



# The end of the CBRN taboo

*“Man seeks drama and excitement; when he cannot get satisfaction on a higher level, he creates for himself the drama of destruction,” Erich Fromm, The Anatomy of Human Destruction (1973)<sup>i</sup>.*

## Introduction

A new era in chemical, biological, radiological and nuclear (CBRN) defence and deterrence is emerging with the threat landscape in Europe. Nuclear disarmament and non-proliferation treaties promised peace to the citizen across the world. Peace was promised implicitly, even from conventional war, yet today we are seeing Russia practising so-called offensive deterrence. Nuclear weapons, radiological accidents or chemical weapons are being brandished by Russia, not to deter an enemy attack on its own soil, but to cover and support its invasion of a sovereign state, Ukraine. The Russian state continually and explicitly reminds the world that it will consider nuclear escalation as an option. A dangerous precedent has been set. Weapons that have been taboo for decades are now being used as blatant threats.


The use of weapons of mass destruction (WMD), for the most part chemical and nuclear weapons, has been rare since World War 2. They were taboo and deterrence has kept CBRN weapons off the international battlefield. The same cannot be said for civil wars, where the use of chemical weapons as a means of domestic riot control is exempted from the Chemical Weapons Convention (CWC)<sup>ii</sup>. Rogue states have used chemical weapons on political dissenters outside their own borders, testing publicly and openly, the resolve of nations seeking to enforce non-proliferation. The volume of non-state actors in conflicts has burgeoned, and with them, so has the risk of CBRN, as many of these weapons are cost-effective and easy to deploy. The spectre of a nuclear threat or even conflict, and consequent mass radiological exposure of civilians has new intensity with the Russian invasion of Ukraine, and its intimidating posturing towards the West. In the Asia Pacific context, China has doubled its military budget since 2012.

The increased proliferation of CBRN weapons is a global concern as the use of artificial intelligence (AI) and the ease of procurement enables them to be rapidly and effectively incorporated into grey zone operations. Grey-zone warfare can be broadly defined as the exploitation of the operational space between peace and war to change the status quo through the use of coercive actions that remain below a threshold that, in most cases, would prompt a conventional military response. They are deniable, more often associated with cyber but can be combined with a conventional attack during state-on-state conflict.

Common characteristics of most CBRN agents is that they are difficult to recognize or detect once released. A biological agent, for example cannot be seen or felt. As a result, it may be difficult to recognise or confirm exposure, with delays or difficulties in attribution, and in determining the type of agent involved or the extent of the adverse health effects in those exposed.

The main threat of CBRN weapons is their potential immediate and long-term health effects on those exposed. The effects range from mild irritation and sickness to severe illness or death. CBRN agents have four properties in common which influence a military and civilian response: toxicity, latency, persistency, and transmissibility. The impact on morale and public resolve should not be understated.

Conventional theory on use of CBRN weapons is that they are effective against less-well trained, less well-equipped military forces. They are horrifically effective against civilians who have no ability to



protect themselves at all. This opens the use of grey-zone warfare to undermine a nation's will to support military operations. Equally, CBRN weapons delivering a similar operational effect to multiple conventional weapons, by creating timely tactical advantage could become a more popular option to our adversaries.

This paper will address the issue of taboo, some of the threats CBRN poses, examples of the measures being taken against the threat, and the reasons for stepping up counter-proliferation efforts and defensive countermeasures.

### **Why the taboo?**


The word taboo was introduced into the English language by the English Captain James Cook, a famous explorer known for his three voyages between 1768 and 1779 in the Pacific Ocean and to New Zealand and Australia. It is Polynesian in origin, "tabu" or "tapu" and was first recorded by Cook during his visit to Tonga in 1771. Its unchanged concept is the prohibition of an action based on the belief that such behaviour is either too sacred and consecrated or too dangerous and accursed for ordinary individuals to undertake.<sup>iii</sup>

Why is there a moral taboo around the use of CBRN weapons? Radiological and nuclear weapons can reasonably be understood to represent a threat to civilisation as we know it, but chemical and biological weapons simply do not hold the same threat. What they carry is a moral stigma. How is it that they are classified as an outrage when horrifying conventional weapons are acceptable and legal in war?

