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What to know about Ukraine's nuclear sites and the risks the Russian invasion could pose

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Russian forces disconnected Ukraine's closed Chernobyl nuclear power plant from the nation's power grid, Ukraine's state-owned grid operator Ukrenergo said Wednesday. The move potentially jeopardizes the cooling of nuclear fuel still stored at the site.

Ukrainian presidential adviser Mykhailo Podolyak said that U.N. monitors had "unexpectedly lost connection" with monitoring systems there, calling it an "extremely dangerous situation."

Electricity is needed for cooling, ventilation and fire extinguishing systems at the site. In a statement on its Facebook page, Ukrenergo said emergency diesel generators have been turned on but that fuel would last only 48 hours.

Ukrainian Foreign Minister Dmytro Kuleba on Wednesday demanded a cease-fire to allow repairs.

The International Atomic Energy Agency said Wednesday on Twitter that the power loss "violates [a] key safety pillar" but that it did not see any "critical impact" on safety.

Concerns emerged that the Russian invasion could jeopardize the safety of Ukraine's nuclear sites after Russian forces took control of Chernobyl on Feb. 24.

Those fears mounted when a Russian projectile sparked a fire early March 4 at the Zaporizhzhia site, Europe's largest nuclear plant, triggering alarm across the world. Authorities have not recorded a release of radioactive material or damage to reactors.

The Zaporizhzhia incident prompted the United States to activate its nuclear-incident response team. At an emergency meeting of the United Nations Security Council on Friday, the United States and allies lambasted Russia for the shelling and seizure of the plant.

“The world narrowly averted a nuclear catastrophe last night,” said Linda Thomas-Greenfield, the U.S. ambassador to the United Nations.

Moscow denied that Russian forces fired on the plant.

Russian troops have placed Ukrainian workers at both the Chernobyl and Zaporizhzhia plants under their command.

In a [statement released Sunday](#), Rafael Mariano Grossi, the director of the International Atomic Energy Agency (IAEA), said that according to Ukraine, Russian troops had cut off access to the Internet and mobile networks around the Zaporizhzhia site, hindering the flow of reliable information from the ground.

Ukraine relies heavily on nuclear energy — its 15 functional reactors, situated in four power stations, provide about half of the country’s electricity. It was also the site of a 1986 nuclear meltdown that sent a radioactive cloud over Europe. The specter of the Chernobyl disaster has loomed large amid fighting near nuclear reactors in recent days.

During a news briefing last week, Russian Foreign Ministry spokeswoman Maria Zakharova said the country was “taking every measure” to maintain the safety of the Zaporizhzhia and Chernobyl plants.

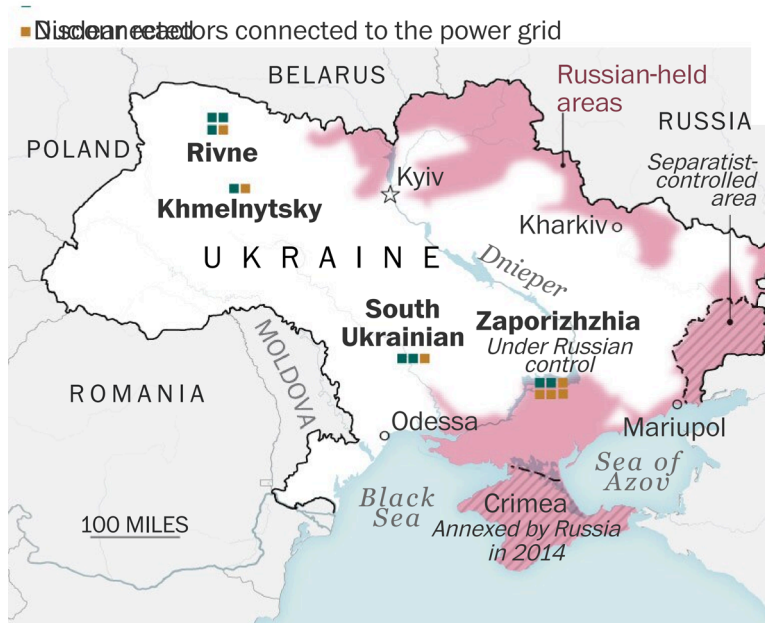
Here’s what to know about Ukraine’s nuclear sites and what risks the invasion by Russia could pose.

WHAT TO KNOW

- ◆ [How many nuclear sites does Ukraine have, and where are they?](#)
- ◆ [Which ones has Russia taken over?](#)
- ◆ [What risks could fighting around nuclear sites pose?](#)

How many nuclear sites does Ukraine have, and where are they?

Ukraine has 15 operational nuclear reactors, spread throughout the country. Six of them are at Zaporizhzhia. Others are in the south, between Kyiv and Odessa, and in the northwest of the country.



