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CBRN weapons Methodology and approach

The fourth Global Security Pulse (GSP) of 2019 focuses on CBRN weapons. The design of the GSP is concise and aims to be agenda-setting. This accompanying paper is intended to explain and justify the underlying (methodological) choices and reflects upon the process.¹ It consists of four parts. Firstly, it will outline the concept of CBRN weapons, as understood in this Pulse. Secondly, it provides the results of the Horizon scan, including a 'medium list' of the signals we have found during the scan. Thirdly, it will show the 10-year threat assessment and a table on the state of the international order. It concludes with a comprehensive source table.

CBRN weapons

Chemical, Biological, Radiological and Nuclear Weapons, or CBRN Weapons, are often labelled as Weapons of Mass Destruction, although especially radiological weapons could better be considered as Weapons of Mass Disruption, as they will generally not be able to cause massive destruction but merely chaos and panic.

An important characteristic of CBRN weapons is that the specific materials to develop them are dual-use; with a few exceptions, materials required to build CBRN weapons can also be used for peaceful purposes. To prevent that any CBRN dual use material would be considered as weapon material, this GSP uses a broadened version

of the so-called General Purpose Criterion of the Chemical Weapons Convention: A CBRN Weapon is CBRN material used to cause intentional death or harm through its CBRN properties. Munitions, devices and other equipment specifically designed to weaponize CBRN materials also fall under the definition of CBRN weapons.²

- 1 See "[General Method: Global Security Pulse](#)" for an outline of the general horizon scanning methodology.
- 2 OPCW, "[What is a Chemical Weapon?](#)".

Figure 1 CBRN security topics



Building upon previous Strategic Foresight Publications on CBRN Weapons³, we have looked for new and/or important signals regarding these weapons in relation two five key topics: Proliferation, Modernization of weapons, Escalation potential, International CBRN regimes, and Non-state actor access. In addition, we have scanned for new and/or important signals that can tell us something about the status and developments with regard to the international order regarding CBRN weapons, especially concerning international norms and rules.

Results of the horizon scan

In total 167 sources were consulted for a period of six months (January 2019 to June 2019 inclusive). This generated 151 potentially relevant signals. 136 of

these were potential threats, 18 were potentially relevant to the international order and 74 had a potential impact on either category. The 151 potentially relevant signals included 14 potentially underappreciated signals. 12 signals qualified as new developments rather than as new manifestations of existing trends (42) or signals already on the radar (139).

The scan resulted in the following medium list, which served as a basis for an expert discussion that was held in August 2019. In this meeting, experts reflected upon these results and shortlisted the trends which they deemed most important in terms of their potential impact on national security and the degree to which they were reflected in Dutch policy discourse. The shortlisted signals are part of the final Global Security Pulse.

³ [Clingendael Radar: CBRN, 2017: 'CBRN Weapons'](#), in: [Clingendael Strategic Monitor 2017](#).

