



International Physicians
for the Prevention of Nuclear War



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War in Ukraine: On the Brink of a Nuclear Catastrophe Briefing Paper

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As the deadly war in Ukraine approaches the one-year mark, an [international expert panel](#) gathered on 18 February to explore the current and potential public health and environmental consequences of the ongoing crisis in Ukraine, along with the solutions to pull us back from the brink of a nuclear catastrophe. The experts' remarks are outlined below, topics include:

- Impacts on health, human rights, and the environment – An assessment of how the war has adversely affected civilians. *Presented by Barry Levy, M.D., M.P.H.* pg 2-4.
- Risk to nuclear reactors — The factors that could lead to a catastrophe at any of Ukraine's nuclear power plants — loss of power, stress-induced worker error or an accidental or deliberate attack — continue to worsen, making such an outcome more likely. *Presented by Linda Pentz Gunter.* pg 4-6.
- Escalation to nuclear weapons – The catastrophic regional and global consequences if nuclear weapons are launched intentionally or by accident or miscalculation. *Presented by Ira Helfand, M.D.* pg 6-8.

Days following our 18 February briefing, Russian President Vladimir Putin announced his decision to suspend Russia's implementation of New START, the last remaining arms control treaty between the United States and Russia. This is the latest in a series of provocations, including both overt and veiled threats to use nuclear weapons in the Ukraine conflict, that have elevated nuclear risks to the highest they have been since the Cuban Missile Crisis just over sixty years ago.

In a [recent statement](#), IPPNW calls on "all nuclear-weapon states to declare that they will not use nuclear weapons. It is of the utmost importance that we step back from the brink of nuclear war, where even an accident or the use of tactical nuclear weapons would be a catastrophe of enormous proportions and could trigger an even larger nuclear conflagration. **The only cure is prevention.**"

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Learn more about IPPNW's response to the ongoing crisis in Ukraine at www.ippnw.org/crisis-in-ukraine.

**Impact of the War on Health,
Human Rights, and the Environment**
Barry Levy, M.D., M.P.H.

The numbers of civilian deaths and injuries in the war are likely very large. However, the United Nations reported less than two weeks ago that, since February 2022, there had been about 7,000 deaths and 11,000 injuries among Ukrainian civilians. These numbers are gross underestimates of the actual numbers. For example, last May, municipal officials in Mariupol estimated that there had been more than 22,000 deaths of civilians in Mariupol alone. And data on fatal and nonfatal *injuries* do not include fatal and nonfatal *illnesses* that have occurred as a result of the war.

What does get reported are mainly deaths and injuries due directly to bombings, shellings, and missile and drone attacks – both indiscriminate attacks and attacks targeted at civilian neighborhoods and civilian infrastructure. Less frequently, the news media report *indirect* illnesses and deaths among civilians -- although the occurrence of these indirect impacts is likely far greater than the occurrence of injuries and deaths due directly to explosive weapons. These indirect health impacts include malnutrition, acute communicable diseases, chronic noncommunicable diseases, adverse effects on reproductive health, and, perhaps most importantly, mental and behavioral disorders, such as posttraumatic stress disorder, anxiety and depression, alcoholism and drug abuse, and suicide.

Waterborne gastrointestinal disease has likely increased because damage to water treatment and supply has contaminated drinking water. Foodborne disease has likely increased because of inadequate refrigeration. Respiratory diseases, such as COVID-19, measles, and tuberculosis, have likely increased because of airborne transmission in crowded areas, such as

subway stations where people have sheltered.

Suffering from noncommunicable diseases has also likely increased, with both increased incidence of heart attacks, strokes, and other illnesses, and increased exacerbations of pre-existing diseases, such as hypertension, coronary artery disease, diabetes, and asthma and other chronic lung disease, because people have been unable to see their doctors or get their medications.

The health of civilians has been worsened by attacks on infrastructure. Almost 500 health facilities have been damaged since the start of violence in late 2015, with about 60 health workers killed and 60 kidnapped. Numerous targeted attacks on the energy infrastructure have resulted in loss of electricity and heat for millions of Ukrainians, and resultant adverse effects on health and availability of health care. Targeted destruction of farms and the food supply system as well as damage to roads and railroads have also adversely affected health.

There have also been many deaths and injuries among Ukrainian and Russian military personnel, which are estimated to be at least 100,000 on each side. Before the war, the vast majority of both Ukrainian and Russian soldiers were civilians. Once the war began, most had little choice but to take up arms -- including thousands of Russian prisoners who were freed on the condition that they be sent to the front lines, generally with little training.

