

Status report: Reactor-by-reactor at the Fukushima Daiichi plant

By **the CNN Wire Staff**

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(CNN) -- Since March 11, the six reactors at the Fukushima Daiichi nuclear power plant have been in various states of disrepair after a 9.0-magnitude earthquake and subsequent tsunami struck the area.

Here is the latest on each reactor and efforts to prevent further releases of radioactive material.

Reactor No. 1

Hidehiko Nishiyama, an official with Japan's nuclear and industrial safety agency, on Sunday described overall conditions in and around the No. 1 reactor as stable. Temperatures in the containment vessel continue to drop.

With pressure levels increasing slightly, the rate of water being injected into the reactor was decreased late Saturday, the nuclear safety official said.

The electrical system used in the water injection process was expected to switch from a diesel-power generator to a source tapping electricity from outside the plant sometime on Sunday, according to Nishiyama.

Authorities finished transferring water that had accumulated in a water condenser to an external surge tank late Saturday afternoon.

Nitrogen is slated to be injected into the No. 1 reactor, an attempt to minimize the possibility of the dangerous buildup of hydrogen, after Tuesday. A hydrogen explosion -- an indicator of possible core damage -- blew the roof and upper walls off the building housing the reactor on March 12.

A camera was installed Sunday in the exposed maintenance tunnel leading to the No. 1 unit's turbine building, where highly radioactive water had been found last week. The goal is to pinpoint how water got into the tunnel, which had been used for electrical cables but wasn't supposed to contain liquid.

Nishiyama on Saturday knocked down a claim made a day earlier by U.S. Energy Secretary Steven Chu that 70% of the No. 1 reactor's core has suffered severe damage. Noting that sensors have been unreliable, Chu said the calculation was based on the fact that radiation levels have been too high for workers to get inside. But Nishiyama said that Japanese authorities' data indicates only 3% damage to the unit.

Tsunehisa Katsumata, chairman of Tokyo Electric Power Company that runs the nuclear power plant, said last Wednesday, "Looking at current conditions ... there are no options other than decommissioning" the No. 1 reactor, as well as Nos. 2, 3 and 4 units. This would mean that the reactor would never be used to produce electricity again.

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This reactor's core has been damaged, but its containment vessel was not, according to the Japan Atomic Industrial Forum, an industry trade group that tracks information from government and Tokyo Electric officials. The containment vessel is a concrete and steel structure that keeps radioactive material inside the reactor.

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Lighting has been restored to the No. 1 and No. 2 units' control room, though the overall power supply in both is subpar.

Reactor No. 2

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Highly radioactive water continued leaking Sunday from the Fukushima Daiichi nuclear power facility directly into the Pacific Ocean, following a failed attempt to plug a cracked concrete shaft.

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Power plant workers had tried -- unsuccessfully -- to fix the leak by pouring in fresh concrete on Saturday, a Tokyo Electric Power Company official said. This was after authorities discovered water gushing out of a two-meter-deep, concrete-lined basin and into the sea via a roughly 20-centimeter (8-inch) crack.

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Nishiyama, the nuclear safety official, said the working theory is that water injected in recent weeks into the No. 2 reactor to help cool its nuclear fuel rods somehow got out. "We were assuming and hoping (that water) would stay in the containment vessel as vapor after being cooled," he said. "However, it may have flowed into the building, and then the trench."

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Tokyo Electric workers next plan is to inject a polymer to fill the crack. They will break the shaft's ceiling and insert the polymer in a different spot from where they tried to place the concrete, the utility's officials said.

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Radiation levels in the affected shaft itself measured at more than 1,000 millisieverts per hour, which is more than 330 times the dose an average resident of an industrialized country naturally receives in a year. Above, the level was 250 millisieverts per hour. The shaft lies at the end of a long channel that has been filling up for days.

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Overall, conditions in the No. 2 unit are stable, Nishiyama said Sunday, even though temperatures had inched up slightly.

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As with the Nos. 1 and 3 units, the electricity source for the cooling system (involving the injection of water) should switch Sunday to an outside power source, replacing the current temporary diesel generator being used, according to the nuclear safety official.

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Authorities also hope this new power source will expedite their ability to monitor various metrics around the No. 2 unit.

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Beginning Saturday night, efforts began to transfer contaminated water from a vapor condenser to a separate storage tank, said Nishiyama. That water had been pumped out of the No. 2 complex using a submerged pump.

