



Introduction: Reducing the Risk of Nuclear Weapons Use in Northeast Asia

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SPECIAL REPORT
Reducing the Risk of Nuclear Weapon Use in
Northeast Asia

Introduction: Reducing the Risk of Nuclear Weapons Use in Northeast Asia



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ABSTRACT

This paper summarises the joint collaborative project between the Nautilus Institute, the Research Center for Nuclear Weapon Abolition, Nagasaki University (RECNA), the Asia Pacific Leadership Network for Nuclear Non-Proliferation and Disarmament (APLN) and the Panel on Peace and Security of Northeast Asia (PSNA) examining cases for nuclear weapons use in a conflict in Northeast Asia by analysing plausible pathways that could lead to the first use of nuclear weapons, and quantitatively estimating the fatalities and health effects of nuclear weapons use. The paper also describes the final year analysis with contributing essays by international experts and recommendations for narrowing the space for nuclear use-case scenarios to arise in the first place through forms of mutual threat reduction (structural risk reduction) and managing within-scenario risks (situational risk reduction) more responsibly if they arise.

KEYWORDS

Nuclear weapons; Northeast Asia; Korean Peninsula; arms control; nuclear risk reduction



In the summer of 2021 the Nautilus Institute, the Research Center for Nuclear Weapon Abolition, Nagasaki University (RECNA), the Asia Pacific Leadership Network for Nuclear Non-Proliferation and Disarmament (APLN) and the Panel on Peace and Security of Northeast Asia (PSNA) embarked on a collaborative research project entitled, “Reducing the Risk of Nuclear Weapon Use in Northeast Asia (NU-NEA)”. Over the course of three years, we analysed plausible pathways that could lead to the first use of nuclear weapons in Northeast Asia, quantitatively estimated the impacts of nuclear weapons use and proposed recommendations to avoid such an outcome. The aim was to assist policymakers in preventing the escalation of conflict in Northeast Asia that could result in a nuclear weapon being detonated and ultimately avoid nuclear conflict.

To do this, we attempted to answer the following questions:

- Under what conditions might nuclear weapons be used (with or without intention) in Northeast Asia (NEA) and by whom? How might such a first use of nuclear weapons escalate to a larger scale of nuclear war? And which states might respond to a first nuclear use with nuclear weapons use of their own?
- What are the possible consequences (fatalities, physical damages to key infrastructure, environmental damages, climate impacts, and more) of potential nuclear weapon use in Northeast Asia?
- What are the possible measures to reduce the possibility of the use of nuclear weapons in the region? What lessons do analyses of use cases offer for the development and deployment of policies that will help to avoid nuclear weapons use?

In the first year of the project, we developed 30 nuclear use cases, quantitatively modelling five of these cases to estimate the impacts of nuclear weapons use, and drew important conclusions and policy recommendations. Thirty hypothetical scenarios of nuclear weapons use were developed for the period between 2025 and 2030, as part of a conflict on the Korean Peninsula or in Northeast Asia. These use cases involved mostly limited nuclear war involving the DPRK, United States, China, and Russia as the states to use nuclear weapons first. These use cases each began with a first-use detonation of one or more nuclear weapons in an attack against an opponent and continued with response detonations or counterattacks by one or more adversaries as the conflict escalated. We also considered the possibility of the use of nuclear or other weapons by non-state actors as a triggering event.

We found many factors that could lead to nuclear first use. One of these that was common to many instances of use was when an adversary **misinterprets** the actions of the other. These misinterpretations include underestimating an opponent’s capabilities, resolve, or reaction to a provocation. Also, many of the use cases are influenced by the **personality of a leader**, and how they respond to a crisis involving nuclear weapons. Several use cases occur when one or more adversaries are **distracted** by other issues, including domestic issues and issues abroad. Many involve a **lack of communication**, or lack of timely or clear communication, between rivals and, in many cases, between allies, or even between those responsible for operating the assets of a single military. Many include key decision points where either escalation or de-escalation of a conflict is possible, based on the choices (or failures to choose) of military and civilian leaders at those moments. Many involve large uncertainties about the outcome of nuclear conflicts. It is difficult to foresee what will happen once a nuclear weapon is used, and nuclear use may escalate to uncontrollable nuclear conflict regardless of what decision-makers want.



