The buildup of highly radioactive water in the tunnels beneath the Fukushima complex is hindering efforts to restore power to the facility. Traces of plutonium, which is highly carcinogenic, are detected in soil around the plant.

Japanese emergency crews are scrambling to contain rising levels of extremely radioactive water that has leaked into tunnels and basement equipment rooms at the Fukushima Daiichi nuclear power plant, putting up dangerous new obstacles to workers trying to bring the reactors under control.

Workers were using sandbags and concrete panels Tuesday in a desperate attempt to prevent the contaminated water from further spreading through the plant or into the nearby soil and ocean.

Their challenge is compounded by the fact that they must continue to douse water on the nuclear reactors and the spent fuel pools that would otherwise overheat and release additional radiation. Japanese officials warned Tuesday morning that temperatures in one of the reactors was again rising.

Chief Cabinet Secretary Yukio Edano said that cooling the reactors would remain the top priority, though workers would try to reduce the amount of water being used in order to reduce the potential for wider contamination. "We have to prioritize cooling," Edano said.

In addition, deposits of plutonium — a long-lived radioactive element — were found in the soil around the plant. The government said some of the plutonium may have seeped from damaged fuel rods inside the plant, with Edano calling the situation "very grave."

The problems represent further setbacks for Japanese authorities, demonstrating that more than two weeks after the earthquake, they still do not know the extent of damage and continue to improvise as they learn more about the state of the damage and the radiation leaks.

"Everything is being done by the seat of their pants," said Edwin Lyman, a nuclear physicist with the Union of Concerned Scientists, a U.S. watchdog group. "They are solving each problem, until the next one comes along."
Japanese and American nuclear industry experts have offered several conflicting explanations of where the water came from: runoff from water cannons fired into the damaged plant, leakage from pools holding spent fuel rods or even coolant from the damage reactor vessels that overheated in the early days of the disaster.

The presence of highly radioactive water was complicating work at the site already hindered by mechanical problems and damage from the quake and tsunami. Engineers have run a crucial new power line to the plant from the electrical grid, but radioactivity was keeping workers from getting close enough to hook it up throughout the complex.

The radiation level of the water in the tunnel at the No. 2 reactor was reported at 1,000 millisieverts per hour; four times a worker's limit for a full year, meaning even brief exposure could be harmful.

Plant authorities were exploring ways to capture and store the contaminated water. But experts say it could take days to weeks to work out a way to remove all the water safely, further slowing efforts to bring the stricken facility under control. The engineers must also figure out where the contaminated water originated and how it got into the tunnels that house pipes connecting the reactor to the turbines.

If not, the tunnels could simply flood again even as water is pumped out.

A U.S. nuclear design engineer said he believes the water accumulating in the tunnels and turbine rooms comes from water cannons and helicopters that attempted to spray water into the spent fuel pools but missed their mark. The water then accumulated radioactivity washed off the plant structure, and coursed downhill through the plant until reaching the tunnels.

"All that seawater they have been spraying on the reactors, tons of seawater, it basically had to go somewhere," said USC nuclear safety expert Najmedin Meshkati.

Even if the water is pumped out, radioactivity may remain behind, leaving the site still dangerous to work in. Lyman said porous concrete walls and floors could absorb the radioactive material and leave the structure still contaminated.

The Japanese also face the problem of what to do with the contaminated water.

Much of the tank space at the site is already full. And simply pumping massive quantities of contaminated water into the ocean may have unknown consequences and violate international law.

"There is a duty to protect the marine environment and that extends to their own borders," said David Caron, a UC Berkeley law professor and president of the American Society of International Law. "The question is whether they adequately prepared and that is in question."

Caron and many other experts said they doubted the contamination would be severe, because the sea would dilute the radioactivity before it could harm another nation's coast or marine environment.

High levels of radiation were found over the weekend in the ocean near the plant, though Japanese authorities said there was no risk to human health.

But the evidence coming out of the plant is contradictory and statements by senior Japanese officials have only added to the confusion. Japanese officials said over the weekend that they measured high levels of iodine-134, an isotope created during fission with a half-life of about 53 minutes. They later backtracked on their measurement.
Iodine-134 should have virtually disappeared after the first day of the accident.

Apart from ocean contamination, plant officials said that tests last week found trace levels of plutonium in soil outside the plant.

The origin of that material could be from a spent fuel pool or from reactor No. 3, which is loaded with plutonium fuel.

Plutonium is highly carcinogenic if particles become embedded in the lungs. Officials of the company that operates the plant said the element was found in two of five samples taken from the grounds of the facility, suggesting that contaminated water from reactor No. 3 had seeped into the soil. That reactor is fueled with a mixture of plutonium and uranium.

Concern about other radioactive substances had already led the government to order people living within 12 miles of the facility to evacuate. Those living between 12 and 18 miles from the plant have been urged to leave voluntarily, or remain indoors if they do not evacuate.

But Edano said evacuees were increasingly breaching the 12-mile perimeter without authorization to retrieve personal items from their homes. He urged them to stop, saying there is a "big risk" to human health.

On a positive note, operators are injecting fresh water into three reactors at the plant, instead of the corrosive seawater that has been used over the last two weeks.

The head of the U.S. Nuclear Regulatory Commission, Gregory Jaczko, arrived in Tokyo on Monday to meet with Japanese authorities and to get a firsthand look at the situation, according to a statement from the U.S. Embassy.

And Yukiya Amano, head of the International Atomic Energy Agency, warned that the crisis could go on for months. "The difficult situation has not been overcome and it will take time to stabilize the reactors," he said. "Radioactivity in the environment, foodstuffs and water is a matter of concern in the vicinity of the Fukushima plant and beyond."

In another sign of trouble, a pumper truck that had been spraying water into the plant broke down.

Japanese officials said it should be back in service by the end of the month.

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