



Humanitarian Impacts of Nuclear Weapons Use in Northeast Asia- Implications for Reducing Nuclear Risk

Science for Peace (S4P) Forum

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Increasing Nuclear Risk

Dooms Day Clock: 90 seconds

2023/1

Worst since the end of WWII



Russian invasion of Ukraine with Threat to use nuclear weapons

Number of nuclear warheads available for deployment is increasing

Lack of progress of US-Russia nuclear disarmament negotiation

Modernization of nuclear weapons in all nuclear weapon states

Change in nuclear doctrine to use nuclear weapons first (North Korea, Russia, China..)

No progress in negotiation with DPRK, Iran.

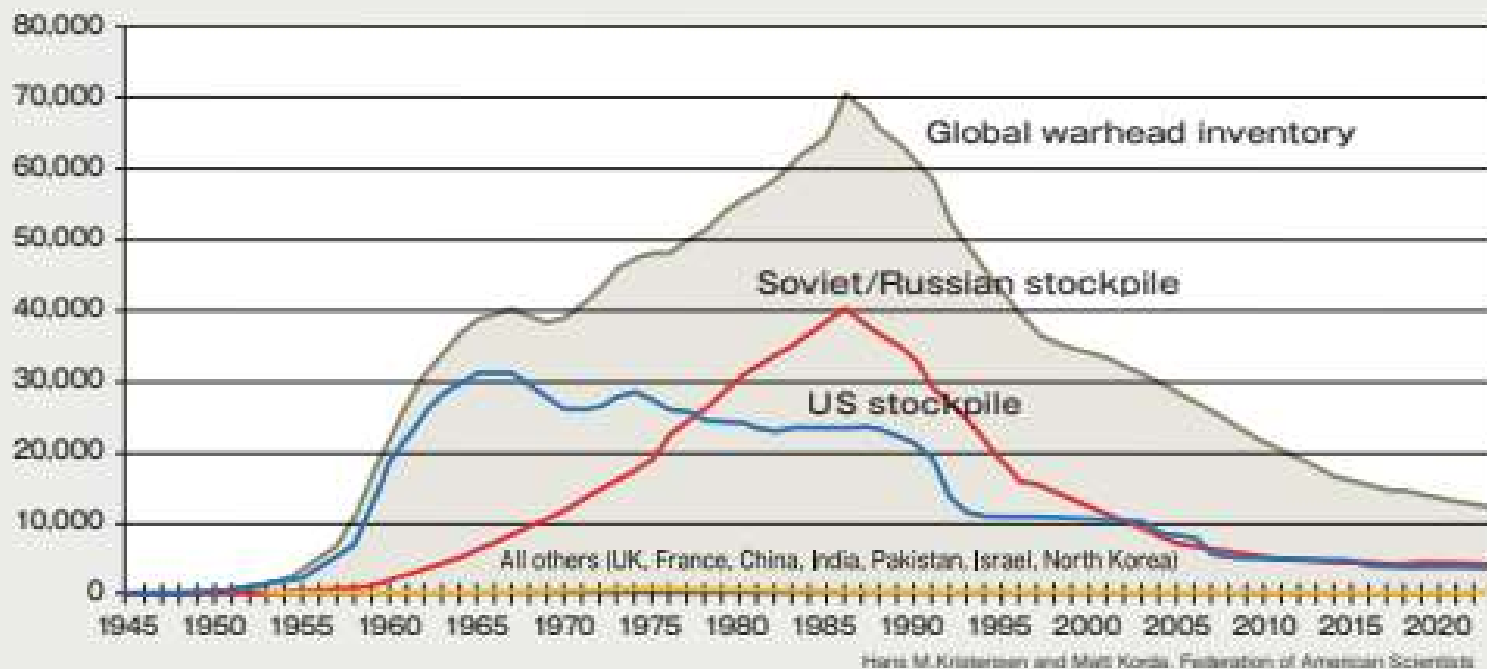
Risk of disruptive technologies, such as cyber,



<https://thebulletin.org/doomsday-clock/current-time/>

Global Nuclear Warheads: declined after the end of Cold War

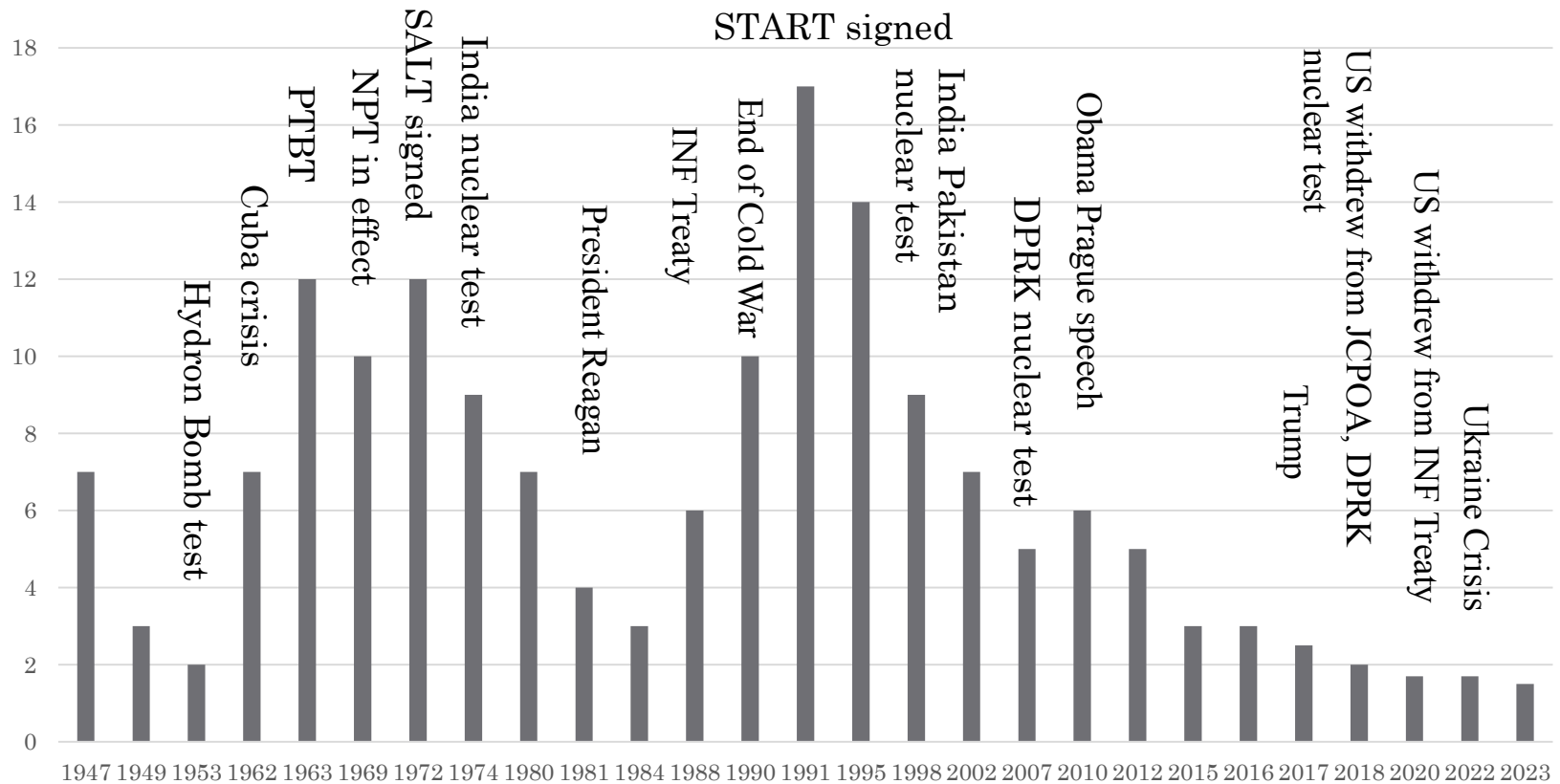
Estimated Global Nuclear Warhead Inventories 1945-2023