Although many of the use cases use similar delivery systems which are dictated in part by the distance between adversaries, as well as their arsenals, some use **very different means of moving nuclear weapons to target** and therefore require different policy approaches to reduce the threat of nuclear use. As of today, the nuclear arsenals of potential adversaries **differ substantially in quantity and quality**, which informs the decisions to use or not use nuclear weapons. Nuclear weapon arsenals of potential adversaries, and the technologies used to deliver them, do not remain unchanged. Future security challenges may be addressed by very different weapons than are used today. And on the adoption, or rejection, of opportunities for stopping conflict through negotiation, different approaches to negotiation may produce significantly different outcomes in nuclear conflicts, although the effectiveness of negotiation can also vary widely.

In the second year of the project, Dr David von Hippel and Eva Lisowski simulated and analysed five of the cases using HYSPLIT simulations and geographical data to provide estimates of fatalities and health effects resulting from nuclear detonations. These use cases began with a first-use detonation of one or more nuclear weapons in an attack against an opponent and continued with response detonations by one or more adversaries as the conflict escalated. In some cases, multiple exchanges between several nations escalate to a global nuclear war.

The fatalities and health effects due to the following six physical impacts of nuclear detonations were estimated: 1) **thermal fluence**, or thermal radiation from the nuclear fireball, depending on the distance from the fireball and other factors, causes skin burns to exposed flesh, and causes combustible materials, such as fuel, building materials, and clothing, to ignite; 2) **firestorms** started by the thermal fluence from the nuclear detonation under certain conditions, with the occurrence and extent of firestorms dictated by weapon yield, height of burst for the detonation, weather, geographical conditions, the presence or absence of fuel for the fire, and other factors; 3) **blast overpressure**, the blast wave and hurricane-force-or-greater winds caused by the explosion, which destroys buildings and other structures, sends debris flying and shatters glass windows even at distances far from “ground zero” (the point on the ground where or over which a weapon detonates); 4) **prompt (or immediate) radiation exposure** from the nuclear explosion, reaching affected people within hundreds of meters to kilometres of ground zero; 5) **radiation exposure from fallout**, which occurs as radioactive materials from the weapon itself and contaminated soil and debris are thrust into the air, dispersed, and deposited downwind; 6) **cancer deaths** caused by biological radiation doses acquired from exposure to prompt radiation, cloudshine (fallout suspended in the air), and groundshine (fallout deposited on the ground).

We drew several conclusions from this analysis:

1. The impact of mass fires or firestorms that sometimes result from nuclear explosions **can surpass the lethality of other direct impacts of nuclear use**. Historically, military planning for nuclear use has lacked sufficient consideration of firestorm impacts.
2. Any nuclear detonations, even in relatively unpopulated areas, are likely to result in at least thousands of deaths, with possible fallout crossing international borders, causing additional health risks and increasing political tensions even when fallout levels are low.
3. Many of the plausible nuclear use cases developed for this project have their genesis in **misinterpretation of intentions and lack of communication between adversaries**, underscoring the need for communication between nations to avert nuclear weapons use, especially during times of conflict and crisis.



