duke University.

Suzanne Claeys is a program coordinator and research assistant with the Project on Nuclear Issues (PONI) at CSIS, where she manages the European Trilateral Track II Nuclear Dialogues and assists with the PONI conference series. Prior to CSIS, she completed a fellowship at American University’s Peace and Violence Research Lab. She holds a BA in international studies and Spanish studies from American University.

Cyrus Jabbari was a research intern with the Project on Nuclear Issues at CSIS.
Endnotes


3 Ibid.


Schneider and Lütkefend, Nowhere to Hide.


ings-bungled-assassination-kremlin-putin-salisbury.


Ibid.


es-violations-norm-against-chemical-weapons.


62 Ibid.


Ibid.


Ibid.


Anders, “Points of Deception.”


Bishop, “Chemical Weapons.”


Ibid.

Ibid.

Ibid.


113 Jabbari and Bleek, “Honey, I Shrunk the Lab.”


117 Ibid.

118 Renee DiResta et al., “The Tactics and Tropes of the Internet Research Agency,” New Knowledge, No-
vember 8, 2018, https://disinformationreport.blob.core.windows.net/disinformation-report/NewKnowl-
118 Ibid.
119 Ibid.
120 Ibid.
121 Ibid.
125 Ibid.
126 Ibid.
127 Ibid.
131 DiResta et al., “The Tactics and Tropes of the Internet Research Agency.”
135 Ibid.
139 John V. Parachini, “Assessing North Korea’s Chemical and Biological Weapons Capabilities and Prioritizing


145 ICG, North Korea’s Chemical and Biological Weapons Programs.


150 Ibid.


152 ICG, North Korea’s Chemical and Biological Weapons Programs.

Rigid Structures, Evolving Threat: Preventing the Proliferation and Use of Chemical Weapons | 42