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Emergency Declared at Japanese Nuclear Plant

By **MATTHEW L. WALD**

The Japanese government declared an “atomic power emergency” and evacuated thousands of residents living close to a nuclear plant in northern Japan after a major earthquake, but officials said there had been no radiation leak from the facility.

Some 6,000 people were told to leave a 2-mile radius around the Fukushima No. 1 plant, operated by Tokyo Electric Power and located in Fukushima Prefecture, after a mechanical failure in the cooling system of the facility, government officials said.

The evacuation was described as precautionary. Near midnight Japan time on Friday, Jiji Press, a Japanese news agency, quoted officials as saying that the cooling system would be reactivated and resume normal operations.

Japan depends heavily on nuclear power for its electricity generation. The facilities are designed to withstand earthquakes, which are not uncommon in Japan, but experts have long worried about the impact a major quake could have if it hit close to a reactor and impacted its safety systems.

Trouble was reported at two other nuclear plants in Japan as well, but there was no radiation leak at either of them, government officials said.

One major concern is that while operators can quickly shut down a nuclear reactor in an earthquake or during another emergency, they cannot allow the cooling systems to stop working. Even after the plant’s chain reaction is stopped, its fuel rods still produce heat. This is because they are filled with radioactive materials that are still throwing off sub-atomic particles or gamma radiation, which generates heat.

Heat from the nuclear fuel rods must be removed by water in a cooling system, but that requires power to run the pumps and to align the valves in the pipes. So the plant requires a continuous supply of electricity even after the reactor stops generating its own power.

An analyst with the World Nuclear Association, a major international nuclear power group, told Reuters that he understood fresh cool water was now being pumped into the cooling system at Fukushima, reducing the threat of a meltdown.

"We understand this situation is under control," the analysts said. The analyst said he understood that a back-up battery power system had been brought online after about an hour, and begun pumping water back into the cooling system, where the water level had been falling.

Civilian power reactors are designed with emergency diesel generators to assure the ability to continue cooling even during a blackout. Many reactors have two, assuring redundancy; some have three, so that if one must be taken out of service for maintenance, the plant can still keep running.

It was not immediately clear how many there are at Fukushima, but the operators reported earlier in the day that they were not working, prompting the evacuation.

Fukushima 1, which was designed by General Electric and entered commercial service in 1971, was probably equipped to function for some hours without emergency diesel generators, according to David Lochbaum, who worked at three American reactor complexes that use General Electric technology.

Mr. Lochbaum, who also worked as an instructor for the [Nuclear Regulatory Commission](#) on GE reactors, said he did not know the details of Fukushima, but that such reactors had pumps that could be powered by steam, which would still be available in case of electric power failure. Valves can be opened by motors that run off batteries, he said. Older plant designs, of the era of Fukushima, generally have batteries sized to operate for four hours, he said.

After four hours, heat production in the core is still substantial but has been reduced, he said. The heat would boil away the cooling water, raising pressure in the reactor vessel, until automatic relief valves opened to let some of the steam out. Then the valves would close and the pressure would start building again.

If the cooling system remains inoperative for many hours, the water would eventually boil away, he said, and the fuel would begin to melt. That is what happened at Three Mile Island, the reactor near Harrisburg, Pa., that suffered a partial core melt in March, 1979. In that case the cause was not earthquake, but mechanical failure, operator error and poor design, government investigators later found.

Mr. Lochbaum, who now works for the [Union of Concerned Scientists](#), a group that is very often critical of nuclear safety standards, said that if the cooling water in the vessel is boiling away, the process of boiling enough to expose the fuel would take “hours, not minutes.”

The radioactive steam — which would become far more radioactive as the fuel began to melt — would fill the containment building, he said. That building is designed to be cooled, to keep down steam pressure and leaks. But those pumps require the main sources of power at the plant to function properly.

“If they start melting fuel, the containment integrity is going to be the key in terms of what gets out,” he said. “Their focus now has to be on getting back AC power” — or the main power supplies for the plant.