Power plant data as of March 7. Control areas as of March 6
 Sources: State Nuclear Regulatory Inspectorate of Ukraine, Post reporting

Ukraine's reactors supplied 51 percent of the country's electricity in 2020, according to the IAEA.

Nuclear power has formed a pillar of Ukraine's strategy to wean the country off its energy dependence on Russia. Two new nuclear reactors are under construction in Khmelnytskyi in western Ukraine, at a plant that already has two functioning reactors.

A plan to link Ukraine to Europe's power grid was expected to go into effect next year. The European Union said on Feb. 28 that it would expedite that move, possibly within weeks.

Zaporizhzhia is the largest nuclear power plant in Europe, built to produce 5,700 megawatts of electricity at full capacity. It sits at the edge of the city of Enerhodar in southeastern Ukraine, about 200 miles from the border with Russia.

The plant's reactors were put into operation between 1984 and 1995. Before the conflict erupted, they produced a fifth of Ukraine's electricity and almost half the energy generated by the country's nuclear power facilities.

Which ones has Russia taken over?

Russia took control of the Chernobyl zone in late February after what Ukrainian authorities described as a fierce battle with Ukrainian forces. The fighting triggered global alarm about disturbance to the site, where the 1986 meltdown left a no man's land of contaminated soil and other fallout, which remains dangerous.

The four reactors at Chernobyl have been permanently shut down for decades. A new concrete shelter was built over the site in recent years to prevent the release of about 220 tons of highly radioactive material.

Ukrainian authorities told the IAEA that they had lost regulatory control over the facilities there, and that Ukrainian staffers continuing to work at the site there were facing “psychological pressure and moral exhaustion.” The IAEA has called for Russia to allow workers there to rotate out — a need that was “becoming increasingly urgent and important for the safe management” of the site, Grossi said in a statement on Tuesday.

One of the seven pillars of nuclear safety is that staff operating nuclear facilities must be able to “make decisions free of undue pressure,” he said.

As of the weekend, only two of Zaporizhzhia's nuclear reactors were operating, according to the IAEA.

What risks could fighting around nuclear sites pose?

The big one is a release of radiation — an invisible threat that can poison people exposed to high doses or cause diseases including cancer later on.

Radiation is impossible to detect without a special measuring device, and its adverse health effects are only apparent only decades after exposure. A dangerous isotope of cesium present around Chernobyl after the accident was linked to a higher risk of developing leukemia later in life, for example. .



The reactors at the Zaporizhzhia site are safer than many older Soviet-era ones like Chernobyl, Jon B. Wolfsthal, a former adviser to President Biden under the Obama administration, told The Post.

“It’s not as dangerous as Chernobyl, but tank fire and nuclear reactors are never a good combination,” he said.

Cooling systems were working on Friday after the fire, Ukraine’s nuclear regulatory inspectorate said. But the inspectorate and international experts said losing that cool-down capability could lead to the release of significant amounts of radiation into the environment. That’s what happened in the accident at a power plant in Fukushima, Japan, in 2011, when an earthquake and tsunami damaged the reactors’ cooling systems and caused meltdowns that released radiation and prompted the evacuation of more than 100,000 residents from the area.

There’s another risk at plants such as Zaporizhzhia: spent fuel, which is kept on site in what looks like a swimming pool. The fuel stores could be vulnerable to overheating and releasing their radioactive contents.

Russia, which could see radiation spread into its territory in the event of a major accident, has an interest in avoiding any mishaps, Graham Allison, a nuclear policy expert at Harvard, [told CNN’s Anderson Cooper](#) last week.

“The real threat to Ukrainian lives continues to be the violent invasion and bombing of their country,” the American Nuclear Society said in a statement.

But Grossi delivered a dire warning of “risks that we may all incur” if fighting around nuclear sites continues. He said he was willing to go to Chernobyl to negotiate a framework that would ensure the security of nuclear plants in Ukraine, their employees, reactors and radiation-monitoring systems.

Nuclear power plants around the world were not built to withstand direct attacks by a nation-state, said Ed Lyman, the director of the nuclear safety project at the Union of Concerned Scientists.

Following the events at Fukushima, Ukraine and other countries adopted new measures to provide backup power generation to the critical safety systems at nuclear plants, Lyman said — but these systems were probably not intended to withstand a full-fledged attack.

Nuclear reactors would not explode like a bomb, but in some ways, they could cause even more widespread damage than nuclear weapons because they contain years of buildup of highly radioactive fission products, said Rod Ewing, a co-director of Stanford’s Center for International Security and Cooperation.

“We are in the middle of a war with great devastation and human suffering and deaths and adding a nuclear event — even if it is minor releases of radioactivity — to the present situation, that is really a heavy burden.”

Steven Mufson contributed to this report.