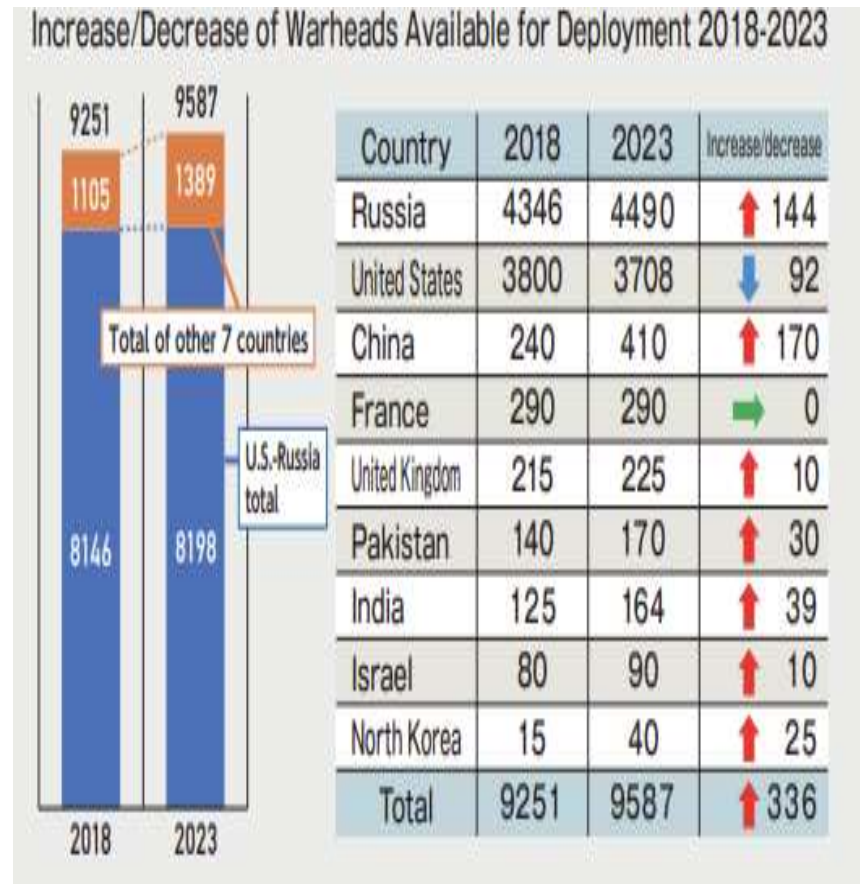
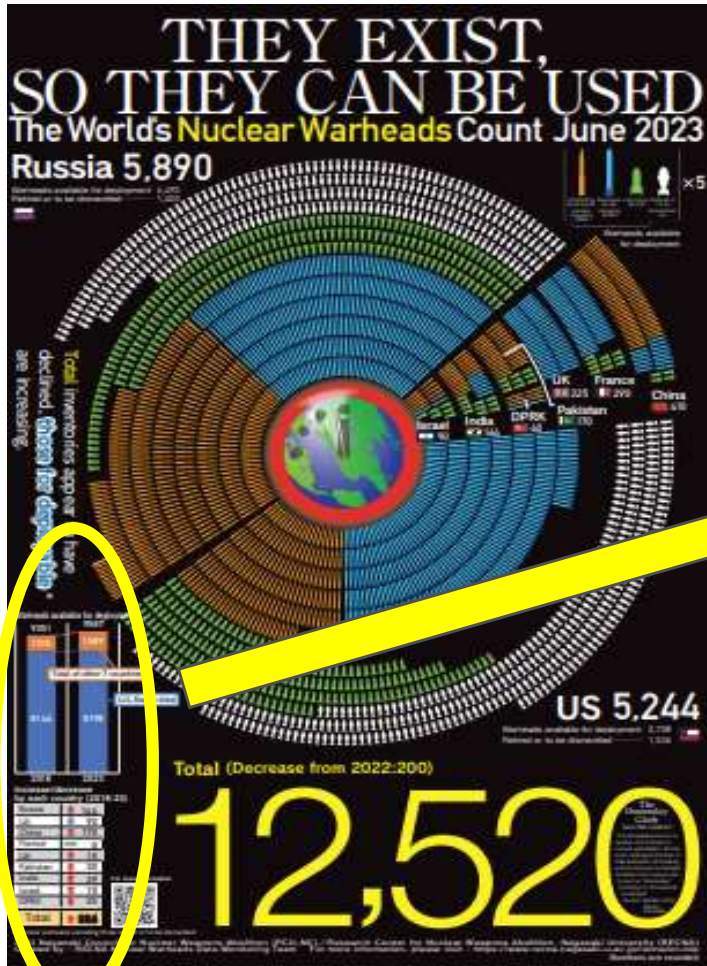
https://www.recna.nagasaki-u.ac.jp/recna/bd/files/NWH_e2023b.pdf

Originally from Hans. M. Kristensen et.al, Federation of American Scientists (FAS)

Nuclear risk is increasing while number of nuclear warheads was decreasing



Global Nuclear Warheads 2023/06



<https://www.recna.nagasaki-u.ac.jp/recna/en-topics/43753>

https://www.recna.nagasaki-u.ac.jp/recna/bd/files/NWH_e2023b.pdf

(2023/5/19)

use, let alone any use of nuclear weapons by Russia, in the context of

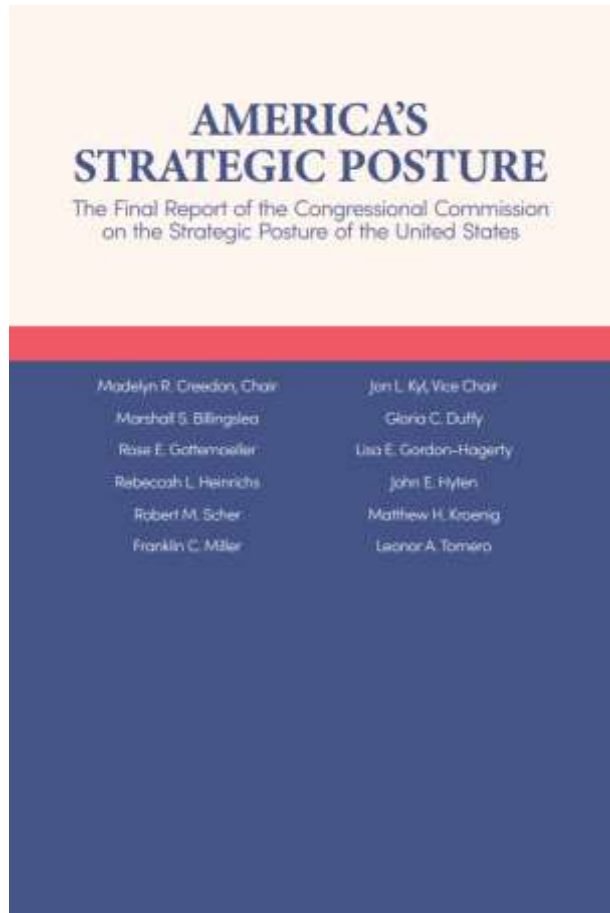
nuclear
weapons, for as long as they exist, should serve defensive purposes,

<https://www.whitehouse.gov/briefing-room/statements-releases/2023/05/19/g7-leaders-hiroshima-vision-on-nuclear-disarmament/>

This is the first time that G7 issued a statement on nuclear disarmament.

But it did not go far enough, as a statement from Hiroshima, as it reconfirms the nuclear deterrence as a base for our security policy

US Strategic Posture: Responding to both Russia and China (2023/11)



strategic posture must change in order to properly defend its vital interests and improve strategic stability with China and Russia.

. If the United States and its Allies and partners do not field sufficient conventional forces to achieve this objective, U.S. strategy would need to be altered to increase reliance on nuclear weapons to deter or counter opportunistic or collaborative aggression in the other theater.

The size and composition of the nuclear force must account for the possibility of combined aggression from Russia and China.

Address the need for U.S. theater nuclear forces deployed or based in the Asia-Pacific theater

Project on

Risk of Nuclear

Nuclear Threats in NE Asia(1)

There are four nuclear armed states (Russia, US, China and DPRK) in the region.

US-Russia nuclear disarmament negotiation is stalled. Russia threatens to use nuclear weapon

China is reportedly increasing its arsenal, including nuclear weapons(expected to increase to ~1500 by 2035), against increasing US military forces in the region (in particular Missile Defense system).

China is the only country officially -first-

DPRK has been developing nuclear weapons as well as sophisticated missile programs. In September, 2022, the new nuclear weapons law specifies the conditions of nuclear weapons use, including first use of nuclear weapons. This was not the case before.



Nuclear Threats in NE Asia(2)

ROK and Japan, depending

US, are now emphasizing military alliance among three nations to strengthen

And we will enhance strategic coordination between the U.S.-Japan and U.S.-ROK alliances and bring our trilateral security cooperation to new heights.