Medium list

Threat & opportunity signals
<p>Demise of CBRN arms control treaties</p> <p>For several years the US and Russia have been accusing each other of violating the INF treaty. The accusations eventually accumulated in the withdrawal of both parties from the treaty, leaving Europe exposed to potential renewed deployment of intermediate- and short-range (nuclear) missiles. The demise of the INF treaty seems to be a symptom of a wider trend of political actors questioning and criticizing current arms control agreements. For example, in anticipation of the expiration of New START in 2021, important actors in the US government and military have expressed doubt about the chances that New START will be renewed and whether it even should be renewed. They cite Russian violations of the INF treaty and the fact that current arms control treaties do not include states like China. In addition, the withdrawal of the US from the JCPOA has put the entire deal under extreme pressure. The US' approach to Iran seems more focused on regime change than on restricting Iran's nuclear program, leading to increased tensions in the region and increased risk of the deal falling apart. Finally, other cornerstones of the CBRN arms control architecture are under pressure as well due to multiple violations: several states are violating the NPT; the use of chemical weapons in the UK, Malaysia, and Syria are serious violations of the CWC; experiments with lethal viruses seem to breach the BWC; and testing of low-yield nuclear weapons violate the CTBT.</p> <p>Sources: New York Times (1), IISS (1), Arms Control Association (1), Jane's 360 (1), Brookings, The Atlantic, SIPRI (2), BBC (1), The Washington Post</p>
<p>Massive investments in nuclear weapons and related missiles</p> <p>Several states are investing heavily in modernizing their nuclear arsenals and new missile technologies. The US and Russia are producing and testing low-yield nuclear weapons. The production of these weapons is controversial as several experts argue that low-yield nuclear weapons raise the escalation potential. Having access to low-yield nuclear weapons may reduce the threshold to use nuclear weapons. In addition, states may not be able to discern between an incoming high-yield and low-yield nuclear weapon, risking escalation in response. Moreover, experts speak of a growing arms race between the great powers when it comes to hypersonic missiles. These missiles raise the escalation potential due to the limited response time political and military actors will have when they are used, and the difficulty of discerning nuclear armed hypersonic missiles from conventionally armed hypersonic missiles.</p> <p>Sources: The New York Times (2), IISS (2), UNODA, The Bulletin of Atomic Scientists (1), The Guardian (1)</p>
<p>Developments in biotechnology with risk of creating (new) biological weapons</p> <p>Advances in knowledge and technology in biomedical sciences raises the risk of (terrorist) attacks with biological agents. Techniques such as Clustered Regulatory Interspaced Short Palindromic Repeats (CRISPR)-Cas9 allows for unprecedented precision in gene-editing. While such techniques can be used to cure diseases, they can also be used to create new diseases or modify existing ones. The ramifications of an attack with such an agent can quickly reach a global scale. Moreover, access for non-state actors to the relevant knowledge and technologies is increasing. Controlling the spread of emerging technologies such as additive manufacturing (AM), or 3D printing, and artificial intelligence (AI), which can be used to manufacture a biological weapon, is difficult due to their dual-use nature. The lack of knowledge on part of policy makers and the limited coverage of current regulatory regimes makes it difficult to address the risks.</p> <p>Sources: SIPRI (1), Science Alert, IDSA, World Economic Forum</p>
<p>Impunity chemical weapons use</p> <p>Chemical weapons have been used in attacks by state and non-state actors in Syria, Malaysia, and the United Kingdom. While there have been unilateral and multilateral responses to these attacks, it remains the question how effective these responses have been. The perpetrators have often evaded direct consequences or are largely unimpressed with the actions taken against them. Unpunished violations of the CWC risks actors using these weapons again and a deterioration of the norm prohibiting the use of chemical weapons.</p> <p>Sources: Arms Control Association (2), SIPRI (2), SIPRI (3)</p>
<p>Confusing lines between CBRN and conventional weapons</p> <p>The fading lines between CBRN weapons and conventional weapons is increasing the escalation potential of military conflicts. Investment in new missile technologies, such as hypersonic weapons, which have a dual-use capability raises questions as to in what capacity they will be used. Uncertainty about the payload of an incoming missile can lead to a disproportionate response and thus full nuclear escalation of an initially limited military conflict. Moreover, the entanglement of command and control systems poses additional risks. Several command and control systems are now used for both nuclear and conventional operations. Attacks on such systems with the aim to take out conventional operation capacity can be interpreted as a strategic strike on a state's nuclear capabilities and as a prelude for nuclear strikes.</p> <p>Sources: Carnegie, BBC (2), BASIC</p>
<p>Technological developments such as cyber, AI and 3D-printing</p> <p>Emerging technologies such as additive manufacturing (AM), 3D printing and Artificial Intelligence (AI) make it increasingly easy for non-state actors to produce chemical and biological weapons. The dual-use nature of these technologies is making it difficult to prevent harmful use of these technologies. Additionally, the reliance of states on technologies such as AI in for example command and control systems or nuclear power plants can create a myriad of new pathways for malevolent actors to infiltrate and manipulate these systems.</p> <p>Sources: IISS (3), SIPRI (1), SIPRI (2)</p>