Country	Number
Poland	1,560,000
Czech Republic	490,000
Bulgaria	150,000
Romania	110,000
Slovakia	110,000
Hungary	35,000
Other	2,380,000

*Approx. Number of Registered Refugees
UNHCR, 2/7/23*

The health and safety of civilians has also been worsened by forced displacement. Almost five million Ukrainian refugees have been registered for national protection – about half in neighboring countries and another half elsewhere in Western Europe. Up to eight million Ukrainian civilians have been internally displaced, some of them multiple times. Their plight has often been far worse than those who have crossed international borders. Both refugees and internally displaced persons have faced risks to their physical and mental health and threats to their safety and security -- especially women and adolescent girls.

The health of civilians has also been placed at increased risk because of impacts of the war on the environment. Explosions and fires have polluted air, water, and soil with toxic chemicals and other hazardous substances. Widespread deployment of antipersonnel landmines and the presence of unexploded ordnance pose safety risks and prohibit residential and agricultural use of much land. Extensive military use of fossil fuels has generated greenhouse gases, which cause climate change. The war has destroyed the built environment – homes, offices, factories, schools. And it has caused damage to ecosystems and animal habitats.



School destroyed by Russian bomb, Zhytomyr, March 4, 2022

During the course of the war, there have been tens of thousands of reports of presumptive war crimes. Attacks on

hospitals and schools. Russian deployment of cluster munitions and landmines, including the POM-2 landmine, which explodes when it senses nearby footsteps. Other presumptive war crimes have included targeted assassination; rape and other forms of sexual violence; deprivation of food, water, and shelter; and forced deportation.

Forced deportation is prohibited under international humanitarian law and can be prosecuted as a war crime and a crime against humanity. In the first five months of the war, an estimated 900,000 to 1.6 million Ukrainians, including 260,000 children, were forcibly transferred to Russia. Recently, there have been credible reports of 43 camps in Russia where forcibly transferred children are being held.

The adverse impacts of the war go far beyond Ukraine. Before the war, Ukraine supplied food for about 400 million people globally, and it accounted for a substantial share of the global production of wheat, barley, maize, and other grains. Of great concern has been the reduction in Ukrainian agricultural production and food export due to decreases in farm yields, interruptions in food transport, and intermittent blockage of grain export by Russian ships. Despite the Russia-Ukraine grain agreement, these decreases have contributed to food shortages in other countries and to higher food prices globally.

Before the war began, many people doubted that Russia would actually invade Ukraine. And few people predicted that, if war did occur, it would last more than a few months. But here we are, almost a year later, with the war intensifying and no end in sight.

From a public health perspective, current challenges include:

- Protecting civilians and civilian infrastructure

- Providing medical care, public health services, and humanitarian assistance
- Providing safe corridors for those who want to leave
- And the threatened use of nuclear weapons.

There will be additional challenges after the war ends, including:

- Reintegrating displaced people
- Creating a framework for reparations
- Repairing and rebuilding infrastructure
- Providing care for the many people affected by mental and physical disorders
- Holding the aggressors accountable
- And building a sustainable peace.

As I contemplate the catastrophic impacts of this war, I am reminded of Bertrand Russell, the late British philosopher and mathematician, who once said: “War does not determine who is right -- only who is left.”

Background Reading

Levy BS. From Horror to Hope: Recognizing and Preventing the Health Impacts of War. New York: Oxford University Press, 2022.

Levy BS, Leaning J. Russia’s war in Ukraine -- The devastation of health and human rights. *New England Journal of Medicine* 2022; 387: 102-105.

Ukraine’s Nuclear Power Plants in a War Zone

Linda Pentz Gunter

A year ago, we warned of the significant and unacceptable risks to Ukraine’s 15 nuclear reactors, should they become caught up in a war zone as a consequence of an invasion by Russia.

[A year later](#), those risks have become a reality.

The scenarios that could lead to a nuclear power plant disaster in Ukraine are, in many ways, the same ones that could cause a nuclear power accident on any given day, even under routine operation. These include loss of power, human error or sabotage. The conditions of war just make such an outcome more likely.

Nuclear power plants are dependent on a constant supply of electricity, as well as a water source, for cooling. If offsite power is lost, operators must turn to onsite power in the form of backup diesel generators. If these fail, the outcome could be explosions, fires and meltdowns.

In Ukraine, we have seen Russia routinely attack the electric grid, leading to periodic loss of offsite power at all four of Ukraine’s nuclear power plant sites. The most in jeopardy is the six-reactor Zaporizhzhia nuclear power plant, the largest in Ukraine and indeed all of Europe. Zaporizhzhia, in the contested southeastern part of the country, has experienced multiple disconnections from the grid. So far, the diesel generators have functioned until offsite power was restored. But they are reliant on a steady replenishment of fuel, which could be impeded were the plant to come under siege.