- **The Spirit of Camp David: Joint statement of Japan, the ROK and US, August 18, 2023.**

<https://www.whitehouse.gov/briefing-room/statements-releases/2023/08/18/the-spirit-of-camp-david-joint-statement-of-japan-the-republic-of-korea-and-the-united-states/>



Extended Nuclear Deterrence

respond with all options, including nuclear weapons, under the bi-lateral security agreement if allies are attacked by enemies.

Reducing Risk of Nuclear Weapons Use in Northeast Asia (NU-NEA):

Currently, risk of nuclear weapons use is said to be the highest since the end of WWII. And in particular, we are concerned about worsening security environment which could trigger the use of nuclear weapons.

END.

The objective of this project is : 1) to understand the risk of nuclear weapons as well as conditions leading to the first use of nuclear weapons, 2) to develop policy recommendations to minimize such risks, and 3) to prevent any use of nuclear weapons in the region.

Reducing Risk of Nuclear Weapons Use in Northeast Asia (NU-NEA):

1. **1st year: Develop plausible cases of nuclear weapons use in the region.**

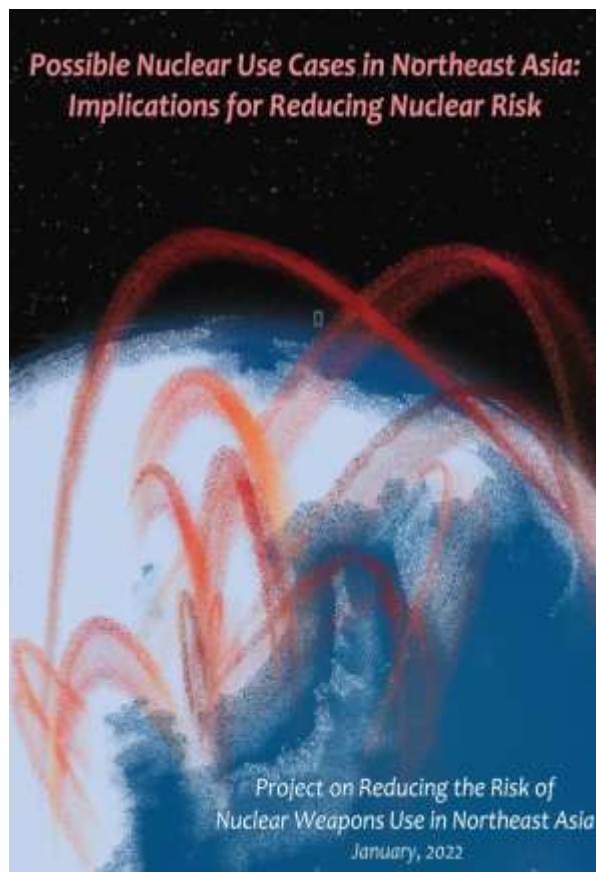
Under what conditions, are nuclear weapons used (regardless of its intentions) ? What are possible processes after the first use of nuclear weapons and how will first nuclear use be developed to larger scale of nuclear exchange?

2. **2nd year: Quantify the consequences of nuclear weapons use in the region.**

What are the possible consequences of nuclear weapons use (casualties, radioactive fall out etc.)?

3. **3rd year: Develop policy recommendations to minimize the risk of nuclear weapons use in the region**

Possible Nuclear Use Cases in Northeast Asia (1st year)



Developed 25 (later 30) cases of Nuclear Weapons Use in NE Asia)

