How to refuel a nuclear power plant during a pandemic

Enlarge / The Palo Verde Nuclear generating plant, the nation’s largest nuclear power plant.
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Each spring, nearly 1,000 highly specialized technicians from around the US descend on the Palo Verde Nuclear Generating Station near Phoenix, Arizona, to refuel one of the plant’s three nuclear reactors. As America’s largest power plant—nuclear or otherwise—Palo Verde provides around-the-clock power to 4 million people in the Southwest. Even under normal circumstances, refueling one of its reactors is a laborious, month-long process. But now that the US is in the middle of the coronavirus pandemic, the plant operators have had to adapt their refueling plans.

Palo Verde is expected to begin refueling one of its reactors in early April—a spokesperson for Arizona Public Service, the utility that operates the plant, declined to give an exact start date—but the preparations began months in advance. The uranium fuel started arriving at the plant last autumn, delivered in the cargo bay of an unmarked semi truck. The fuel arrives ready for the reactor as 1,000-pound rectangular bundles of uranium rods that are 12 feet tall and about 6 inches on each side.
The latest shipment of fuel arrived at the plant well before

the coronavirus pandemicbrought the world to a standstill, says Greg Cameron, the nuclear communications director at Palo Verde. The biggest change with this refueling cycle, he says, is the scope of the operation. “We’ve tried to trim down the amount of work to just what is necessary to ensure that we run for the next 18 months without impacting the reliability of the plant,” Cameron says.

Each of Palo Verde’s three nuclear reactors are ensconced in their own bulbous concrete sarcophagus and operate almost entirely independent of one another. This allows plant operators to periodically take one of the reactors offline for refueling and maintenance without totally disrupting the flow of energy to the grid. Each reactor is partially refueled every year and a half, with about one-third of the fuel in the reactor core being swapped out for a fresh batch.

Adding new fuel to the reactor is like playing a giant game of Jenga underwater. The oldest uranium rods are moved to a holding pool, where they cool for several years before being transferred to dry storage casks. Since the energy produced by a uranium rod decreases over time, the remaining fuel in the reactor has to be shuffled around to evenly distribute its heat before the new rods are added. The entire process is conducted with a machine that is essentially a giant version of the arcade claw crane. that ensures the rods never leave the water, which shields radiation and prevents the fuel from overheating.

Refueling usually takes around a month and involves hosting hundreds of electricians, welders, and other industrial workers who rove around the country refueling nuclear power plants. But not all of these contractors are needed just to top up a reactor. Many are involved with opportunistic repairs, upgrades, and inspections that can only occur while

the reactor is offline. To cope with the pandemic, Arizona Public Service made the decision to only conduct repairs that are essential for keeping the reactor running until its next refueling outage in the fall of 2021.

“Any work that is rescheduled is evaluated to ensure the impact of not completing it is well understood and within guidelines,” a spokesperson for the Nuclear Energy Institute, the industry’s trade group, wrote in an email to WIRED. If a nuclear power plant defers maintenance, its operators must demonstrate that the delay won’t compromise safety and get final approval from the Nuclear Regulatory Commission.

By scaling back the scope of the upgrades and repairs planned for their reactor, Palo Verde operators halved the number of contractors that will have to work there this month. Most of Palo Verde’s staff has been working remotely for weeks, but control room operators and other critical employees must still come in to monitor the nuclear reactors. For the last few weeks, medical personnel have worked in large tents outside the facility, screening anyone coming into the power plant for symptoms of COVID-19. Once refueling begins, control room operators and temporary workers will use separate entrances to the facility to limit contact between the two groups.

Palo Verde isn’t the only nuclear power station that will have to adapt its refueling process to cope with the pandemic. According to the Nuclear Energy Institute, nearly one-third of America’s 99 nuclear power plants have a scheduled refueling before June. All but two must be refueled before the end of the year. But as one of the 16 sectors designated as “critical” by the Department of Homeland Security, the nuclear industry—and the energy sector more broadly—is well-prepared to keep the lights on during a crisis.

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