

The background features a series of diagonal bands in shades of gray, each containing a pattern of dots of varying sizes and densities. The top-left and bottom-right corners are the darkest, while the center is the lightest.

THE IMPLICATIONS OF A RUSSIAN NUCLEAR STRIKE IN UKRAINE

OCTOBER 2023

Overview

Russia invaded Ukraine in February 2022, and the fighting has continued between the two countries since with significant destruction in Ukraine and force depletion in Russia. President Vladimir Putin has taken increasingly aggressive tactics to try and achieve his strategic objectives of bringing eastern Ukraine back to Russia and putting into place a puppet regime in Kyiv. During this conflict, Russia has threatened the possibility of using tactical nuclear weapons repeatedly, and while the "[nuclear taboo](#)" remains, the use of tactical nuclear weapons is a distinct if unlikely possibility.

Corporations need to prepare for the possibility because of the far-reaching impact such an event will have on the global community and market. Therefore, this report assesses the impacts of Russia using nuclear weapons. To assess the impacts, the report will *assume* the event has occurred to develop a scenario for corporations to utilize for possible business continuity plans and to determine impacts to the markets in which they operate.

Russia would most likely utilize tactical nuclear weapons (yields of 10-50 kT) such as the R-500 (Iskander-K cruise missiles), which can be used both on civilian targets and in the battlefield. The use of tactical nuclear weapons would allow Putin to eliminate targets and battalions without harming his own troops or entirely destroy the country he wants to occupy. Currently, Russia has approximately 2,000 tactical nuclear weapons available for use. Depending on the targets, they could cause massive civilian deaths and ruin Ukraine's place in the global economy, which is important for agriculture and the semiconductor supply chain. Secondary impacts from that fallout would lead to food insecurity in the Middle East and North Africa region, causing massive protests and violence. In addition, the chips shortage would expand into several years and make basic production difficult.

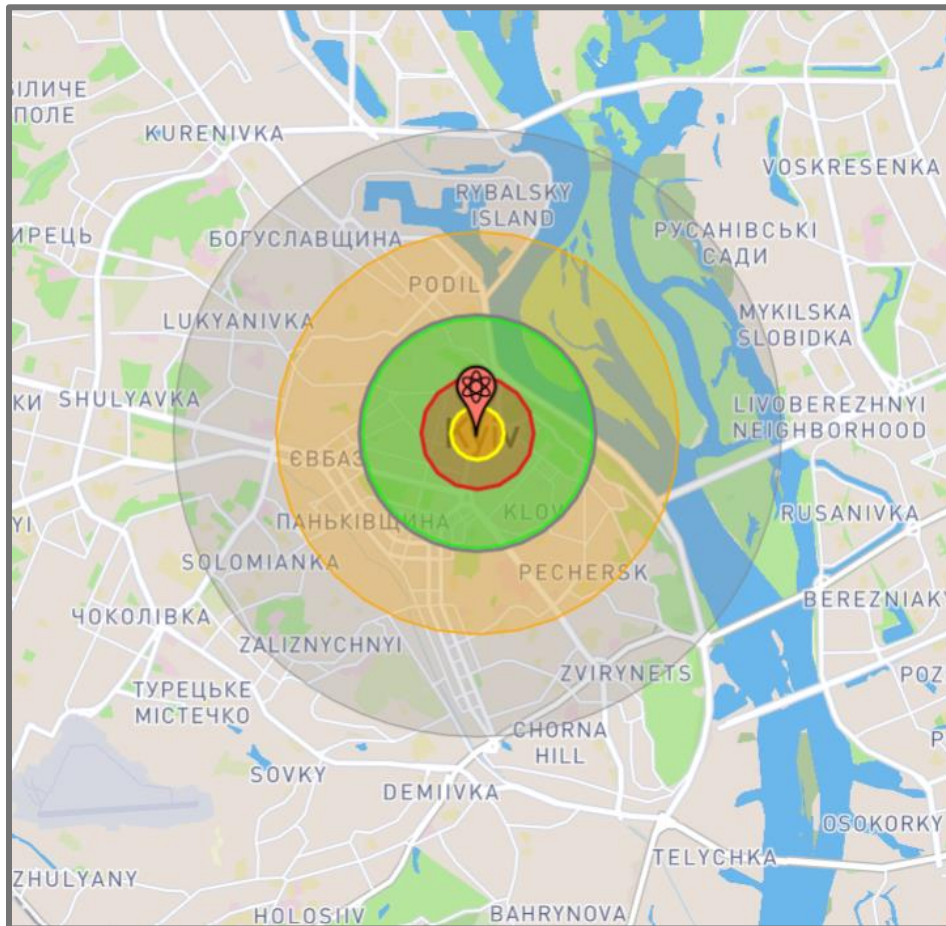
See [here](#) for research concerning the likelihood of escalation by RAND Corporation.