There is a long history of moral stigma around chemical and poisonous weapons. The first bilateral treaty banning the use of chemical weapons - poisoned bullets - was signed in 1675 between France and the Holy Rome Empire. The Hague Convention of 1899 outlawed shells for the "diffusion of asphyxiating or deleterious gases"<sup>iv</sup> even before they had been used on the battlefield. The rationale behind the ban was the just-war doctrine. This viewpoint abhorred weapons that could spill over into the civilian sphere, and they were seen as immoral and uncivilised. There is conjecture among historians that there was agreement to ban these weapons as a test case because they had not yet been developed for the battlefield, so a consensus was easy to obtain. The effects of the weapons and the shared international experience in World War 1 for chemical and biological and then World War 2 for the radiological and nuclear, set in stone the taboo against CBRN for decades to come.

They remain to this day strange and frightening weapons. There is a potent myth of defencelessness against chemical and biological attack. A gas we can't see, an insidious virus or bacteria, that can never be attributed to the enemy. CBRN weapons require extreme justification and a politicisation of their implementation. In Ukraine today, what weapons are being threatened and brandished, to terrify the West into relative inaction? The weapons bearing taboo. They are the choice weapon threatened by the politician: it is Vladimir Putin who will threaten the use of chemical or radiological weapons. They simply won't be implemented without political approval by a battlefield leader without first the warning shot of the political leader in a speech broadcast to the world.

CBRN weapons are the inhuman weapons that will only be triggered by a political act. These weapons have not been threatened in a broader international context since World War 2. They are threatened regularly by the Kremlin, with the goal of deterring Western action in Ukraine to defend its territorial integrity. Putin is trying to change the narrative in Ukraine from a "special military operation" into a national threat against Russia, and justification for the partial mobilisation in September. In 1994, Ukraine became one of four countries that voluntarily relinquished their nuclear arsenals and joined the Nuclear Non-Proliferation Treaty. Now if, on the one hand, the



response by the West to the threat of the use of CBRN is vague, and without clear consequences, the message to Putin, on the other hand, is clear. It will be this: the CBRN taboo is over and using this threat is a guarantee that CBRN weapons can be used for strategic deterrence of Western action, for prosecuting conventional wars, and for advancing foreign policy motivations without fear of consequences.

## **CBRN Threats**

### **The Chemical Weapons Threat**

April 29, 2022 marked the 25<sup>th</sup> anniversary of the entry into force of the CWC. Other treaties governing the use of chemical and biological weapons range from the 1899 Hague, Convention; the 1925 Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare (the Geneva Protocol).

Chemical agents are considered toxic chemical substances found naturally in our environment, or are artificially created in a laboratory, genetically modified or synthetically engineered.<sup>v</sup> Most are for legitimate industrial, agricultural or medical purposes such as, hydrogen cyanide (industrial), chlorine (industrial), organophosphates (agricultural) and carbamates (medical).

In a globalised planet, it is highly likely that adversary forces have already, or can easily obtain, the necessary knowledge and equipment to create and deploy chemical weapons. The CWC signatory nations are prohibited from using chemical weapons in a theatre of war. However, recent history has shown that this is not suppressing their use.


Russia has used chemical weapons against individual dissidents outside the country: Novichok against Sergei and Yulia Skripal in the UK in 2018 and against Alexei Navalny in 2020. The Organisation for the Prohibition of Chemical Weapons (OPCW) fact finding mission established that chlorine and mustard chemical weapons were used in the civil war in Syria from 2014-2018<sup>vi</sup>. There are also allegations that chemical weapons were used by the Russians in the siege of Mariupol in Ukraine in 2022.

The CWC states: "Riot control agents, such as tear gas, are considered chemical weapons if used as a method of warfare. States can legitimately possess riot control agents and use them for domestic law enforcement purposes, but states that are members of the Chemical Weapons Convention must declare what type of riot agents they possess<sup>vii</sup>." President Assad to impose a heavy cost on the supporting civilian population of opponents in the civil war. Supported politically by Russia, the chemical agents employed range from mustard gas, sarin and VX nerve agent. The regime delivered chemical attacks using barrel bombs and crude explosive devices dropped by helicopter.<sup>viii</sup> On 21 August 2013, a large-scale chemical weapons attack using sarin nerve gas occurred in the Ghouta area of Damascus, killing around 1400 people.<sup>ix</sup>

Time will tell if Russia decides to openly test the resolve of the CWC signatory nations in Ukraine.

