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Tainted Water at 2 Reactors Increases Alarm for Japanese

By **DAVID JOLLY**, **HIROKO TABUCHI** and **KEITH BRADSHER**

*This article is by **David Jolly**, **Hiroko Tabuchi** and **Keith Bradsher**.*

TOKYO — Japan's troubled effort to contain the nuclear contamination crisis at its stricken Fukushima Daiichi plant suffered a setback on Sunday when alarmingly high radiation levels were discovered in a flooded area inside the complex, raising new questions about how and when recovery workers could resume their tasks.

Tokyo Electric Power Company, the operator, said the elevated radiation levels in the water, which had flooded the turbine buildings adjacent to the reactors at the plant, were at least four times the permissible exposure levels for workers at the plant and 100,000 times more than water ordinarily found at a nuclear facility.

That could mean crews seeking to determine damage and fix the problems at the plant, hit by a magnitude 9.0 earthquake and a tsunami more than two weeks ago, may not be able to approach some of the most troubled parts of the complex until the water can be safely removed.

Tetsuo Iguchi, a professor in the department of quantum engineering at Nagoya University, said that at the sharply elevated levels of radiation, workers would be able to remain on the site for only about 15 minutes before health considerations required them to leave. That could compromise attempts to bring the crisis under control.

Alarm over the radiation levels first intensified Thursday when two workers were burned after they stepped into highly radioactive water inside reactor No. 3 of the plant. Late Saturday, a worker trying to measure radiation levels of the water at another reactor, No. 2, saw the reading on his dosimeter jump beyond 1,000 millisieverts per hour, the highest reading on the device. The worker left the scene immediately, said Takeo Iwamoto, a spokesman for Tokyo Electric Power.

Michiaki Furukawa, a nuclear chemist and a board member of the Citizens' Nuclear Information Center, a Tokyo-based watchdog group, said exposure to 1,000 millisieverts of radiation per hour would induce nausea and vomiting, while exposure to triple that amount could be lethal.

There was no evacuation of the roughly 1,000 workers stationed at Daiichi after the high radiation levels were discovered. Naoki Sunoda, another spokesman for Tokyo Electric Power, said that since the crisis began, 19 workers had been exposed to radiation levels of 100 millisieverts.

Despite the new problem, Mr. Sunoda said, workers on Monday were still trying to determine a way to approach the turbine building of reactor No. 2 to extract the contaminated water.

"Radiation levels are high, but nothing will be resolved if we stay away," Mr. Sunoda said. "Our objective is to restore power to all reactors so cooling functions can be restored."

The Japanese government's top spokesman, Yukio Edano, said in an afternoon press briefing on Sunday that it looked like the radioactive water had appeared when the No. 2 unit's fuel rods had been exposed to air, but that "we don't at this time believe they are melting. We're confident that we are able to keep them cool."

The higher levels may have suggested a leak from the reactor's fuel rods — from either the suppression chamber under the rods or various piping — or even a breach in the pressure vessel that houses the rods, the Japanese nuclear regulator said earlier.

There was also deep concern early Sunday about initial readings of radioactive iodine 134, which has a half-life of only 53 minutes and would not be present in large quantities unless fission had restarted. That would present the alarming possibility of an out-of-control reactor. Several hours after releasing the initial results, the plant operator said that those readings had been in error, and that retesting had shown negligible amounts of the isotope.

But the revised readings confirmed the overall high radiation readings at the plant, and utility officials continued to search for the exact source. And they still may need to retest for other radioactive isotopes that had been found in the seawater around the No. 2 reactor, including troubling quantities of cesium, barium, cobalt and lanthanum. The company has not yet been able to determine the source of those leaks, and confirming the isotopes' exact levels could take much longer.

Sunday's developments came after the world's chief nuclear inspector said that Japan was "still far from the end of the accident" that struck the plant. [Yukiya Amano](#), the director general of the [International Atomic Energy Agency](#), acknowledged that the authorities were still unsure about whether the reactor cores and spent fuel were covered with the water needed to cool them and end the crisis.