Immediate Effects

The use of tactical nuclear weapons on the battlefield would only give Russia modest gains against Ukraine. As the [Institute for the Study of War](#) put it, "At best, Russian nuclear use would freeze the front lines in their current positions and enable the Kremlin to preserve its currently occupied territory in Ukraine." However, the use against civilian targets would cause significant harm because of the destruction of infrastructure and the impact on the local economy. The following images demonstrate the fallout of a single 50kT bomb both on the surface and in the air. Russia would not use just one tactical nuclear bomb, but this exemplifies what would happen at each location they used the weapons.

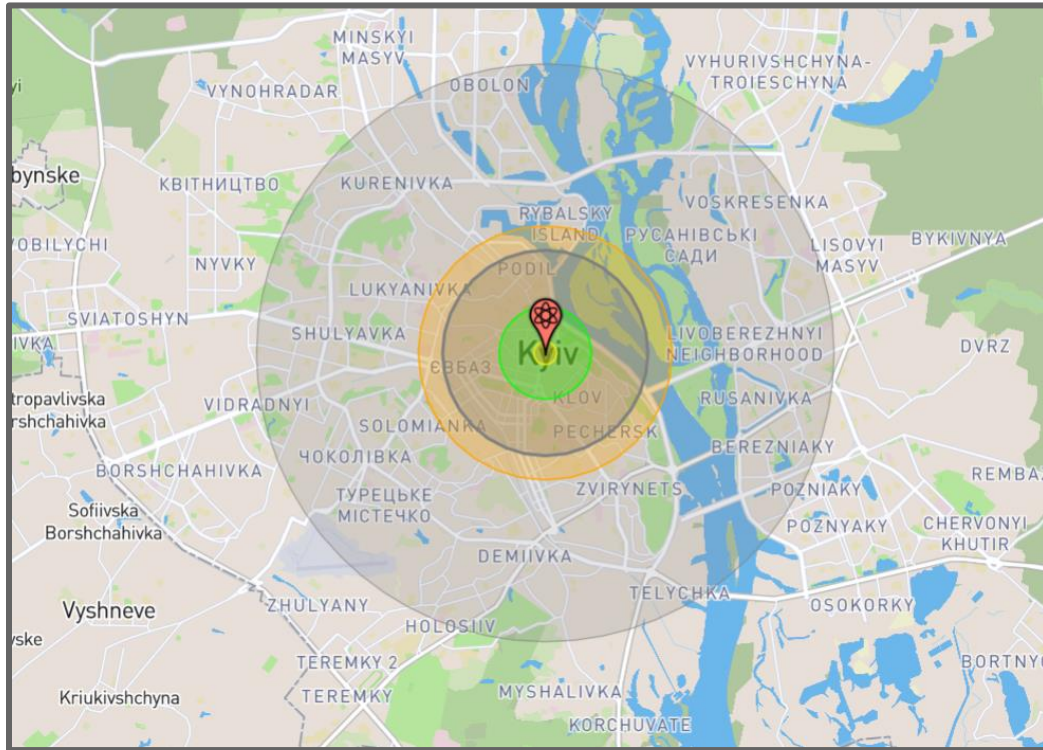
Examples of Blast Radius: 50 kT Explosions

Surface Bombing of Kyiv



- Fireball radius: 379 m (0.45 km²)
- Heavy blast damage radius (20 psi): 0.8 km (2.02 km²)
- Radiation radius (500 rem): 1.64 km (8.41 km²)
- Moderate blast damage radius (5 psi): 1.69 km (8.94 km²)
- Thermal radiation radius (3rd degree burns): 2.87 km (25.9 km²)
- Light blast damage radius (1 psi): 4.33 km (59 km²)

