GLOBAL NUCLEAR EFFECTS CONFERENCE

June 1-2, 2022

SUMMARY

The Global Nuclear Effects Conference on June 1 and 2, 2022, focused on the global effects of nuclear conflict on the environment, climate, agriculture, critical infrastructure, and society. Speakers discussed, amongst others, pertinent vulnerabilities in our economies and societies, the threat of cascading failures, prospects for recovery, and the role of resilience. Participants engaged on topics related to four thematic blocks: (i) Nuclear War and Needs for Human Survival; (ii) Critical Infrastructure and Prospects for Economic Recovery; (iii) Social Impacts of Nuclear Conflict; and (iv) Translating Science into Policy Action.

This document provides a (non-exhaustive) summary of key points made by speakers and discussants during presentations and Q&A and panel discussions.

Key Takeaways from Presentations

- **Scientific research increasingly shows that a nuclear conflict would have catastrophic effects on modern society and the continued existence of human civilization.**
  - On land, severe climatic cooling (also known as "nuclear winter), low light and precipitation levels, and high doses of radiation, could shorten the growing season and significantly reduce agricultural yields or eliminate certain crops, leading to production shortages more extensive than any reported in history. Sudden global cooling would likely be more harmful than gradual global warming.
  - At sea, nuclear winter would result in a new "ocean state" with perturbations of ecosystems lasting 10's to 1000's years. Due to a long-term decrease in biomass, intensified fishing would only lead to a short-term increase in catch which would not suffice to compensate for the massive shocks to agricultural production.
  - Compensating for production shortages through national reserves and imports would be possible for up to one year at best, after which countries may revert to economic protectionism by adopting export restrictions or bans that would propagate supply shocks to the rest of the world.

- **Critical infrastructure and just-in-time global supply chains remain strikingly vulnerable to single points of failure, which could trigger catastrophic cascading failures when attacked.**
  - A report from the Federal Energy Regulatory Commission indicates that the U.S. electrical grid could collapse entirely if only 9 out of 30 critical electric-transmission substations were

attacked, resulting in a blackout that could last 18 months or more, according to conservative estimates.
    - Similarly, the destruction of transport hubs including ports and roads as well as other critical energy infrastructures such as refineries and backup generators could halt fuel supply to critical systems – and vice versa (e.g., no transportation without gas, no food refrigeration without electricity, and no heating in winter).
    - Under such circumstances, no industry would be able to function, rendering the US import-dependent for essential goods and services and producing instant and detrimental ripple effects to the broader economy, human health, and disaster response, which, in turn, could lead to social instability and governance collapse.

- **While no country is prepared to deal with the humanitarian catastrophe that would follow a nuclear exchange, the world's poorest and marginalized communities would bear inequitable consequences.**
    - The dehumanization used to justify modern exploitation and the use of nuclear weapons is based on the same practice of "othering" that enabled slavery in the United States and racial discrimination more broadly.
    - Nuclear weapons programs divert public funds from health care, education, disaster relief, and other vital services that would benefit communities that have long suffered from disinvestment.

Cross-Cutting Conclusions

- **New technologies expand possibilities for scientific research on nuclear effects but modeling the breakdown of complex interacting systems remains challenging.** Advances in knowledge and computing power mean models are constantly revised and improved, creating the potential for painting an increasingly accurate picture of nuclear effects. However, modeling efforts are complicated by the complex and dynamic networks underpinning our societies and countries today, as data on infrastructure interdependencies is sparse and poorly collated. In addition, multi-hazard events, the potential overlap of infrastructure shocks and conflicts, and constraints on national and international governance and institutional capacity represent crucial variables whose impact is still poorly understood.

- **Drawing analogies to natural and anthropogenic hazard events can help understand the effects of nuclear use, even though results might not always be transferable.** Past nuclear events like Fukushima and Chernobyl or natural hazards such as volcanic eruptions and hurricanes can provide valuable data that can support the modeling of nuclear effects on agricultural, economic, and social systems.

- **Considering human behavior in the aftermath of a nuclear conflict is essential to assess the full range and severity of effects. However, making accurate predictions is difficult, especially in times of cascading crises.** For example, supply chain consequences and food security in the aftermath of a nuclear exchange depend on human judgment and crisis policies such as export and import rules. Prospects for recovery from nuclear weapons use also largely depend on the availability and readiness of the workforce, e.g., to access radiologically contaminated areas or

shift to different types of labor altogether. Therefore, more behavioral science studies will be needed to inform economic, political, and social consequences of a nuclear conflict.