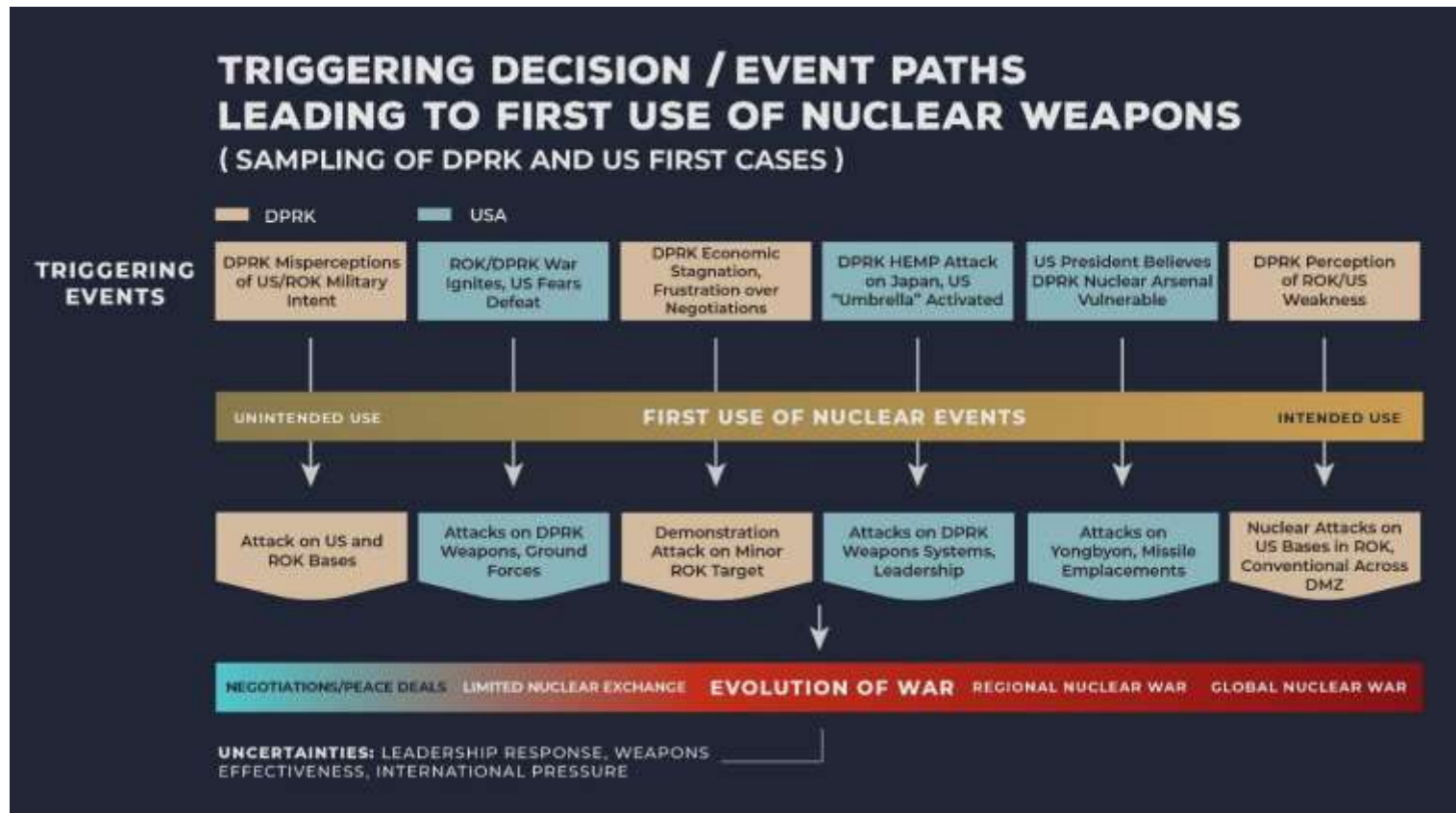
Think Unthinkable: Do not consider

Based on factual evidence Should be

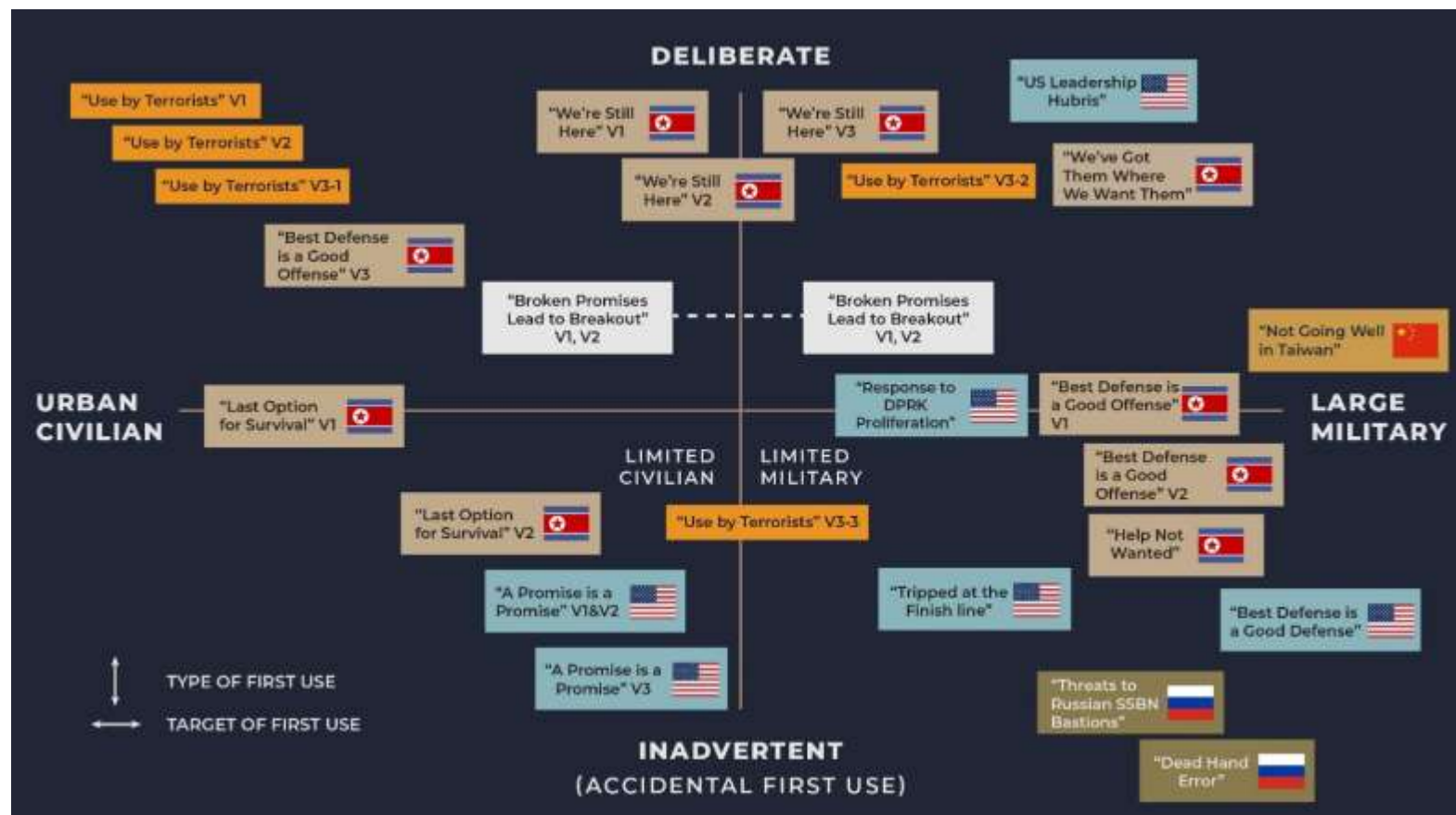
Draw Policy Implications Cases should be useful to draw policy implications

Held a closed on-line workshop (with Chatham House Rule) inviting about 30 experts on nuclear strategy, security policies, political science, regional politics etc., from US, ROK, Japan, Russia, Australia, China, etc. And commissioned 10 research papers.

Triggering Events



25 Cases: Who and Targets



Development after the first use



Summary of Cases (examples)

Use Case Title	<u>Triggering Events and First Use</u>	<u>How the Conflict Evolves</u>	<u>Use Case Consequences</u>	<u>Uncertainties, Ultimate Outcome, Policy Lessons</u>
"We're Still Here" Variant 1	Frustrated by lack of progress in negotiations, DPRK demonstrates a nuclear weapon on a low-value, non-military ROK target	US/UN Command conventional attack on DPRK forces near DMZ, US nuclear attack on nuclear weapons targets in DPRK	High-level US mission reassures China and Russia, engagement keeps exchange limited, leads to diplomacy, DPRK opening	Would US/ROK be able to refrain from attacking DPRK leadership? Close call leads to renewed efforts at arms control Lessons: Need to take stock of DPRK intentions before firing back, be ready to deploy high-level delegations to DPRK and China
"We're Still Here" Variant 2	As above, but DPRK attack not carried out due to malfunction or timely, successful negotiation	US/UN Command develop counterattack plan, but do not implement because of successful diplomacy	China and Russia support DPRK engagement with international community, diplomacy re-starts	
"We're Still Here" Variant 3	As in Variant 1, but DPRK attacks a US naval battle group offshore of the ROK with a nuclear missile fired from DPRK territory	United States uses nuclear and conventional (with ROK) weapons on DPRK military and nuclear targets, in part at insistence of ROK and Japan	Scale of US counterattack leads DPRK to begin conventional war on ROK, nuclear attacks on United States and Japan. United States attacks DPRK troops with low-yield weapons	Would Russia and China be willing to stay out of the war? Would the Europe and others in the international community be able to mediate a crisis of this magnitude?
"The Best Defense is a Good Offense" Variant 1	Changes in United States and ROK behavior leave DPRK leadership convinced that an attack is imminent, and it launches what is effectively a preemptive strike on United States and ROK bases	US responds with conventional attacks on military installations, nuclear weapons on ICBMs and other nuclear sites and on Pyongyang command bunker	Remaining DPRK leadership offers terms for ceasing military conflict with international access to and control over DPRK's nuclear weapons in exchange for "Marshall Plan" for the DPRK	DPRK nuclear mines on DMZ might leave Peninsula divided and badly damaged Defeated DPRK leadership could inflict pain to ROK civilian populations, leaving Korea uninhabitable Lessons: Importance of leadership, US attention, understanding between allies
"The Best Defense is a Good Offense" Variant 2	As above, but with fraying of US/ROK Alliance	As above, with US nuclear attack depending on analysis of DPRK ICBM capability at the time	China and Russia stay out of war, but demand say in governing DPRK, maybe through UNSC	

Key lessons from 25 cases

Possible policy implications

weapons.

- miss communication, lack of mutual understanding, accident, human errors etc.

Once nuclear weapons are used, it is very difficult to foresee what will follow.

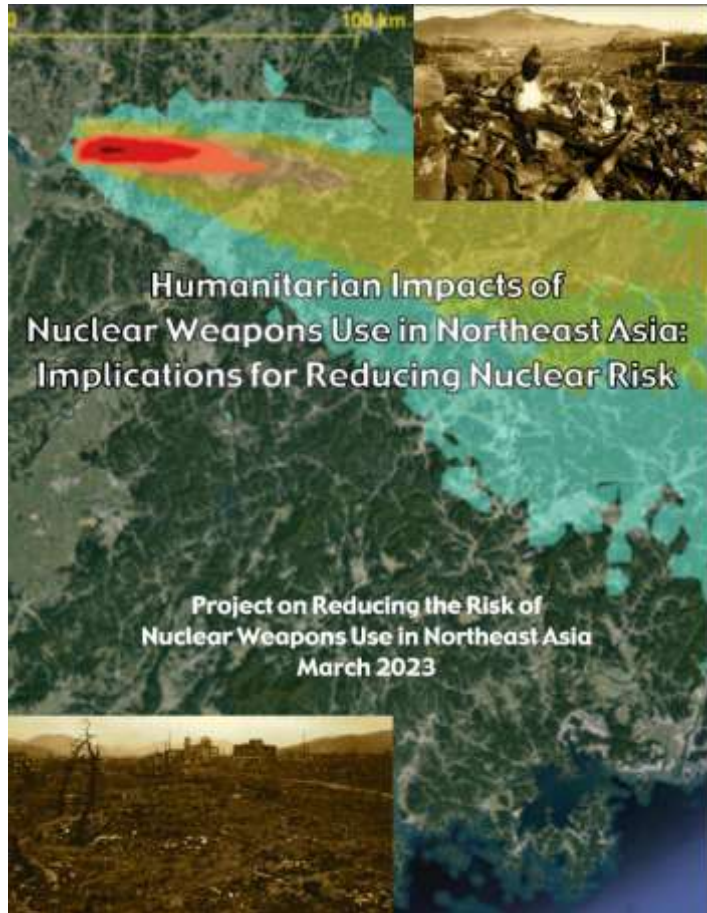
Diplomacy to end the conflict may work, but developments after the first use are unpredictable

Regardless of intentions by policy/military leaders, it is possible that the first use of nuclear weapons could develop into uncontrollable nuclear exchange.

Personalities and behaviors of leader under the pressure (crisis

Diversity of nuclear weapons/nuclear strategies make it more difficult to deal with nuclear weapons under the crisis situation.