Medium list

International order signals
<p>Decreasing trust in multilateral system</p> <p>With the demise of the INF treaty and the (accused) violations of other arms control treaties, the multilateral system finds itself under severe pressure. Trust in multilateral arms control fora is quickly decreasing. Several political actors in the US are expressing doubt about the effectiveness of current and future arms control agreements. The unraveling of current agreements without replacing them with new agreements, opens the door for renewed arms races. The development of new technologies such as hypersonic weapons and the unwillingness of states to cover such new weapons in arms control agreements amplifies the risk of uncontrolled arms races.</p> <p>Sources: New York Times (1), IISS (1), Arms Control Association (1), Jane's 360 (1), Brookings, The Atlantic, SIPRI (2), BBC (1), The Washington Post</p>
<p>Escalation potential</p> <p>The first half of 2019 has seen quickly rising tensions between several states, some of which possess nuclear weapons. As result of the demise of the INF treaty, Russia has stated that deployment of land-based missile systems can trigger a 'Cuba-crisis' type of crisis between NATO and Russia. Similarly, tensions are rising between Iran and the US. Some experts point out that the latest Nuclear Posture Review gives President Trump the space to use nuclear weapons in the context of a limited conflict. Tensions also persist between the US and the DPRK. While the dialogue between the countries has somewhat reduced tensions, the DPRK is still testing missiles and American generals argue that the US should still be prepared for every scenario. Furthermore, tensions have been rising between India and Pakistan, which on several occasions resulted in (brief) armed conflicts.</p> <p>Sources: Reuters, The Bulletin of Atomic Scientists (2), Jane's 360 (2), The Bulletin of Atomic Scientists (3)</p>
<p>Political rhetoric on nuclear weapons</p> <p>Related to the escalation potential is the political rhetoric on nuclear weapons. This includes the implicit threat of actually using nuclear weapons and the perception that the weapons could in fact be used. Russia's warning for a crisis like the Cuba crisis of 1962 in response to potential NATO actions after the demise of the INF treaty implies that they foresee a nuclear standoff with, potentially, dire consequences. Likewise, the fact the US Nuclear Posture Review allows for the use of American nuclear weapons against Iran, signals a perception that nuclear weapons can legitimately be used, even if not attacked first with nuclear weapons.</p> <p>Sources: Reuters, The Bulletin of Atomic Scientists (2)</p>
<p>Proliferation of CBRN technology</p> <p>Several experts are worried about the nuclear programmes of Saudi Arabia and Iran. In the case of Saudi Arabia, experts are concerned that the civilian nuclear programme might be a steppingstone towards developing nuclear weapons. Experts assume that Saudi Arabia would want to develop these weapons in order to match the capacities of Iran. Concerns about Iran's nuclear programme pertains to the falling apart of the JCPOA. Iran has so far restrained from taking serious steps towards the development of nuclear weapons, but the country is already diverging from the limits set under the JCPOA. If problems around the JCPOA are not resolved, Iran might take more serious actions. Proliferation of CBRN technology however, is not limited to states. Besides these national programmes, technology and the diffusion of knowledge make the access, use, and proliferation of CBRN technologies easier for non-state actors. This is especially true for advances in the biological and chemical fields.</p> <p>Sources: IISS (4), The Bulletin of Atomic Scientists (4), Arms Control Association (3), SIPRI (1),</p>
<p>(Accusation of) Violations of CBRN agreements</p> <p>As mentioned in the medium list before, arms control treaties are falling apart and trust in the multilateral system is significantly decreasing. The most prominent causes of these developments are the (accused) violations of specific CBRN agreements. For example, both Russia and the US have been accused of violating the INF treaty. Russia has been accused of breaching the CWC by using chemical weapons in an assassination attempt in the UK. The Syrian regime has similarly been accused of using chemical weapons in Syria. In addition, Russia has been accused of violating the CTBT by testing low-yield nuclear weapons. Finally, there is uncertainty about the legality under the BWC of some US sponsored experiments with diseases.</p> <p>Sources: The Bulletin of Atomic Scientists (5), The Guardian (2), SIPRI (2), BBC (1), The Washington Post (2)</p>
<p>Implicit recognition of DPRK as nuclear weapons state creates precedent</p> <p>The first half of 2019 has seen several meetings between the leaders of the US and the DPRK. While not all summits were equally successful, the fact that there is a dialogue, reduces tensions. While the current talks offer an unique opportunity to stabilize the situation, some experts argue that negotiating with North Korea sets a dangerous precedent. Other countries might interpret the US' willingness to negotiate with North Korea as proof that developing nuclear weapons brings them in a more powerful and secure position. They can interpret the case of North Korea as a case of successful nuclear deterrence which forces other countries to the negotiation table.</p> <p>Sources: The Atlantic, Arms Control Association (4),</p>