- **There is no playbook for recovery.** As has become evident in the COVID-19 pandemic, countries remain dangerously unprepared to deal with global crises and cascading failures. Many measures to increase preparedness and disaster resilience are based on the principle of solidarity (e.g., the EU Solidarity Clause) which assumes that resources for crisis response will be available "elsewhere." This assumption needs to be critically challenged. Similarly, disaster response mechanisms are often designed to facilitate rapid recovery from singular, sudden shocks but are poorly equipped to effectively deal with long-term and compound crises, challenging the prevalent model for resilience. Therefore, recovery from nuclear war is far from certain, as are potential pathways to achieve that.

- **Efforts to build resilience to a nuclear conflict must be weighed against the prospects of survivability and the importance of prevention.** Food, energy, and transportation security would be among the most critical factors for human survival after a nuclear exchange. However, current efforts to develop alternative food sources and resilient critical infrastructure are unlikely to produce sufficient output and volumes to maintain a functioning modern society in the aftermath of a nuclear conflict. The question of whether resilience to nuclear war is genuinely possible is as critical as considerations about the (lacking) quality of life humanity would face in a world post-nuclear war. Finding answers to these fundamental questions will be essential to guide resources and actions in the future.

Translating Science Into Policy

- **There is an urgent need for a new theory of change**. While there is still an enormous amount of research gaps to be filled, it is uncertain whether more widespread awareness of nuclear effects will directly lead to new grassroots or elite policy action. In the absence of precise data and definitive conclusions, some element of uncertainty about nuclear effects will likely remain in the future. Compelling scientific evidence alone might therefore not be sufficient to raise doubts about the validity of nuclear deterrence policies, given that advocates hold deeply entrenched beliefs about the benefits of nuclear weapons and are convinced of the rationality of nuclear-armed states despite—or perhaps because of—their knowledge of nuclear effects. Finding innovative and creative ways to raise awareness of and communicate the catastrophic risks of nuclear use while continuing to pursue nuclear risk reduction should, therefore, become part of a new, common theory of change. Such discussions should also address how to shift to an alternative security paradigm not based on the premise of mutual annihilation.

- **Future studies on nuclear effects could help determine scientifically-informed waypoints for nuclear disarmament.** Participants discussed whether scientific evidence could inform tipping points of cascading failures and resulting thresholds for gradual policy changes and arms control measures towards disarmament (e.g., determining the number and size of a nuclear weapons exchange that would produce existential consequences to humanity vs. "only" catastrophic effects). Some participants expressed their concern that determining specific tipping points would provide justification and incentives for nuclear-armed states to retain a certain "safe" number of nuclear weapons, which would contradict the notion of responsible research. However, developing that understanding could help set realistic targets for threat reduction on a path to disarmament in the medium term.

- **Today's unprecedented vulnerability of critical infrastructures raises the question of nuclear obsolescence** given that the collapse of entire systems could also be brought about by a conventional attack (e.g., through precision-guided munitions directed against critical nodes). In fact, the use of nuclear weapons would not provide any added military value in such cases and could be regarded as "overkill," opening a potential path for policy innovation and disarmament by declaring nuclear weapons obsolete.

- **Efforts for nuclear disarmament can learn from and join forces with other movements by connecting the threat of nuclear weapons to social justice.** The climate change movement has successfully identified climate change as a human rights and social justice issue, making the problem more tangible for people and creating agency (e.g., support from the Black Lives Matter movement - "Climate Justice is Racial Justice). Such interlinkages could also be explored in the nuclear field. Connecting the nuclear disarmament and climate change movements could, for example, be achieved through a shared focus on the area of divestments from nuclear weapons.

- **Effective communication of nuclear effects should incorporate narratives, storytelling, and different types of media to make the issue more accessible to domestic and international audiences.** Using the example of the Nuclear Freeze Movement in the 1980s, simplifying the scientific evidence and making it "personal" can help create a message that reaches both Congress and the masses. While scientific indicators will rarely change anybody's mind (due to their complexity and a remaining level of uncertainty), positive and hopeful stories have the potential to do so. In addition, to achieve equitable representation at the table and incentivize all parts of society to engage on nuclear disarmament, "traditional" forms of inclusion such as internships and educational scholarships/loans will not be sufficient. Instead, reaching different demographics will require the use of various media such as music, graphic design, and virtual reality (e.g., "On the Morning You Wake" project).