4. There are many plausible pathways to nuclear war that would have cataclysmic effects. Most of these pathways involve “slippery slopes” of descent into nuclear war, where an action by one party is misinterpreted by another, leading to conflict escalation that proceeds further and more rapidly than adversaries intend or foresee. As such, **these potential pathways to nuclear war are often invisible to policymakers.**
5. It is urgent to reduce the risk of choosing or stumbling onto one of these pathways by developing and applying regional and global policy measures such as increasing transparency of nuclear stockpiles, deployments, and operational and declaratory doctrine—especially relating to the integration of nuclear firestorms into nuclear targeting— such as increasing communications with nuclear hotlines.
6. It is important to explore policy measures to **reduce the role of nuclear weapons in security policy and to revive arms control and disarmament diplomacy.** Such measures include introducing a nuclear no-first threat norm; resolving regional conflicts; and, ultimately, establishing a regional security framework including denuclearisation of the Korean Peninsula and a nuclear-weapon-free zone in the region towards the elimination of nuclear weapons altogether.

Building on these learnings, in the third year of the project, we sought analysis by five experts focusing on contemporary issues that should inform the thinking on nuclear risk reduction in Northeast Asia. These analyses form the basis of this special edition report.

Rabia Akhtar in “The Political Reckoning in a Post-Nuclear Use Landscape” provides a comprehensive analysis of the multifaceted challenges posed by nuclear weapons in Northeast Asia. She explores the political ramifications of potential nuclear use in the region, examining potential power shifts, the changing role of anti-nuclear groups, and the broader impact on security policies. The exploration extends to scenarios post-nuclear use, encompassing positive, negative, and other complex outcomes. Positive outcomes include the possibility of comprehensive dialogues on various arms control strategies, US-DPRK arms control negotiations, bolstering disarmament and non-proliferation education, and leveraging technological advancements in disarmament. In the negative forecast, she describes the failure of deterrence and breaking of the nuclear taboo where nuclear weapons are considered legitimate and feasible means to attain strategic objectives on the battlefield, aggressive nuclear modernisation, and the increased development of destabilising technologies.

Lauren Sukin and Woohyeok Seo in “East Asia’s Alliance Dilemma: Public Perceptions of the Competing Risks of Extended Nuclear Deterrence”, ask what drives nuclear anxiety in East Asia? And how can the United States most effectively resolve it? The authors discuss “nuclear anxiety” among publics in Australia, Indonesia, Japan, South Korea, and Taiwan through a survey analysis which also analysed how the publics view the nuclear threat environment. They argue that “nuclear anxiety” is embedded in alliance politics and worries over abandonment or entrapment by US regional allies can worsen nuclear anxiety. They explore the consequences of “nuclear anxiety”, such as public attitudes to nuclear armament and the forward deployment of US nuclear weapons, including the debate in South Korea. Their findings show that US allies and partners worry about the reliability of the United States following through on its security commitments and the consequences if it does. They point out that abandonment and entrapment concerns are driving growing regional interest in nuclear proliferation and may underlie expanding nuclear cooperation and consultations between the United States and its partners in the region.



Benjamin Zala in “Nuclear-Conventional Entanglement in Northeast Asia: The Case for Crisis Management Interoperability” writes that non-nuclear armed US allies are beginning to acquire conventional capabilities with the ability to impact nuclear balances when these forces are combined with those of the United States. This makes the dynamics of a nuclear crisis in regions such as Northeast Asia – home to multiple US allies with such weapons in addition to extended nuclear deterrence guarantees – far more complicated than most scholars, analysts, or policymakers appreciate. The new layers of complexity added to nuclear-conventional entanglement by alliance relationships are important to explore before any new crisis erupts. Zala surveys the nuclear-conventional entanglement risks in Northeast Asia as well as the ways that this growing entanglement is driving a new era of nuclear arms racing in response. He discusses two areas of risk reduction that can be explored to lower the chances of crises occurring as well as peacefully manage those crises that occur. He makes the case for developing ‘crisis management interoperability’ between allies and the need to refocus current efforts from a pure focus on deterrent threats to a more balanced approach which addresses the more difficult task of providing the assurances that are critical to a successful deterrence strategy.