### **The Biological Weapons Threat**

Biological and toxin weapons are either microorganisms such as viruses, bacteria or fungi, or other toxic substances produced by living organisms that are produced and released deliberately to cause disease and death in humans, animals or plants.<sup>x</sup> While bioweapons are unlikely to be used, the implications of research in biology for military preparedness and operations is important. Internationally, the World Health Organisation (WHO) and the European Medicines Agency (EMA)



and national organisations have identified key diseases of bioterror concern. These include: *Bacillus anthracis*, *Clostridium botulinum* (toxin), *C burnetii*, *Francisella tularensis*, *Yersinia pestis* (the Plague), filoviruses (Ebola and Marburg virus), Lassa virus, and variola major, among others.

The threats from biological weapons lie in their use by states, groups and individuals who are not bound by the same conventions, taboos, moral imperatives, ethical, legal and policy structures that we are, even vis-à-vis their own people. The risk of pathogens or other materials being stolen from a laboratory for malevolent purposes is real and growing in proportion to the booming biodefence industry.

Biodefence encompasses activities to prevent, prepare for and respond to large-scale biological threats to both civilian and military populations from natural disease outbreaks, bioterrorism and biological warfare. Declarations regarding biodefence programmes were first introduced in 1992 by the Biological Weapons Convention (BWC) Confidence Building Measures (CBM). There were 13 countries with declared programmes in 1992 and by 2020, 29 countries are likely to have declared biodefence programmes.<sup>xi</sup> A major risk from the increased global biodefence activities, increased number of facilities and researchers working with dangerous pathogens is that these could be used as a cover for an offensive programme.


### **The Nuclear and Radiological Threat**

A nuclear agent can be defined as “radioactive material generated from nuclear fission or fusion, such as those produced by detonation of a nuclear weapon or releases from damaged nuclear power plants.”<sup>xii</sup> To be effective, a nuclear threat capability requires not only the possession of nuclear weapons but also the means to use them. Despite history demonstrating through the Cold War that assured mutual destruction is an effective deterrent the development and acquisition of nuclear weapons continues today.

Russia has threatened the use of a nuclear weapon against Ukraine. North Korea continues to conduct nuclear missile testing, with 31 tests having been conducted as at the end of August 2022. North Korean leader Kim Jong-un, has put an end to its self-imposed moratorium on testing long-range ballistic missiles and nuclear weapons established in 2018, clearing away a major obstacle to its nuclear ambitions.<sup>xiii</sup> The International Atomic Energy Agency (IAEA) Director General Rafael Grossi affirmed in mid-2022 that it cannot confirm the correctness and completeness of Iran’s declarations under its Comprehensive Safeguards Agreement (CSA), stating Iran has “not provided explanations that are technically credible in relation to the Agency’s findings at three undeclared locations in Iran.”

The current evolving radiological threat is from Russia with its large, diverse and expanding nuclear capabilities occurring in the context of its military assault on Ukraine. Russia has eroded the international treaty regime aiming at non-proliferation of delivery systems for WMD. Russia consistently violated the Intermediate Range Nuclear Forces Treaty that led to its collapse. Russian political and military threats about the use of nuclear weapons have led to international alarm about the potential for their use.<sup>xiv</sup>

The geographical focus of the radiological and nuclear threat today is Ukraine’s Zaporizhzhya nuclear power plant. In a campaign of misinformation, Russian Defence Minister Sergei Shoigu has claimed Ukraine's shelling of the Zaporizhzhya nuclear power plant was raising the risk of a nuclear catastrophe in Europe. Shoigu accused Ukraine of "nuclear terrorism" and rejected assertions by Kyiv and the West that Russia had deployed heavy weapons at Europe's biggest nuclear power plant,



located in southern Ukraine and under Russian control. Both Kyiv and Moscow have accused each other of attacking the facility.