A ready supply of cooling water is also essential. However, observers recently noted an alarming drop in the water level of the [Kakhovka Reservoir](#), on which the Zaporizhzhia nuclear power plant relies for its cooling water. Why the reservoir is being drained is unclear, but it is thought to be a possible Russian military tactic to flood strategic areas, making them impassable to advancing Ukrainian troops.

A second disaster scenario is one caused by human error. This was at the root of both the 1979 Three Mile Island nuclear power plant accident in the United States and the 1986 Chernobyl Unit 4 explosion in Ukraine. At Zaporizhzhia, the workforce has been under foreign occupation since March 4, possibly working at gunpoint and subject to acts of violence. Some workers have either been forcibly removed or have fled with their families. A diminished workforce pulling long shifts under duress makes a potentially lethal mistake more likely.

Finally, there is the possibility that one or more of Ukraine's reactors could suffer a major bombardment. It is hard to see what advantage there could be to the perpetrator of a deliberate attack, although each side has accused the other of attempting precisely that. Shelling has landed dangerously close to Ukraine's nuclear sites, and cruise missiles have recklessly flown overhead, on their way to other targets. But whether deliberate or accidental, a serious assault would release potentially enormous amounts of dangerous radioactive isotopes into the environment.



Ukraine's 15 operating nuclear reactors

The 1986 Chernobyl fallout map provides a rough guide as to the extent of the radioactive contamination that would be spread by such an event. The Chernobyl disaster contaminated 40% of the European landmass beyond the most severely affected countries within

the former Soviet Union. The often far away hotspots are a factor of wind speed, wind direction and precipitation in the aftermath of the accident.

Chernobyl Unit 4 had been operating for only two years, yet it released 200 times more radiation than the Hiroshima and Nagasaki bombs combined. The Chernobyl Exclusion Zone extends to 1,000 square miles. With [2,000 tonnes](#) of radioactive waste on site, the intensity and extent of the radioactive plume and eventual fallout released from a major hit at Zaporizhzhia could be far worse.

The reason damage from a nuclear power plant disaster is so serious is in part due to the longevity of the radioactive isotopes released and also because the fallout deposits these into the food chain by contaminating water, soil, crops and livestock. Even today, wild boar and mushrooms in parts of Germany are too radioactive to eat. Sheep in parts of the UK only came back to market in 2012.

Some of the enduring health outcomes include thyroid cancer, birth defects, stillbirths, neonatal deaths, leukemias — especially among children — cancers and cardiovascular disorders. However, it should be noted that studies have also found elevated rates of leukemia in children living close to routinely operating nuclear power plants.

It's also worth remembering that people live in Hiroshima today while nobody should live in the Chernobyl Zone today or for the foreseeable future. This is not to diminish the horrors of Hiroshima but to point out that the long-term medical effects of a major nuclear power plant disaster persist down generations and across vast areas.

The international response so far has

come mainly from the International Atomic Energy Agency (IAEA), which has called for [safe zones](#) around Ukraine's nuclear power plants but so far has been [unsuccessful](#) in instituting these. And safe zones, while an essential first step, only prevent disaster resulting from a direct hit but are ineffective against loss of grid access or human error.

Meanwhile, even in the midst of this devastating war, Ukraine has chosen to make a deal with the American company, Westinghouse, to purchase [two new AP1000 reactors](#). It is of course unrealistic to envisage these actually being built during a war and, if ever operational, they would simply become additional lethal targets.

Apart from being pre-deployed radiological weapons, nuclear power plants must, for safety reasons, be shut down when embroiled in a war. In Ukraine, where 50% of the country's electricity is supplied by nuclear power, this means plunging an already terrified population into greater misery in the midst of winter. The lesson learned is that nuclear power, due to its inherent dangers, cannot serve as a reliable energy source. We must reject it as we do nuclear weapons and turn to other, more benign and renewable ways of supplying electricity.

Escalation to Nuclear Weapons **Ira Helfand, M.D.**

In the weeks before Russia's invasion of Ukraine last February, there was concern that any conventional conflict in Ukraine could escalate to a nuclear war between Russia and NATO. In the year since, those fears have grown

dramatically as Russia has issued a series of increasingly belligerent threats to use nuclear weapons, culminating in Putin's decision to withdraw from the New START Treaty. But that dramatic announcement was only the latest in a long series of nuclear threats.