Airburst Above Kyiv



- Fireball radius: 292 m (0.27 km²)
- Radiation radius (500 rem): 1.16 km (4.25 km²)
- Moderate blast damage radius (5 psi): 2.59 km (21.1 km²)
- Thermal radiation radius (3rd degree burns): 3.2 km (32.2 km²)
- Light blast damage radius (1 psi): 7.28 km (167 km²)

Medium-Term Impacts

Importantly, the “[environmental effects](#)” of tactical nuclear weapons use are difficult to calculate and would depend on warhead yield, detonation height, weather, and local geography.” Yet there are general implications, especially for the market of Ukrainian products. The economic fallout would be far reaching and negative. Radioactive fallout from even smaller devices would thoroughly contaminate the air, soil, water, and food supply. Ukraine is already familiar with these effects because of the Chernobyl nuclear disaster in 1986.

The [immediate response](#) to Japan safe release of nuclear waste water from Fukushima led to protests and opposition, for example, but the Japanese government demonstrated the safety of doing so. Markets would not respond rationally to nuclear fallout in Ukraine and would be extremely likely to boycott products or move the supply chain out of country. Ukraine is an important agricultural producer as more than 50% of the country is arable land, and farming employed 14% of the populace before the war. In 2021, [Ukraine accounted](#) for one-third of the

world's sunflower oil production, and that same year was the sixth largest producer of corn and was the seventh largest producer of wheat.

The most likely impact to the agriculture sector will be a significant collapse because most places will not want to purchase possibly tainted food or material. This will lead to food insecurity in the Middle East and North Africa, which sources a significant amount of food products from Ukraine. Massive and violent anti-government protests will ensue in the region.

Fallout from tactical nuclear weapons would at a minimum completely disrupt Ukraine's mineral production for the next few years. Ukraine is a critical exporter of iron ore, manganese, titanium, and graphite. However, the most important minerals that Ukraine produces are neon gas and krypton. [Estimates point](#) to Ukraine producing 70% of global neon gas and 40% of global krypton, but more importantly Ukraine supplies about 90% of the semiconductor-grade neon used by U.S. chip makers. Neon gas producer Ingas was based in [Mariupol](#), a location constantly targeted by Russian bombs, and it closed because of the war. A significant portion of [neon output](#) has already been disrupted by the war, but the use of tactical nuclear weapons would likely reduce that further.

Advanced semiconductors need extreme ultraviolet (EUV) lithography for production rather than neon, but the majority of the chips market will still be strongly impacted. In response to the shortages in the war, TSMC began recycling neon for chipmaking, but this is unlikely to be a long-term strategy. Any transition away from neon will take several years, and the global chip shortage will last significantly longer if Russia uses tactical nuclear weapons.

Long-Term Impacts

The long-term impacts of the use of tactical nuclear weapons will be to fundamentally change geopolitics in three ways.

First, the United States would be highly likely to use force against Russia in the event of a nuclear war. This does not mean that the U.S. would use strategic nuclear weapons against Russia, but the conflict in Ukraine would greatly expand as the U.S. would likely send troops to the region to combat Russia. Crossing the nuclear threshold would alter America's calculations and cause a local war to become a probable global one. If the U.S. attacked Russia, then Russia would respond by attacking American assets in places like Africa and the Middle East, which could have the potential to draw in regional allies. There is a distinct likelihood of a global conflagration stemming from Russia using tactical nuclear weapons.

Second, other nuclear-armed countries like Israel, India, and Pakistan would alter their own calculations in their regional conflicts. Because the nuclear taboo will have ended it will create a justification for the use of nuclear weapons against regional enemies. Israel would be more likely to use nuclear weapons against Iran if/when Iran declared its own nuclear capabilities. Should war break out between India and Pakistan, then both sides would also be significantly more likely to use nuclear weapons. Most concerning would be North Korea. Russia's use of such

weapons would completely justify North Korea's use against South Korea, Japan, and the United States.

Finally, there would likely be a massive proliferation of nuclear weapons because countries could no longer rely on the nuclear taboo or the U.S.'s nuclear umbrella to prevent their use. Countries like Brazil, South Africa, Saudi Arabia, Japan, and others would be highly likely to pursue nuclear capabilities.

Combined all three long-term impacts of Russia's use of tactical nukes would create global instability not seen before. That instability would cause incalculable harm to everything from trade to supply chains to technological production.