Humanitarian Impacts of Nuclear Weapons Use in Northeast Asia (2nd year) (2023/03)

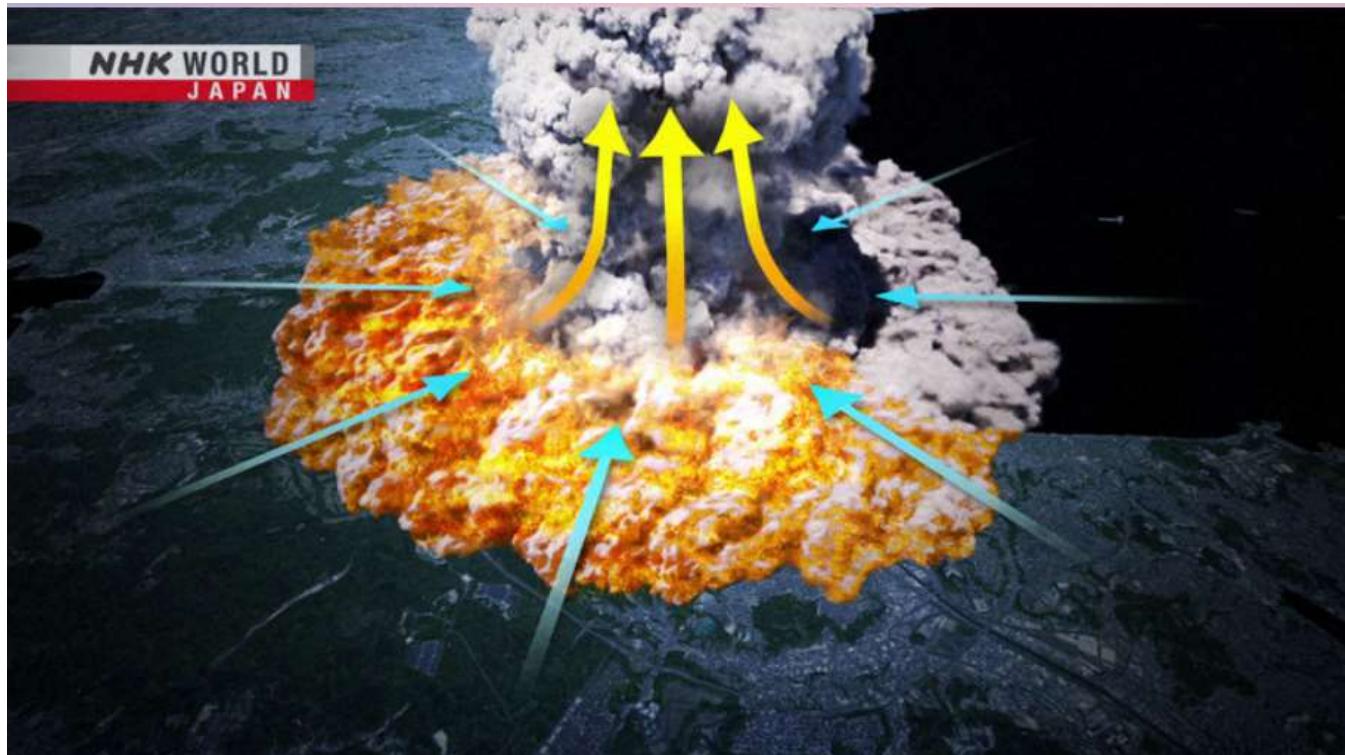


5 cases were chosen out of 30 cases (25 plus 5 new cases after the Ukraine War) for quantification of the impacts.

Quantify only physical impacts (short term and long term deaths, radioactive cloud and possible radiation dose) of nuclear weapons use.

Draw possible lessons from the humanitarian impacts of nuclear weapons use in the region for policy recommendations (to be published in the 3rd year).

Introduced by NHK news program
(2023/09/15)



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Impacts considered

Thermal fluence

Blast overpressure

Fire Storms

Prompt Radiation exposure

**Radiation exposure from fallout
(long-term effects)**

5 Selected Cases

Evaluated Use Case	First User	Responding User(s)	Weapon Sizes	Total Detonations
#1: "We're Still Here" Variant 1	DPRK	United States	10 kT (fission), 8 kT (2-stage H-bombs)	3
#2: "US Leadership Hubris"	United States	DPRK, China	20 and 10 kT (fission), 8, 50, 200, and 300 kT (2-stage H-bombs)	18
#3: "Terrorist" Variant 1	Terrorist	[None]	10 kT (fission)	1
#4: "Conflict from Ukraine Spreads East"	Russia	United States	2-stage H-bombs, 150, 200 kT, and 8 kT	8
#5: "Not Going Well in Taiwan"	China	United States, China	8, 50, 250, and 300 kT (2-stage H-bombs)	24

Case 1 :DPRK as a first user

Triggering Event Unhappy about lack of progress in nuclear weapons

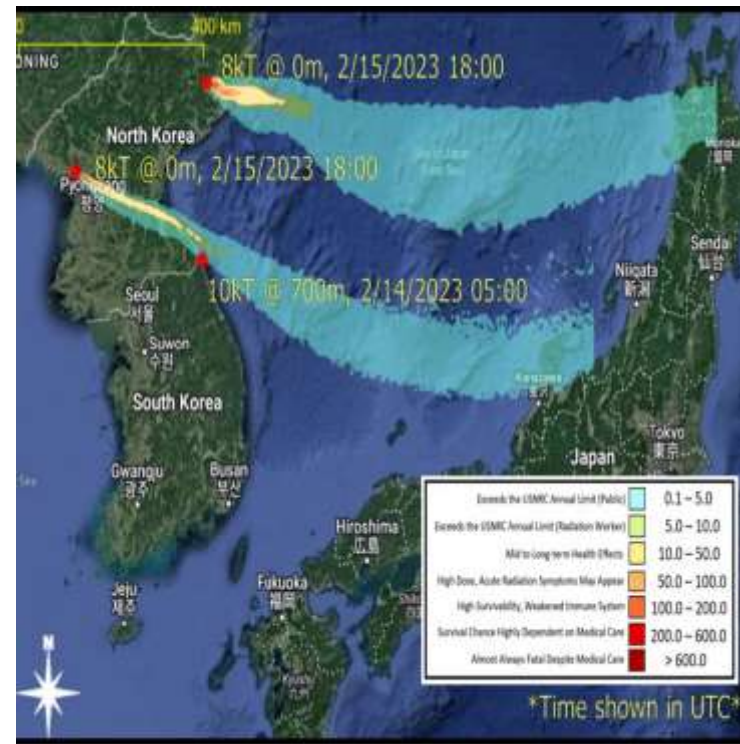
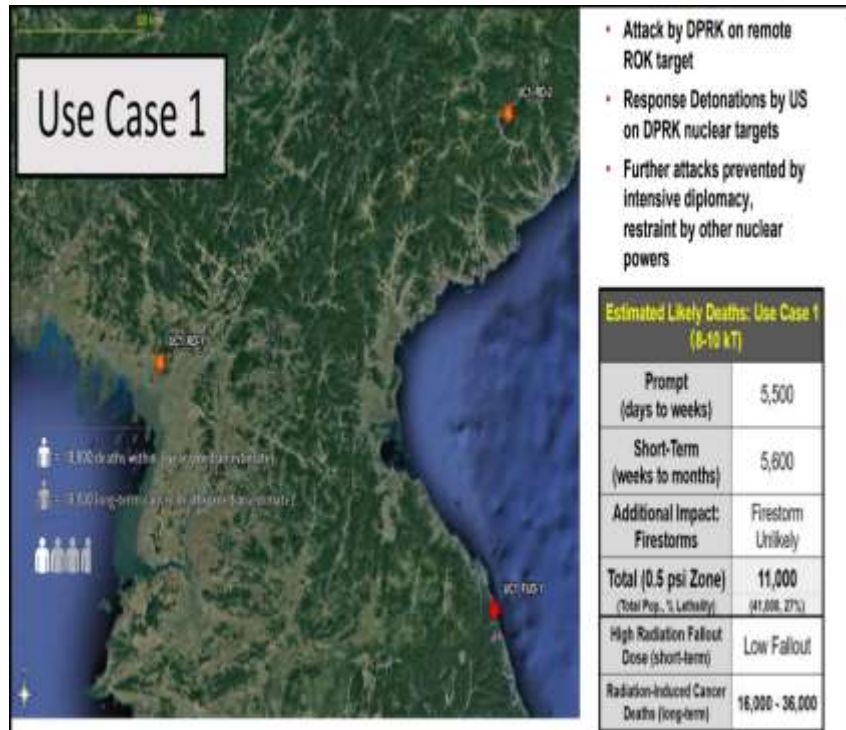
Target Military base in ROK (far from populated area)

Developments after the first use Responding to the request from ROK, US will attack DPRK with conventional force first. Then US used nuclear weapons (small yield) to attack underground military facilities.