The threat of CBRN substances is beyond that of their deliberate use, with our militaries also threatened by a release other than attack (ROTA). Nuclear power plant accidents can and do occur despite state-of-the-art safety measures employed by Governments such as Japan. The Fukushima accident occurred in 2011 as a result of a tsunami generated by an earthquake, at the Fukushima Daiichi (“Number One”) nuclear power plant in Japan. It is the second worst nuclear accident in the history of nuclear power generation, after the Chernobyl disaster. Immediately after the accident radiation levels increased in food, water, and the ocean near the Fukushima Daiichi plant. Around 150,000 people were forced to evacuate their homes due to the threat of radiation. There were subsequently multiple leaks at the facility. In 2013 one of these leaks was classified as a level-3 nuclear incident.

Defending against these CBRN threats, both military and accidents / disasters will not be static. The rate of advance of CBRN capabilities, their complexity and potential use is at its highest since the Cold War. Science, technology and rapid innovation will key to the evolution of CBRN defence.

### **Science, Technology and Innovation**

NATO’s report on trends in science and technology 2020-2040 sees the major impact on chemical weapons counter measures arising from research into the quantum structures and behaviour of new chemicals and materials that will be simulated to create new biochemicals and materials for CBRN countermeasures.<sup>xv</sup> They also see bio and human enhancement technologies as having a major influence on defence preparedness for a chemical weapons attack by improving detection through advances in personalised medicine, biomarkers, bioengineering, resilience and stress resistance. This research is moving at a breathtaking pace despite requiring serious government investment and commercial commitment. It is providing militaries around the world with cheaper, smaller, and more robust sensors to detect and consequently counter chemical weapons.

The same NATO report highlights advances in combat care. Wearable biomedical systems that monitor a soldier’ health continuously could provide better knowledge and care for injuries over time. Knowledge of the health status of soldiers on the battlefield could provide the essential warning information that an individual has been affected by an agent. Biomarkers, for instance, are a naturally occurring molecule, gene, or characteristic by which a particular pathological or physiological process, or disease can be identified, are being developed for human optimisation for combat readiness. Forces, leveraging bioinformatics, sensors and enhancement technologies, should be able to operate in smaller groups. This has implications for budgets and affordability.

The main limits on this research are around the use of genetic engineering and the release of personal biodata to publish peer-reviewed research. The use of pharmacological enhancements is contested in Western societies. The boundaries placed by national governments on the ethical testing on humans of the new therapeutics and countermeasures is a serious hindrance on progress.

The current sensors available to military are mostly designed for optimal detection of chemical weapons only. Future research on sensors is motivated by the ability to support the soldier to make decisions and act. These are predicted to go beyond diagnostics and will improve bio-situational awareness through advanced data collection and predictive analysis, not to mention combat casualty care.<sup>xvi</sup> NATO expects that ocular enhancement, restoration of muscular control through bodysuits and auditory enhancement will be available to the soldier in the next 20 years. Neural enhancement is expected to take longer, unfortunately, and will not be available till at least 2050.

### **Respirator Filter Technology**

Australia's national science agency, Commonwealth Scientific and Industrial Research Organisation (CSIRO), will in 2022 accelerate the development of ground-breaking protection for our defence force from CBRN effects with an \$8.6 million Defence Innovation Hub contract to further develop and commercialise its world-leading respirator filter technology.

The filter canister is a step change from existing technology, providing both protection for longer periods, and against more potential threats. As well as providing protection from biological and radiological agents, it will significantly reduce exposure to a broad spectrum of toxic industrial chemicals, also critical to the nation's first responders.

### **Counter CBRN technology in Supporting Civilian Structures**

In response to the terrorist attacks of 2001 in the US, and the anthrax attacks in the same year, significant research funding has been invested to investigate weaponised biological pathogens. The past 20 years has seen advances in biosecurity, bio-surveillance, diagnostics, medical countermeasures and vaccines.

Digital bio-surveillance and early warning networks which aim at mitigating biosecurity risks are another form of countermeasure managed by civilian organisations, which can inform military preparedness and response. They fall into two categories: disease surveillance and bioterrorism surveillance. Examples include the US Centre for Disease Control and Prevention (CDC), the EU's Biological and Chemical Agent Attacks (BICHAT) and Global Outbreak and Alert Response Network (GOARN) created by the WHO<sup>xviii</sup>.