On February 28, 2022, just four days after the start of the invasion he put Russia's nuclear forces on a "special mode of combat duty", and a few days later he warned that if nations came to Ukraine's aid, "Russia will respond immediately, and the consequences will be such as you have never seen in your entire history."

On April 24, Foreign Secretary Lavrov threatened that support for Ukraine would lead to World War III.

On September 21, after Russia's illegal annexation of four Ukrainian provinces, Lavrov warned that Russia might use nuclear weapons to defend those provinces, much of whose territory was, and is, still controlled by Ukraine.

Five days later, on September 26, former Russian President Medvedev said that NATO support for Ukraine would lead to a nuclear apocalypse.

On January 22, Medvedev warned that a Russian defeat might lead to nuclear war. And on the same day Patriarch Kiril, head of the Russian Orthodox Church and a close ally of President Putin, threatened that "the destruction of Russia will mean the end of the world."

Commentators on official Russian media have been even more apocalyptic in their threats. The chief of the television network RT called for a nuclear confrontation with NATO, saying "no one will win in a nuclear war, but who needs the world if Russia isn't in it?"

These threats are particularly worrisome in view of the new study published in [Nature](#) last August by Lili Xia and her colleagues on the extent of global hunger that would follow a nuclear war. The study showed that as few as 100 Hiroshima sized bombs would cause enough climate disruption to trigger a global famine that would kill 260 million people. A war involving 250 warheads, each with the destructive power of 100 kilotons, would kill 2.1 billion people worldwide, most in the industrial countries of the global north. Such a conflict would end modern civilization. An all-out war between Russia and the United States would create a full nuclear winter and kill three quarters of the human race, more than 6 billion people using current population figures.

Table 1: adapted from Xia et al, Nature Food, August 2022



Nuclear war scenario	Millions of metric tons (Teragrams) of soot generated	Direct fatalities	Deaths due to famine by the end of Year 2
100 weapons detonated 15 kilotons each	5 Tg	27 million	260 million
250 weapons detonated 15 kt each	16 Tg	52 million	930 million
250 weapons detonated 50 kt each	27 Tg	97 million	1.4 billion
250 weapons detonated 100 kt each	37 Tg	127 million	2.1 billion
500 weapons detonated 100 kt each	47 Tg	164 million	2.5 billion

[Nuclear Famine \(2022\), IPPNW](#)

Many concerned citizens feel powerless to stop the slide to a broader war. And, if we are to be honest with ourselves, there is little that we can do to affect the immediate situation. Whether the war in Ukraine escalates to nuclear war is largely in the hands of one individual who has shown singularly poor judgment over the last 12 months. But, if we are lucky enough to survive the current conflict—and our survival will be primarily a function of luck—we must work to make sure that we are never in this kind of danger again. We must eliminate nuclear weapons before

there is any question of their being used in a future crisis.

Fortunately, the International Campaign to Abolish Nuclear Weapons (ICAN), the global civil society movement that IPPNW launched in 2006, provides a path forward in this dangerous situation. The Treaty on the Prohibition of Nuclear Weapons (TPNW), which grew out of this campaign, creates a framework for mobilizing governments and civil society to put pressure on the nuclear armed states to eliminate their arsenals.

Pressure is growing within the nuclear armed states themselves in support of this Treaty. In the United States, for example, [the Back from the Brink campaign](#), has won endorsements from more than 60 cities and towns, seven state legislative bodies, and more than 400 NGO's for its call for the US to embrace the TPNW and begin negotiations with the other eight nuclear armed states for a verifiable, enforceable, timebound agreement to eliminate their nuclear arsenals. It is now working to secure co-sponsors for a Congressional Resolution, [H. Res. 77](#), introduced in the US House in support of the campaign's policy platform.

The Russian invasion of Ukraine has created a threat of nuclear war equal to the Cuban Missile Crisis in 1962 and the Euro Missile Crisis in 1983. After each of these moments of extreme nuclear danger, the leaders of the countries involved came away sobered, frightened by the apocalypse they had nearly unleashed. And, in the aftermath of each of them, significant progress was made to lower the nuclear danger. Within months of the Cuban Missile Crisis, the US and the Soviet Union signed the Partial Test Ban Treaty and established the "hot line" to enable communication in future moments of crisis. Within a year and a half of the Euro Missile Crisis, the

heads of the US and the Soviet Union stunned the world by declaring that nuclear war could never be won and must never be fought and began the process of ending the Cold War arms race.

The current moment of existential danger may lead to a similar reckoning, and a new openness on the part of the nuclear powers to rethink their disastrously dangerous policies. We need to do everything we can to make sure that this moment leads to the definitive solution to the nuclear danger, the complete and permanent elimination of these weapons.