Consequences Total of three nuclear weapons were used and conflicts ended.

Uncertain factors Can US/ROK deter first use of nuclear weapons by DPRK? Will Russia and China never participate?

Consequences of Case 1



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Case 2 US as a first user

Triggering Event Overconfident US President initiated first strike of nuclear weapons against DPRK, in order to eliminate nuclear weapons systems in DPRK.

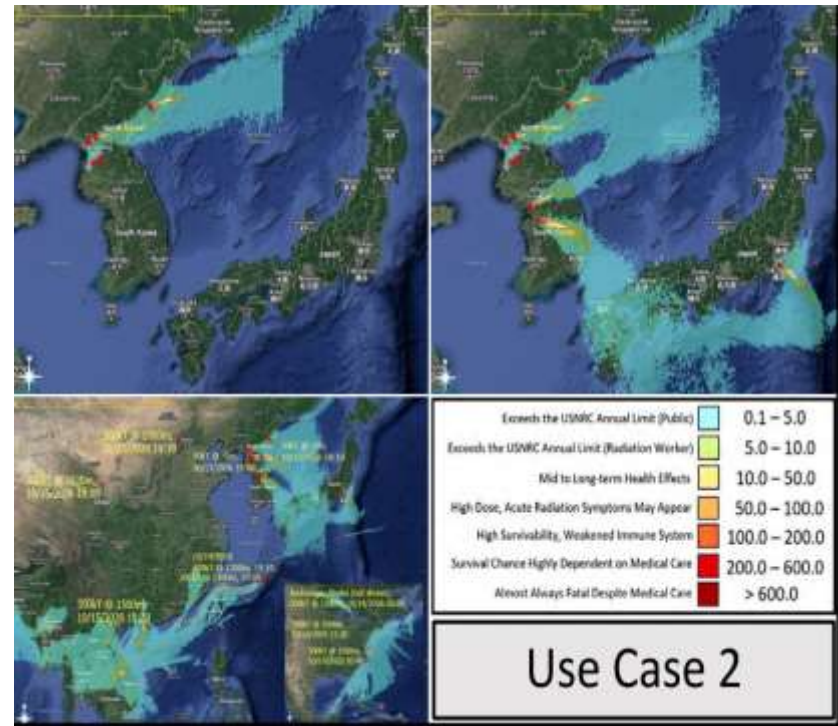
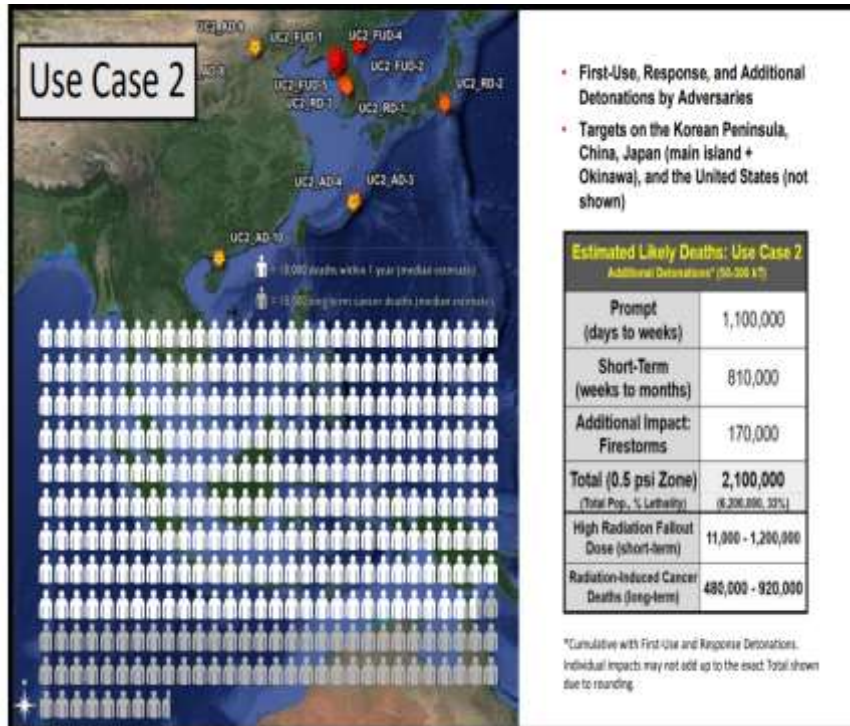
Targets Military facilities, especially related nuclear weapons.

Developments after the first use DPRK responded with surviving nuclear weapons and attack US bases in ROK and Japan and some cities nearby. US again responded with nuclear weapons to attack DPRK.

Consequences In order to prevent US/ROK forces coming to DPRK territory, China responds with conventional forces. But further military conflicts lead to Chinese nuclear attack against US bases and total of 18 nuclear weapons are used

Uncertain factors Accuracy of advanced nuclear weapon systems. Personal characteristics of US president.

Consequences of Case 2



Case 3: Terrorist attack with nuclear explosive

Triggering event To attract global attention, a Japanese terrorist group exploded a nuclear bomb in the center of a large city

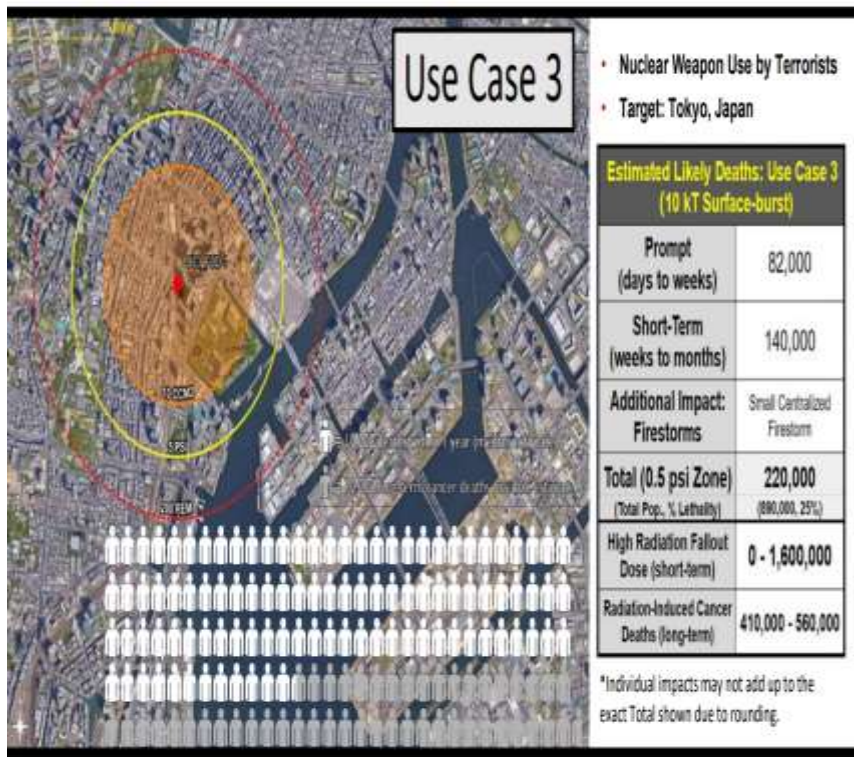
Target Middle of a large city

Developments after the first use Nuclear forensic analysis proved that the material used in the bomb came from DPRK. But the evidence was not sufficient to prove the case and denied by DPRK.

Consequence In order to prove that DPRK was not involved, DPRK offered assistance to Japan. The US decided not to attack DPRK, by analyzing their response to the incident. Total of one bomb was used.

Uncertain factors Origin of nuclear material used for the terrorist attack

Consequences of case 3



Case 4 Russia as a first user

Triggering Event In the midst of increasing tensions of Ukraine military conflicts, responding to requests from Japan and ROK, US sent nuclear submarines, bombers with nuclear warheads in to the Northeast Asia region. Responding to US moves, Russia ordered nuclear forces in Far East to raise the preparedness for nuclear war. Russia, misunderstanding of US intentions, being afraid of initial attack by the US, initiated first nuclear strike against US bases and military ships in the region.

