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Ukraine invasion – explained

Ukraine strains to safely operate nuclear power plants while under Russian invasion

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Heard on Morning Edition



Brian Mann

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Technicians at the Khmelnytskyi nuclear power plant demonstrate the process for reactivating one of the facility's Soviet-era reactors.

Brian Mann/NPR

KHMELNYTSKYI, Ukraine — The head of Ukraine's nuclear energy utility, Energoatom, says his country is trying to do something never before attempted: operate a large network of atomic reactors in the midst of a full-scale war.

"Never such case has happened before actually," said Petro Kotin, who spoke to journalists recently in a room deep inside the Khmelnytskyi nuclear power plant in central Ukraine.

"This is the first time when the country who possesses nuclear power came to another country with a developed nuclear industry and just captured the plant, the biggest nuclear power plant in Europe," Kotin said.

Kotin was referring to Russia's full-scale invasion and capture of Ukraine's Zaporizhzhia nuclear complex in March 2022.

During previous conflicts, nuclear facilities in other countries have occasionally come under attack. But those incidents involved complexes that were under construction, unfueled and nonoperational — or the attacks involved reactors used in military research or weapons development. Ukraine's network of more than a dozen civilian nuclear power reactors is the first to face a sustained war-time threat.

Kotin said the situation at Zaporizhzhia is dire, with safety systems forced at times to operate on backup diesel generators.

"It was full blackout at the plant and it was like the first stage of the Fukushima scenario where you do not have external power," he said. "It was an awful situation."

In 2011, a tsunami in Japan destroyed the power supply to three reactors at the Fukushima plant, triggering a nuclear accident that still poses major environmental challenges.

In Ukraine, a country still haunted by the 1986 nuclear disaster at Chernobyl, the threat of an event like Fukushima is galling. Kotin said what the Russians are doing "is crazy."

There are six reactors at Zaporizhzhia maintained by Energoatom personnel, according to Kotin, but Russia controls the plant. Those reactors are currently offline. Meanwhile, Ukraine is operating nine reactors generating electricity at three other locations around the country.

Ukrainian officials say they have no choice but to keep the plants operating. Together they provide roughly half of Ukraine's electricity.

Kotin spoke during a demonstration at the Khmelnytskyi plant staged for journalists. A team of technicians showed their step-by-step process for restarting a reactor and connecting it to the power grid.

Officials said the actual restart of one of the plant's Soviet-era reactors was happening in another part of the complex, after a cycle of routine maintenance and refueling.





Petro Kotin, head of Energoatom Ukraine's nuclear utility, said his country is doing everything it can to protect reactors from Russian attack. He acknowledged that the danger is unprecedented.

Brian Mann/NPR

Atomic reactors sheltered by air defense weapons

Keeping these facilities operating is clearly a point of pride for Ukrainians.

"We are constantly increasing our protection of nuclear power plants," Kotin said.

"This is a task for our military and their special anti-drone equipment."

But Edwin Lyman, a physicist and director of the nuclear power safety program for the Union of Concerned Scientists, said Ukraine is taking a calculated risk.

"These plants were not designed to be hardened against military attack," he told NPR.

"Even though there's some capability to protect the air space [around nuclear power plants] from missiles and drones, it's not perfect."





The Khmelnytskyi nuclear power plant in west-central Ukraine. Atomic reactors like this one provide roughly half the nation's electricity, but could be vulnerable to Russian missile and drone strikes.

Brian Mann/NPR

Lyman noted the conflict in Ukraine has been volatile and unpredictable — not an ideal environment for managing the complex technical support network and supply chain required to operate atomic reactors safely.

"Unfortunately, the Zaporizhzhia situation has shown how vulnerable nuclear power plants can be in a country at war and under attack."

According to Lyman, none of the reactors currently operating in Ukraine have the design flaws that contributed to the Chernobyl accident in 1986.

But he said it's "certainly plausible that in the worst-case [scenario] one or more reactors in Ukraine could experience a Fukushima-like meltdown and radiation release."

Ukraine has equipped its nuclear plants with modern backup systems including diesel generators. Most of the country's reactors are located much farther from the front lines than Zaporizhzhia.

Officials say they've managed to conduct regular maintenance and refueling work at all the country's plants, other than Zaporizhzhia, despite the war.

They've also successfully shifted their supply chain. Soviet-era reactors that once relied on Russia for replacement parts and fuel are now supported by Western companies, including Pittsburgh-based Westinghouse.

But Lyman noted Russia has been targeting the energy grid used to supply Ukraine's reactors with the power needed to operate safely.

"There was one incident last year when all the plants in the country briefly lost off-site power access when Russia launched a broad attack on the power grid," Lyman said.

Energoatom's Kotin said his country's air defenses are also focused on protecting sensitive transformers and utility lines "from possible attacks from drones and rockets."

But he acknowledged that as long as Russian missile and drone strikes continue, Ukraine's reactors will face unprecedented peril.

Meanwhile, the situation at Zaporizhzhia, where all the reactors have been taken offline, remains uniquely precarious.

"Degradation everywhere" and a warning from IAEA

"Unfortunately it is degradation everywhere," Kotin acknowledged, describing conditions at the sprawling plant in eastern Ukraine.

"We're talking about radiation safety, equipment, competence and personnel, everything is in very bad condition."

Officials with the International Atomic Energy Agency currently have inspectors on-site at Zaporizhzhia.





The Zaporizhzhia Nuclear Power Plant seen from Nikopol, Ukraine, on July 21. The plant and nearby areas are under threat from attacks amid Russia's invasion of Ukraine.

Ercin Erturk/Anadolu Agency via Getty Images

But in a statement on Sept. 1, the IAEA warned that Russian troops are refusing to let the agency's team examine key parts of the complex to determine whether mines or other military explosives have been placed in sensitive areas.

"The IAEA experts continue to hear explosions and the sounds of military activity taking place some distance away," the statement also said, adding that a drone hit a nearby residential building on Aug. 23.

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