Adam Mount in “No First Use Can Still Help to Reduce US-China Nuclear Risks” analyses China’s No First Use (NFU) policy, the US debate on NFU, and the value of nuclear declaratory policy. He posits that NFU declaratory statements are unlikely to significantly affect US-China nuclear crises but that they can still play an important role in reducing risks between the two countries through the adoption of practical planning and posture measures to reduce the reliance on nuclear first use. For example, the United States could develop an NFU internal policy which means changes to presidential guidance and force posture to reduce the dependence on nuclear first use in planning. This creates expectations of nuclear restraint and effective non-nuclear options as well as options available other than nuclear first use. Although US-China bilateral discussions on no first use are unlikely to lead to changes in US declaratory policy, they could provide an opportunity to discuss the risks of nuclear escalation, better understand each country’s doctrine, and lay the groundwork for future risk reduction talks. Essentially facilitating a bilateral discussion on NFU could lead to a valuable dialogue on the role of nuclear weapons.

Ulrich Kühn and Heather Williams in “Behavioral Arms Control and East Asia” make the case for Behavioural Arms Control, a novel approach that includes China, tackles emerging technologies and circumvents the intractable challenges of traditional arms control such as negotiating treaties and gaining approval from legislatures. Their suggested approach of Behavioral Arms Control is built on informality, responsibility, and multidimensionality. Namely, not relying on formalised treaty processes, focusing on military behaviours and activities instead of numbers of weapons, encompassing a broad scope to reduce risks in both nuclear and non-nuclear domains and involving cooperative initiatives with the potential to include multiple actors including those from the Global South.

Finally, in the project’s final concluding report, **Van Jackson** identified key areas of vulnerability in Northeast Asia’s security architecture, offering practical policy recommendations for avoiding nuclear war, aimed at the governments of Japan, South Korea, the United States, China, and North Korea (Jackson 2024). The analysis points to nuclear and conventional military decision-making interacting to compound risks of nuclear use, which always involves one or more of the following factors drawn from the project’s year one analysis: 1) miscommunication and poor communication;

2) misperception, both of enemy actions and enemy intentions; 3) overconfidence in the ability to coerce the enemy with military force; 4) insensitivity to the decision pressures of political and military leaders. Any policy formulation that seriously seeks to reduce nuclear risk must respond to these four factors and also be based on the principles of transparency, predictability, strategic empathy and rebalancing deterrence and reassurance. He argues that Northeast Asia is unique for being a region that includes rivalries with both high structural risk and high situational risk because it is a site of escalating arms competition and first-use nuclear incentives (structural risk), and a high degree of reliance on coercive military signalling (situational risk). He suggests approaching risk reduction by narrowing the space for nuclear use-case scenarios to arise in the first place through forms of mutual threat reduction (**structural risk** reduction) and to help manage within-scenario (**situational**) risks more responsibly when they arise. He considers the feasibility and desired impact of recommendations by suggesting **warming actions** (rhetorical and diplomatic gestures); **ripening actions** (individual restraint); and **reciprocal transformations** (multilateral processes). Governments must warm and ripen the regional security environment for ambitious measures to reduce the threat of nuclear weapons to be politically feasible.

Looking forward, issues that remain to be explored beyond the project include the legality of nuclear weapons threats and actual use which is poorly understood, particularly with respect to the legality of nuclear threats, whether made rhetorically or by signalling intention by displaying changes in the alert status of fielded nuclear forces or other nuclear-war-related activities. The sources of international law that pertain to nuclear threat and use are also manifold and varied; and the degree to which these laws are salient also varies with respect to the extent to which states have signed, ratified or qualified their commitments, and whether such laws are customary or treaty-based international law. The Treaty for the Prohibition of Nuclear Weapons was born from the frustration generated by this lack of clarity. However, the legal reach of the treaty beyond the territorial jurisdictions of ratifying states is extremely limited. Many are confused about claims about the legality and illegality of nuclear threat and use, and what the legal options are, if any, to restrain such threats and use, and to hold accountable those making threats or using nuclear weapons. Exploring the issues of international law, nuclear threats and nuclear use can build on the foundations that this project has cemented.