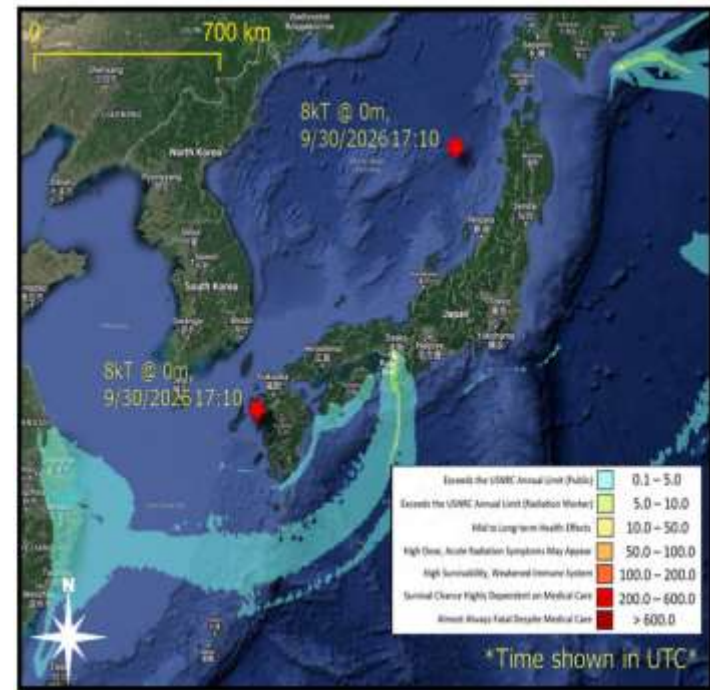
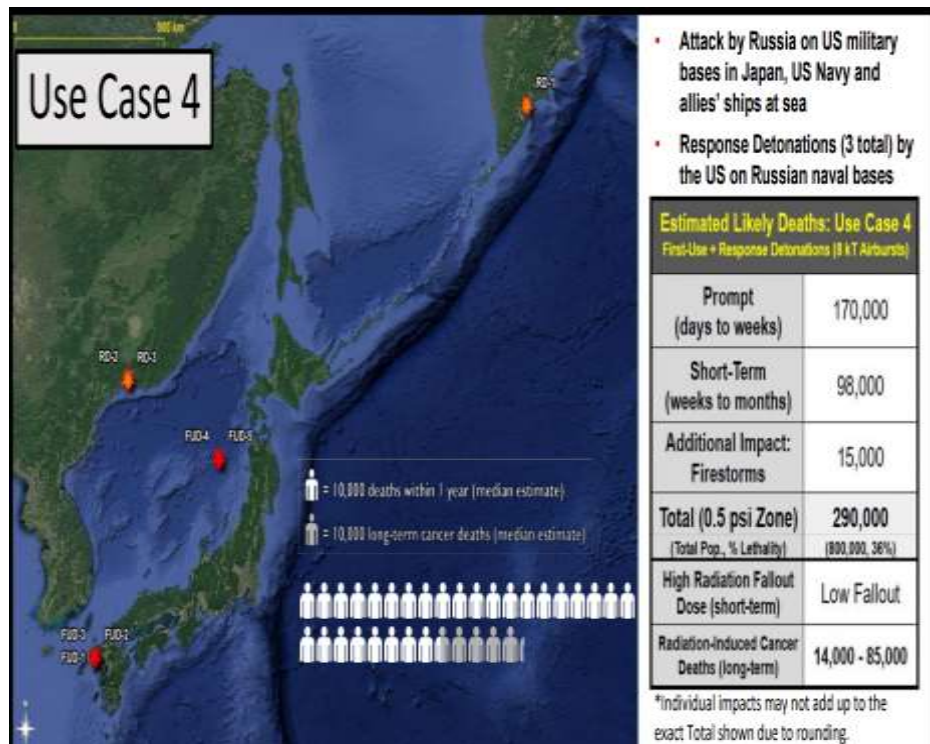
Targets Military bases in Japan/ROK, Military ships deployed in the region.

Developments after the first use US responded by attacking Russian military bases in Far East with nuclear weapon.

Consequences Diplomacy worked to end the war. Total of 8 nuclear weapons were used.

Uncertain factor Will US/Russia diplomacy ever work?

Consequences of Case 4



Case 5 China as a first user

Triggering event In Taiwan, new government which is in favor of political problems, China decided to attack Taiwan. US military intervened the conflict. Concerned about losing the war, China threatened to use nuclear weapons. Without much success, China decided to initiate nuclear strike.

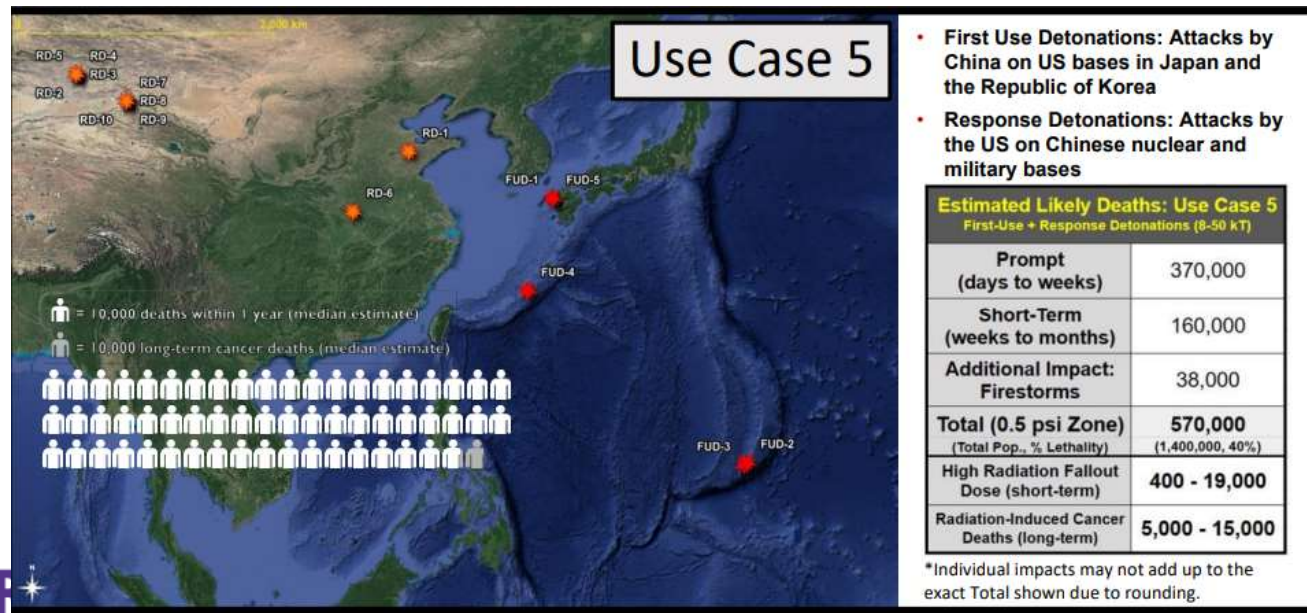
Targets US bases in the region, US military ships

Developments Responding to Chinese attack, US attacked Chinese military bases (especially bases for ICBM). China responded with nuclear weapons attacking US bases in US mainland. Nuclear exchange continued between China and the US.

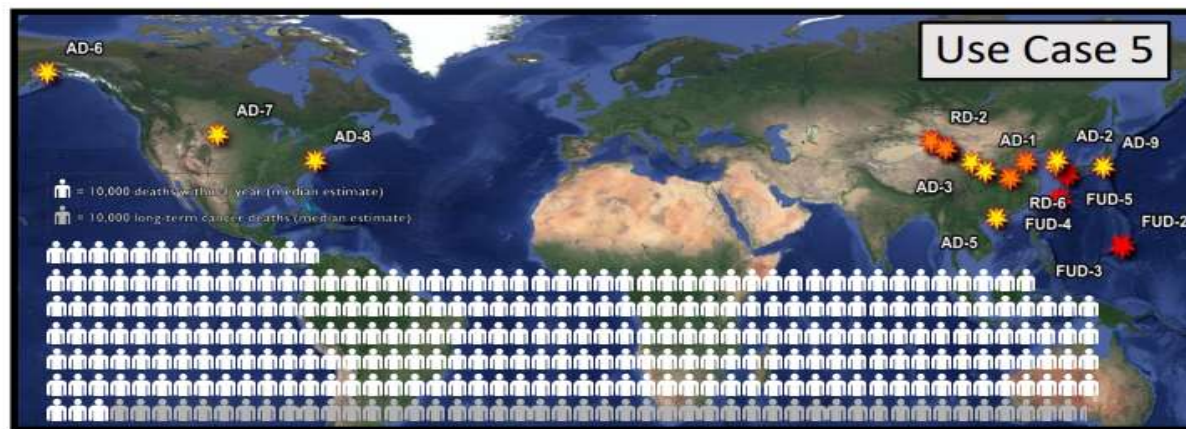
Consequence It is possible to escalate nuclear war, but here we assumed total of 24 nuclear weapons.