There was no immediate response Saturday to a claim, made by U.S. Energy Secretary Steven Chu, that the No. 2 reactor core had suffered a 33 percent meltdown. But Nishiyama, of Japan's nuclear safety agency, did try to debunk Chu's claims about the No. 1 reactor.

As with the Nos. 1 and 3 units, there is a plan to inject nitrogen into the No. 2 reactor in order to prevent a buildup of hydrogen that might cause an explosion. One such blast occurred at the No. 2 unit on March 15.

Katsumata said last Wednesday that, "looking at current conditions," the No. 2 reactor and three others would be decommissioned -- meaning it would never be used to produce electricity again.

Workers have been pumping freshwater into the No. 2 unit's reactor core, which the Japan Atomic Industrial Forum says has been damaged. The building housing the reactor has only been "slightly damaged," according to the industry group.

Lighting has been restored to the No. 1 and No. 2 units' control room, though the overall power supply in both is subpar.

Reactor No. 3

Parameters appear to have stabilized in and around the No. 3 nuclear reactor, Nishiyama said Sunday.

Like with the Nos. 1 and 2 units, an external electricity source should be set up Sunday to help power the No. 3 unit's cooling system.

About 75 tons of freshwater was sprayed Saturday into the No. 3 unit's spent nuclear fuel pool. This was part of the ongoing attempt to keep cool fuel rods that are stored there.

A camera was installed Saturday in the exposed maintenance tunnel connected to the No. 3 complex's turbine building. The hope is that the camera can be used to spot the source of seepage of highly radioactive water into that tunnel.

Workers on Monday plan to start draining water that had been pumped out of the No. 3 unit into a vapor condenser. That radioactive water will be moved to a storage tank.

Japan's nuclear safety agency earlier announced plans to pump in nitrogen -- a non-flammable substance -- into the No. 2 reactor and two others in a bid to prevent an explosion caused by the buildup of hydrogen. Eleven people were injured on March 14 when one such explosion occurred at the No. 2 unit.

Like the Nos. 1, 2 and 4 reactors, the No. 3 reactor is likely to put out of service permanently even after the crisis resolves, Katsumata said Wednesday. Among other issues, the use of seawater in the post-crisis response has corroded the reactor, experts have said.

The No. 3 reactor had been of particular concern because it is the only one to use mixed-oxide fuel that contains a small percentage of plutonium, which is also a byproduct in other reactors. A small amount of plutonium was detected in soil samples on the plant grounds last week, Tokyo Electric reported Monday. Edano said Tuesday that it was "likely" the plutonium came from this reactor.

The cooling pool where spent fuel is stored may also have been damaged, the Japan Atomic Industrial Forum reports. Workers used a concrete pump to douse the spent fuel pool with water Tuesday, said Hidehiko Nishiyama of Japan's nuclear and industrial safety agency.

Freshwater has been injected into the No. 3 reactor core in order to prevent overheating of nuclear fuel inside.

The No. 3 reactor is believed to have suffered core damage, and a hydrogen explosion did extensive damage to the building surrounding the reactor March 14.

Reactor No. 4

About 180 tons of freshwater were to be sprayed, starting Sunday evening, into the No. 4 unit's spent nuclear fuel pool on Friday using a concrete pump truck, a Tokyo Electric official said.

Workers restored power in the reactor's control room Tuesday -- a move that officials say could be a key step in efforts to bring cooling systems back online.

This reactor was offline in a scheduled outage when the earthquake hit. Still, it has had several major problems since then, including a March 15 fire that damaged the building that houses the reactor.

The nuclear fuel rods were in the unit's spent fuel pool, but not in the reactor itself. The reactor's pool of spent nuclear fuel was "possibly damaged," which is why authorities have made repeated efforts to pour water onto the structure.

Reactors Nos. 5 and 6

Reactors No. 5 and 6 were not in operation at the time of the earthquake and are in "cold shutdown," Japan's nuclear and industrial safety agency reports.

The reactors were shut down for a scheduled outage when the quake hit and there are no major issues with the reactors and cores themselves. The cooling systems in the pools of spent nuclear fuel are thought to be functioning, though there are continued concerns about keeping power running to the systems.

Three holes were punched in each building earlier to relieve pressure and prevent a feared hydrogen explosion.

<http://www.cnn.com/2011/WORLD/asiapcf/04/03/japan.nuclear.status/?iref=obinsite>