CONCLUSION

Over the course of three years of the project we have defined a plausible set of use cases for nuclear weapons in a nuclear conflict war on or involving the Korean Peninsula and in Northeast Asia; calculated the direct and indirect effects, including dispersion of radioactivity, impacts on infrastructure, populations, and the environment of resulting nuclear detonations in Korea and beyond; and drawn policy implications based on the results of the analyses of the pathways to, and impacts of limited nuclear wars in the Northeast Asian region. In addition to devastating losses of human life, a host of economic and societal impacts, including billions of dollars in infrastructure damage and health care costs, as well as global, regional, and local ecological impacts such as climate effects or effects on oceans, would result from the nuclear use cases we presented. To prevent this, Northeast Asian security must be reshaped to make meaningful risk-reducing policies possible. The nuclear bombings in Hiroshima and Nagasaki continue to be the only instances of nuclear weapons being used. In a region facing worsening nuclear risks and growing militarisation with deterrence-oriented policies, now is the time to explore credible approaches to reduce the risk of nuclear weapons use and ensure that Nagasaki remains the last case of nuclear use.



DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author(s).

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Shatabhisha Shetty is the Executive Director of the Asia-Pacific Leadership Network for Nuclear Non-Proliferation and Disarmament (APLN). She is a co-founder of the European Leadership Network (ELN), serving as Deputy Director for over a decade before joining the ELN Executive Board in 2020. She is a project advisory board member of Leicester University's Third Nuclear Age, assessing strategic conventional weapons and the next revolution in the global nuclear order and sits on the Advisory Committee for Women in International Security-UK (WIIS-UK). Her research interests include nuclear and conventional arms control, disarmament diplomacy, great power politics, and emerging technologies, and she has written and spoken internationally on a range of related issues.

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The Asia-Pacific Leadership Network for Nuclear Non-Proliferation and Disarmament (APLN) is a Seoul-based organisation and network of political, military, and diplomatic leaders and experts from across the Asia-Pacific region working to address global security challenges, with a particular focus on reducing and eliminating nuclear weapons risks.

The mission of APLN is to inform and stimulate debate, influence action, and propose policy recommendations designed to address regional security threats, with an emphasis on nuclear and other WMD (weapon of mass destruction) threats, and to do everything possible to achieve a world in which nuclear weapons and other WMDs are contained, diminished, and eventually eliminated.



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Nagasaki University is the only university in the world that has inherited a medical college having experienced the atomic bombing. Achieving a “world free from nuclear weapons” is thus a paramount concern to the University. Research Center for Nuclear Weapons Abolition, Nagasaki University (RECNA), located in a city that was attacked by an atomic bomb, is an educational and research institute which is the interdisciplinary center of local academia with a firsthand experience of the horror of nuclear weapons. Founded in 2012, its objectives encompass a twofold mission: firstly, through rigorous academic inquiry and analysis, to redefine the significance of Hiroshima and Nagasaki experiences in the light of the current world trend, and disseminate information and make proposals from various aspects towards abolishing nuclear weapons; secondly, to make best use of such a process and outcomes of its research and analysis, and contribute to university education. RECNA, as a think tank open to the local community longing for nuclear weapons abolition, operates in close cooperation with partners including Nagasaki City and Nagasaki Prefecture.



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Since its founding in 1992, the Nautilus Institute has evolved into a thriving public policy think-tank and community resource. Along the way it has addressed critical security and sustainability issues such as US nuclear policy, especially in Korea, energy insecurity in Northeast Asia, and the effect of the U.S.-China relationship on environmental insecurity. The Institute has built a reputation not only for innovative research and analysis of critical global problems, it also translates ideas into practical solutions, often with high impact. Nautilus Institute holds that the key to reducing global insecurity—in short, to making the world peaceful, equitable, and sustainable—lies in the creation of a global civil society committed to joint problem-solving. The Nautilus community is a global network built around this strategy serving thousands of people in over fifty countries and working with partners in every country in the region.



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