Uncertain factors

Consequences of Case 5 (1)



Consequences of Case 5 (2)



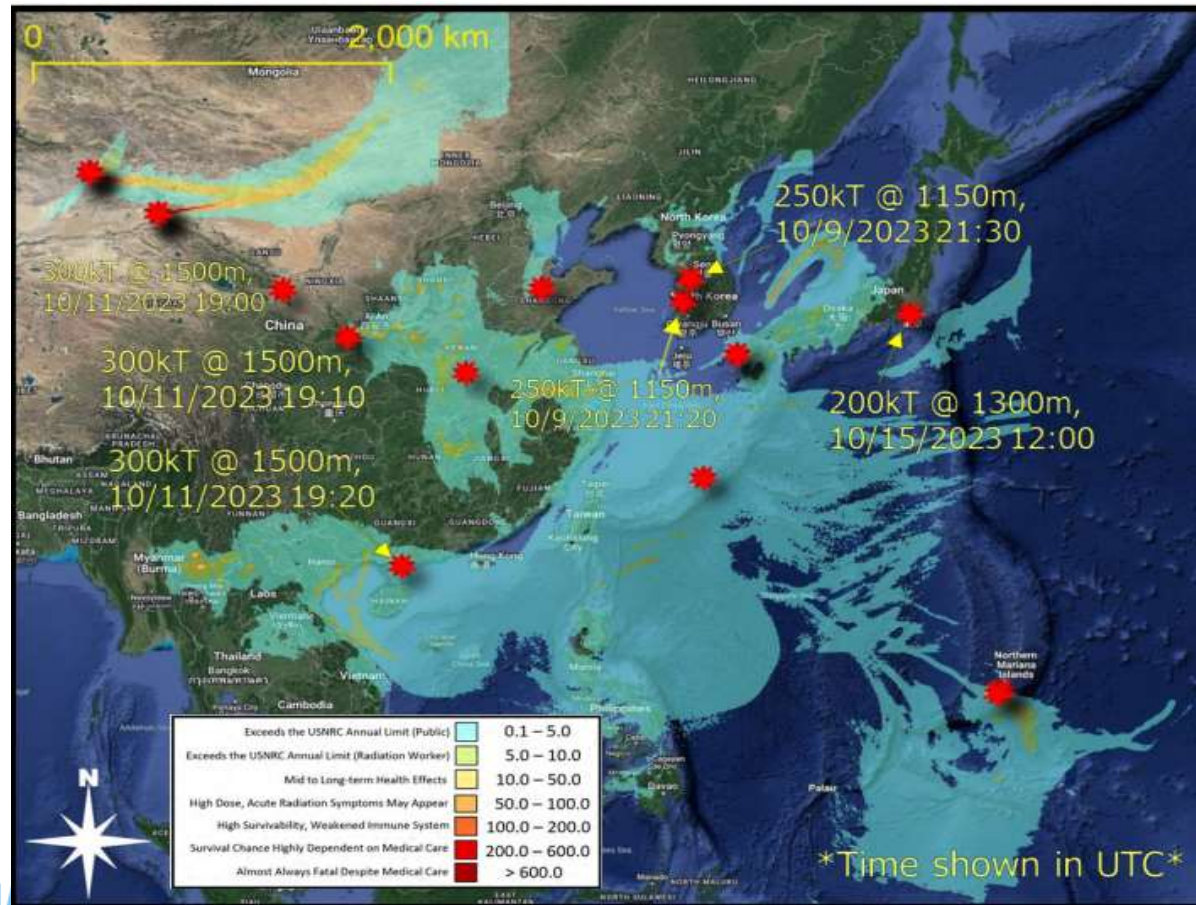
- **First Use Detonations:** Attacks by China on US bases in Japan and the Republic of Korea
- **Response Detonations:** Attacks by the US on Chinese nuclear and military bases
- **Additional Detonations:** Attacks by China and the US on their adversary's nuclear and military bases

Estimated Likely Deaths: Use Case 5 Additional Detonations*

Prompt (days to weeks)	1,500,000
Short-Term (weeks to months)	930,000
Additional Impact: Firestorms	190,000
Total (0.5 psi Zone) (Total Pop., % Lethality)	2,600,000 (7,600,000, 35%)
High Radiation Fallout Dose (short-term)	400 - 19,000
Radiation-Induced Cancer Deaths (long-term)	96,000 - 830,000

*Cumulative with First-Use and Response Detonations.
Individual impacts may not add up to the exact Total shown due to rounding.

Consequences of Case 5 (3)



Summary of estimated casualties of all cases

Estimated Likely Deaths	Prompt (days to weeks)	Short-Term (weeks to months)	Additional Impact: Firestorms	Total Fatalities within 0.5 psi Zone (Total Population, % Lethality)	High Radiation Dose (Fallout) (short-term deaths)	Radiation-Induced Cancer (long-term deaths)
Use Case 1 Airburst: 1, Surface-burst: 2	5,500	5,600	Firestorm Unlikely	11,000 (41,000, 27%)	Low Fallout	16,000 - 36,000
Use Case 2 Airburst: 11, Surface-burst: 7	1,100,000	810,000	170,000	2,100,000 (6,200,000, 33%)	11,000 - 1,200,000	480,000 - 920,000
Use Case 3 Surface-burst: 1	82,000	140,000	Small Centralized Firestorm	220,000 (890,000, 25%)	0 - 1,600,000	410,000 - 560,000
Use Case 4 Airburst: 8	170,000	100,000	15,000	290,000 (800,000, 36%)	Low Fallout	14,000 - 85,000
Use Case 5 Airburst: 16, Surface-burst: 8	1,500,000	930,000	190,000	2,600,000 (7,600,000, 35%)	400 - 19,000	96,000 - 830,000

1. About 25% of population will be a victim of smaller yield of nuclear weapons and surface-burst. But, it will increase to 35% for larger yield and air-burst bomb
2. Consequences could be much more severe when/where fire storms happen.
3. Even with smaller yield nuclear weapons, casualties increase dramatically when consider long-term radiation effects.
4. It is impossible to forecast how many bombs will be actually used. These are just references for future discussion.

Preliminary Conclusions

There are many pathways to leading to first use of nuclear weapons (with or without intentions). Once the nuclear weapons are used, it is hard to predict the development even for decision makers/military planners.

It is possible that regional conflict involving nuclear weapons could develop to larger scale of nuclear exchange within hours or days.

Even an attack against remote military facilities, it could result in thousands of casualties.

Impact of fire-storms could be much more significant than previously considered. The death rate is likely to be much higher. Previous nuclear plans have not considered the impact of fire storms and thus considering fire storm impact could influence future nuclear planning.

It is now clear that radioactive fallout could diffuse widely, affecting the regions outside the conflict area. Those areas might include nuclear weapon-free zones or countries who are no longer dependent on nuclear weapons.

the states. and

Possible implications for Reducing Risk of Nuclear Weapons Use

Communications among nuclear weapon (armed) states are critically important.

Information sharing of nuclear strategy (doctrine), transparency of nuclear forces.

-nuclear
weapon states with nuclear weapon (armed) states.

Reduce the role of nuclear weapons, or dependence on nuclear deterrence, in security policies

No first use, No threat of use policy

Regional confidence building measures

Set up a forum for security dialogue in Northeast Asia

Denuclearization of Korean Peninsula and establishment of Nuclear Weapon Free Zone(NWFZ) in the region.

Now it is time for nuclear disarmament, cannot wait for improving security environment

First, **norm of non-use of nuclear weapons** must be maintained.

Second, **specific measures to reduce risk of nuclear weapons use need to be discussed** among interested parties.

Third, **international laws and treaties to prevent nuclear proliferation must be maintained and honored** strictly.

- Izumi Nakamitsu

Sekai (World), June 2022, pp.105-112