The Australian Department of Health is planning to create an Australian Centre for Disease Control as a lesson learned from the COVID-19 pandemic. Monitoring networks in much of the world suffer from technical staff shortages, fragmented management, lack of investment and lack of basic surveillance systems for diseases and mortality. A major new development in disease monitoring is China's Biosecurity Law of April 2021 passed in response to COVID-19.<sup>xix</sup>


### **Wearable Sensors**

The authors of a study published in Nature in 2019 have developed a tattoo that can monitor the internal workload of the athlete to tailor recovery protocols for the individual. The ability to monitor biomarkers from saliva or sweat in a non-invasive and continuous way represents the next technological step for medicine to tailor athletic recovery methods. Flexible and stretchable electronics coupled with technology to quantify biochemical analysis and physiology can enable the detection of key markers in performance and stress. ([Nature, 2019](#))

### **Interoperability**

The NATO Comprehensive Approach based on lessons learned from missions and operations requires the combination of political, civilian and military instruments.<sup>xx</sup> A radiological or nuclear crisis requiring a military response would necessarily engage the full political-civilian-military community.

A CBRN release event in the context of an armed conflict directly aiming at harming the civilian population would pose enormous challenges to international, civilian first responders. The shock of mounting such a response would face the added complexity of allegations, legal uncertainties around attribution, political responses and media frenzy. In response to this risk, the International Committee of the Red Cross conducted reviews of capability early this century and built a CBRN response framework, but no humanitarian stand-by capacity exists.



The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is the Australian Government statutory agency charged with the responsibility for protecting the health and safety of people and the environment from the harmful effects of radiation. It is also the national centre for excellence in radiation protection and nuclear safety in Australia. ARPANSA and Australian Nuclear Science and Technology Organisation (ANSTO) have coordinated with the IAEA to donate radiation measurement and personal protective equipment to Ukraine in 2022.

### **The Future for Deterrence and Taboo**


Nuclear deterrence is a defensive military doctrine based on a mutual fear of the consequences of using nuclear weapons first. Deterrence is based on the ability to retaliate in the event of a nuclear attack. Historically, military deterrence has always existed. It consists of raising the fear of a military response in case of the transgression of an agreement, a rule or convention. Nuclear deterrence, however, has the distinguishing feature of the devastating power of the nuclear weapon. The fear of nuclear weapons is linked to the risk of mutual assured destruction (MAD) and its long-term consequences of irreversible damage to the planet and life on Earth itself.

The US Department of Defense defines deterrence as “a strategy that seeks to prevent an actor from taking specific action and has been central to keeping peace for nearly 70 years. Applying the enduring concepts of deterrence requires a continuous effort to tailor as the security environment evolves.”<sup>xxi</sup> Only radiological and nuclear weapons benefit from an interventionist monitoring and surveillance structure - that is the IAEA.

Taboo is a strong feature of the reasoning behind the non-use of CBRN in war. During the World War eras, the moral and social imperatives constituting a taboo grew on these as a class of weapons as people lived with the horrific effects of the weapons. These taboos arise from the horrific effects of the weapons, and collective fear among the civilian population. There are two taboo logics which stand out as dominant explanations for non-use: the consequentialist logic of deterrence and the prohibition-norm logic. The rational consequence logic is dependent on cost–benefit calculations by rational actors who are acutely aware of the threat of retaliation in kind, or worse, thereby informing states of the potential impact of their weapons choices during war. The prohibition logic is based on communal abhorrence of the weapons.<sup>xxii</sup>

The world is now receiving a lesson in offensive deterrence. Western deterrence policy actions to prevent the Russian invasion of Ukraine clearly failed, and Russia is discouraging and deterring certain responses from Ukraine’s allies. This has major implications for CBRN defence as these are the weapons we rely on to be governed by specific non-proliferation agreements and the moral tenet of prohibition. In contrast to a Western understanding of the cost-benefit analysis to both sides of deterrence, Russian strategic culture emphasizes cost imposition on the adversary and the civilian support population. This imposition of cost takes precedence over denial for deterrence purposes. They are exercising forms of calibrated damage as a vehicle by which to manage escalation. In research on Russian escalation management, the US Centre for Naval Analyses asserts, “Despite acquiring non-nuclear means of deterrence, Russia continues to rely on nuclear weapons to deter and prosecute regional and large-scale conflicts, seeing these as complementary means within a comprehensive strategic deterrence system.”<sup>xxiii</sup> The use of CBRN weapons to achieve operational effects, coerce a population through a deniable, low-cost method using grey-zone warfare, coordinated with conventional military actions is an increasing threat.