Data used for long-term trend tables

	Indicator	Sources
Arsenals	Number of CBRN weapons	The Bulletin of Atomic Scientists' Nuclear Notebook ; OPCW Annual Reports ;
	Investments in modernisation of weapons	SIPRI Yearbook ; IISS' The Military Balance
	Investments in missiles	IISS' The Military Balance
Policies	Political threshold for CBRN weapon use	Media, Twitter, and expert meeting
	Non-state actors' access to CBRN weapon technology	SIPRI Yearbook ;
	Clear lines between CBRN and conventional weapons	Media, Twitter, and expert meeting
	Trust in multilateral system regarding CBRN	Media, Twitter, and expert meeting

Norms	Sources
States should work towards world without CBRN weapons	Non-Proliferation Treaty (NPT) ; Chemical Weapons Convention (CWC) ; Biological Weapons Convention (BWC) ; Comprehensive Test Ban Treaty (CTBT) ; Treaty on the prohibition of nuclear weapons (TPNW)
CBRN weapons should never be used	Chemical Weapons Convention (CWC) ; Biological Weapons Convention (BWC) ; Geneva Protocol ; Comprehensive Test Ban Treaty (CTBT) ; Treaty on the prohibition of nuclear weapons (TPNW)
Rules	Sources
States should decrease the role of CBRN weapons in their defence policies	Intermediate-Range Nuclear Forces Treaty (INF) ; New START (Strategic Arms Reduction Treaty) ;
Arms control agreements should not be violated	All arms control agreements
Access of non-state actors to CBRN weapon materials should actively be prevented	Nuclear Terrorism Convention ; Convention on the Physical Protection of Nuclear Material (CPPNM) ;

Sources used for the scan

(Inter)national organisations	Think tanks / research centers	Specific sources	General sources	Twitter
International Atomic Energy Agency (IAEA)	Royal United Services Institute (RUSI)	Ploughshares Fund	Aljazeera	CSIS – Proliferation Prevention Program
United Nations Office for Disarmament Affairs (UNODA)	Middlebury Institute of International Studies at Monterey	Nuclear Threat Initiative	AP News	Sico van der Meer – Clingendael Institute
Organisation for the Prohibition of Chemical Weapons (OPCW)	Center for strategic and international studies (CSIS)	The EU non-proliferation consortium	BBC	Jeffrey Lewis (@ArmsControlWonk) – Middlebury Institute of International Studies
European External Action Service (EEAS)	European Parliament Think Tank	Jane's 360	Bloomberg	Mark Fitzpatrick – IISS
World Economic Forum (WEF)	Carnegie Endowment for International Peace	Arms Control Association website and Arms Control Today journal	CNBC	Mark Hibbs – Carnegie




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(Inter)national organisations	Think tanks / research centers	Specific sources	General sources	Twitter
	International Institute for Strategic Studies	Federation of American Scientists (FAS)	Deccan Chronicle	Gaukhar M – Middlebury Institute of International Relations
	Brookings	Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (Romania)	Foreign Policy	Gregory Koblentz – George Mason University
	Stimson	Odessa Centre for Non-proliferation (Ukraine)	France 24	Joe Cirincione – Ploughshares Fund
	European Leadership Network	NTI	Iran Press	
	Valdai Club	Bulletin of the Atomic Scientists	Los Angeles Times	
		Council for a liveable world	Politico	
		38 North	Reuters	
		Army Technology	Science Alert	
		BASIC	TASS	
		Center for Naval Analyses (CNA)	The Atlantic	
		International Politics and Society	The Diplomat	
		Nonproliferation Review	The Economist	
		Russia Matters	The Guardian	
		Fierce Healthcare	The New York Times	
		Homeland Preparedness News	The Sociable	
		Institute for Defence Studies and Analyses (IDSA)	The Washington Post	
		In Homeland Security	USA Today	
		Inside Defence		
		Vision		
		Stockholm International Peace Research Institute (SIPRI)		

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