

Chernobyl and Zaporizhzhia power cuts: Nervous wait as Ukraine nuclear power plants could start leaking radiation

March 10 2022, by Lewis Blackburn



Chernobyl, Pripjat, Ukraine. Credit: Unsplash/CC0 Public Domain

The catastrophic disaster at the Chernobyl Nuclear Power Plant in 1986 was caused by an explosion at the Reactor 4 Unit. This expelled a

sizeable quantity of radioactive material into the surroundings, alongside a partial meltdown of the reactor core. The last few decades have seen substantial international efforts to safely contain and decontaminate the site, including the recent installation of the New Safe Confinement structure.

But Russian forces have now seized the site, along with the Zaporizhzhia [nuclear power plant](#), as part of the ongoing conflict in Ukraine.

Moreover, on March 9, Ukrainian authorities reported a [power loss](#) at Chernobyl, [followed by a partial one at Zaporizhzhia](#).

Despite [reassurances](#) by the International Atomic Energy Agency (IAEA) that there is no imminent safety threat posed by the power isolation, it is important to understand the potential impact going forward.

When [nuclear fuel](#) is removed from the core of a [reactor](#), it is redesignated as "spent" nuclear fuel and often treated as a waste product for disposal.

But fuel will continue to dissipate heat due to radioactive decay, even after being removed from the reactor core. It is therefore of foremost importance that the spent fuel material contained at the Chernobyl site is adequately and continuously cooled to prevent a release of radioactivity.

At Chernobyl, as well as other sites, standard procedures to safely handle such material involves placing the fuel into water-filled ponds, which shield the near-field environment from radiation. They also provide a medium for [heat transfer](#) from the fuel to the water via continuous circulation of fresh, cool water.

If circulation is compromised, such as the recent power shutdowns, the fuel will continue to emit heat. This can make the surrounding coolant

water evaporate—leaving nothing to soak up the radiation from the fuel. It would therefore leak out to the surroundings.

In the case of Chernobyl, the spent fuel material has been out of the reactor for an adequate period of time and does not, therefore, require intensive cooling. However, the surrounding water could nevertheless be evaporated eventually if the power is not reinstated. This could, in turn, heighten the risk for an increased radiation dose uptake by the remaining site workers and beyond.

The remaining risks are mainly posed by the severely damaged Reactor 4 Unit, which contains sizeable quantities of a [lava-like material](#), commonly referred to as "corium" (because it comes from the core). This is highly radioactive and its eventual disposal continues to present a substantial scientific and engineering challenge. It is therefore necessary that the continued operation of radiation monitoring and ventilation systems within the New Safe Confinement structure remain online.

At Zaporizhzhia, two out of six reactors are actually operating. The damaged power connection luckily affects a reactor [that is currently shut down](#). This is undergoing repair—but it is difficult to get spare parts in the middle of the war.

Nervous wait

Despite assurances that there exist on-site reserves of diesel fuel that could feasibly provide back-up power for approximately 48 hours at Chernobyl, we don't know how long the site will be without power. It should be reiterated, however, that IAEA have said there is no cause for immediate alarm. That's because there is enough water in the spent [fuel](#) pools to avoid an accident. It may be months before the [water](#) is completely gone.

This is reassuring, but then the fighting in the region is reportedly already making it difficult to fix the power connection problem.

At Zaporizhzhia, the damaged power connection is undergoing repair—but it is difficult to get spare parts in the middle of a war. The fact that the reactor is shut down means it is not an immediate safety risk. But if [power](#) is cut to one of the operating reactors, paired with substantial damage to backup generators, this could result in meltdown in the worst case.

The safe dismantling, decontamination and decommissioning of the Chernobyl site is the collective aim of the global engineering community, yet estimates of completion range into the late 2060s. Clearly, the latest events pose a serious threat to the ongoing decommissioning efforts in Ukraine.

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