Deterrence and taboo explain why states in most circumstances, exercise restraint in the use of CBRN weapons. They have simply not been used en masse since the atrocities committed on the



battlefields of World War 1 and against civilians in World War 2. They are being used and threatened now with strategic effect by Russia and this may well embolden likeminded aggressive states. There is no good reason for complacency anymore. Given the threat assessments conducted by nations around the world, there is every reason for building civilian and military preparedness for a CBRN attack.

Civilian and military response to CBRN threats is interlinked and complementary. Military resilience requires civilian services and infrastructure, transport, telecommunications, information technology services, energy food and water supply, law enforcement and medical services. The civilian effort requires military knowledge, capability, structures, and its trained people. While civilian and military capabilities and strengths are supportive of each other, they are not interchangeable, and neither can one substitute the other. Without resilience in the civilian sphere, the military deterrence effort will be compromised.

National resilience will need to be created on the premise that an international network of CBRN defence capability exists, that we and our partners can rely on. Military-to-military relationships are built on two pillars: the structural, which comes from agreements, memorandums of understanding, and the historical and personal, which result in trust based on a bank of shared experience. The examples of the contribution a relatively small nation like Australia can make to the global CBRN effort illustrate that a networked effort is required to have an impact on grave situations. All nations have a contribution to make.

The CBRN taboo has been shattered. It must be urgently replaced by a structured, supportive civilian effort in science, technology and emergency response led by clear and stated national and multi-national deterrence policies which governments must be ready to enact.

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## Endnotes

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- <sup>i</sup> 'The Anatomy of Human Destructiveness' by Erich Fromm: New York, Holt, Rinehart and Winston, 1973
- <sup>ii</sup> [Chemical Weapons Convention](#)
- <sup>iii</sup> [Encyclopaedia Britannica](#) – The Polynesian origin of taboo
- <sup>iv</sup> <https://ihl-databases.icrc.org/ihl/INTRO/150> ICRC database on Conventions States and Commentaries
- <sup>v</sup> [Chemical, Biological, Radiological and Nuclear Response introductory guidance](#), ICRC Publications (June 2020)
- <sup>vi</sup> [Fact-Finding Mission | OPCW](#)
- <sup>viii</sup> [Fact-Finding Mission | OPCW](#)
- <sup>ix</sup> [Attacks on Ghouta: Analysis of Alleged Use of Chemical Weapons in Syria | HRW](#)
- <sup>x</sup> [World Health Organisation – Biological Weapons](#)
- <sup>xi</sup> 21<sup>st</sup> Century Biodefence (2020) Gregory Koblentz, Filippa Lentzos, Kings College, University of London
- <sup>xii</sup> CBRN Response introductory guidance, ICRC Publications (June 2020)
- <sup>xiii</sup> [Timeline: North Korean Nuclear Negotiations \(cfr.org\)](#)
- <sup>xiv</sup> NATO's Chemical, Biological, Radiological and Nuclear (CBRN) Defence Policy, 14 June 2022
- <sup>xv</sup> [NATO Science and Technology Trends Report 2020-2040](#)
- <sup>xvi</sup> Ibid
- <sup>xvii</sup> <https://www.csiro.au/en/news/news-releases/2022/worlds-best-respirator>
- <sup>xviii</sup> <https://extranet.who.int/goarn/>
- <sup>xix</sup> Surveillance of emerging infectious diseases for biosecurity (March 2022) Science China Life Sciences, Rongzhang Hao, Yuqi Liu, Wanzhu Shen
- <sup>xx</sup> [NATO - Topic: A "comprehensive approach" to crises](#)
- <sup>xxi</sup> <https://dod.defense.gov/News/Special-Reports/21st-Century-Nuclear-Deterrence-and-Missile-Defense/>
- <sup>xxii</sup> Damir Kovačević, Afrimadona & Martin Claar (2019): Gas, power, and norms: competing logics for the declining use of chemical warfare, The Nonproliferation Review
- <sup>xxiii</sup> <https://www.cna.org/about-us/what-is-cna>; Russian Strategy for Escalation Management: Evolution of Key Concepts Michael Kofman, Anya Fink, Jeffrey Edmonds, CAN Publications April 2020