Mr. Amano, taking care to say that he was not criticizing Japan's response under extraordinary circumstances, said, "More efforts should be done to put an end to the accident."

He cautioned that the nuclear emergency could still go on for weeks, if not months, given the enormous damage to the plant.

Asked on Sunday at a news conference what was the company's projected timeline for emerging from the crisis, [Sakae Muto](#), a vice president for Tokyo Electric Power, said, "We don't have a concrete schedule."

Mr. Muto declined to answer a journalist's question about a possible worst-case outcome, saying, "The important thing is to keep cooling the reactor and prevent the current situation from getting worse."

[Hidehiko Nishiyama](#), the deputy director general of the Japanese nuclear safety agency, said that it was likely that radiation was leaking from the pipes or the suppression chamber, and not directly from the pressure vessel, because water levels and pressure in the vessel were relatively stable.

All Sunday, the government and company officials fielded questions from the Japanese media about whether plutonium might have escaped from one of the damaged facilities. [Mr. Edano](#) said the area around the reactors was being tested for plutonium, but "this is not an easy process." He said that if the presence of plutonium was confirmed, "We will take measures depending on the situation."

The I.A.E.A. cited information from Prime Minister [Naoto Kan](#)'s office on Sunday that Tokyo Electric had begun pumping water out of some of the turbine buildings at the Fukushima plant.

Workers were pumping water from the No. 1 unit turbine to its main condenser and were making preparations to do the same at the No. 2 unit, the I.A.E.A. said, noting that a main condenser's function in a nuclear power plant is to condense and recover steam that passes

through the turbine. The company also was considering ways to remove water from the turbine buildings of the No. 3 and No. 4 units, the agency said.

The No. 5 and No. 6 units are thought to be out of harm's way.

Separately, the I.A.E.A., citing data from the Japanese authorities, reported that two of three workers who were exposed to radioactive water last Thursday suffered "significant skin contamination over their legs."

"The Japanese authorities have stated that during medical examinations carried out at the National Institute of Radiological Sciences in the Chiba Prefecture, the level of local exposure to the workers' legs was estimated to be between 2 and 6 sieverts," the I.A.E.A. said on its Web site.

"While the patients did not require medical treatment, doctors decided to keep them in hospital and monitor their progress over coming days."

While relief supplies are reaching more earthquake survivors, low temperatures and aftershocks continue to make life miserable for the population of the earthquake-stricken area.

On Monday morning, an aftershock with a magnitude of 6.5 off the coast of northeast Honshu triggered a tsunami alert, which was later canceled.

Japan's National Police Agency said on Sunday that the death toll from the quake and tsunami had risen to 10,668, with 16,574 people still missing.

Meanwhile, radiation in the Tokyo water supply continued to diminish on Sunday, the authorities said. At two of three monitoring stations operated by the municipal waterworks bureau, no radiation was detected. At a third, the level was 27 becquerels per liter, well below the maximum recommended limits for both infants and adults.

The elevated levels of radiation at and around the Fukushima plant will require careful monitoring of seafood in Japan, said Kimberlee J. Kearfott, a professor of nuclear engineering and radiological sciences at the [University of Michigan](#).

"It is extremely important that seafood be carefully monitored," she said in an e-mail. "This is because many of the radionuclides are concentrated in the environment," she added. "For example, iodines are concentrated in kelp (a Japanese food, seaweed) and shrimp."

“Iodines, cesium and strontium are concentrated in other types of seafood,” she continued. “Fish can act like tea or coffee presses. When you push down the plungers, the grounds all end up on one side. In this case, that is the fish.”

Hiroko Tabuchi and David Jolly reported from Tokyo, and Keith Bradsher from Hong Kong. Reporting was contributed by Ayasa Aizawa, Ken Ijichi and Kantaro Suzuki from Tokyo, and William J. Broad from New York.