



1. **NUCLEAR: Radiation levels spike, forcing temporary retreat by reactor emergency workers at Fukushima** (03/16/2011)

Peter Behr, E&E reporter

The remaining emergency workers battling to save Japan's Fukushima Daiichi nuclear complex were pulled back temporarily Wednesday after a dangerous spike in radiation levels. Authorities said they were initially unsure whether the source was the blast-damaged Unit 2 reactor or another of the units.

A plan to drop treated water from helicopters or cargo planes on the plant's reactors was also put on hold because of the radiation threat. Emergency crews will use hoses for the task, authorities said. Replenishing water in Unit 4's spent fuel pool is essential to prevent an ultimate radiation release there, experts said. A second fire broke out in that unit Wednesday but was controlled. Its cause and consequences were not immediately clear.

Water temperatures in the pool and other spent fuel tanks have been rising because their cooling system are without power, and if the water cover boiled away over a period of days, exposed fuel rods could ignite, spreading radiation into the atmosphere, U.S. experts warn.

"We have no options other than to pour water from a helicopter, or to spray water from the ground," a spokesman for operator Tokyo Electric Power Co. (TEPCO) said on television Tuesday. "We have to take action tomorrow or the day after."

Although news reports said the emergency crew returned to their posts Wednesday after radiation levels fell back, the threat to them is high. The metrics of the battle could be reduced to the question of whether the radiation hazard will permit workers to stay at their posts to keep reactor cores and spent fuel pools under enough water to prevent meltdowns, experts said.

The hopes for stabilizing the reactors long term depend on restoring outside electric power to the complex and getting the reactor cooling and control systems operating again.

Japanese Emperor Akihito, in a rare address over television, called the nuclear crisis as "unprecedented in scale."

"I hope from the bottom of my heart that the people will, hand in hand, treat each other with compassion and overcome these difficult times," the emperor said.

'Slow-moving nightmare'

"The news we have received in the last 24 hours is worrying," Yukiya Amano, director of the International Atomic Energy Agency, said at a press conference in Vienna on Tuesday. "It is too early to say whether the situation has peaked, or whether worse developments are yet to come," he said, Dow Jones reported.

"This is a slow-moving nightmare," said Thomas Neff of the Center for International Studies, Reuters reported.

The 50 remaining emergency workers were withdrawn Wednesday morning local time after smoke or steam emerged from Unit 3, press reports said. Japanese authorities said that morning radiation readings had ranged between 600-800 microsieverts per hour, but at 10 a.m., readings rose to 1,000 microsieverts per hour. Readings began to fall again an hour later.

On Tuesday, Japan's Health Ministry said it was raising the legal limit on the amount of radiation to which each worker could be exposed, to 250 millisieverts from 100 millisieverts, five times the maximum exposure permitted for American nuclear plant workers, *The New York Times* reported.

Although the change would permit workers to remain on the site, authorities said they would not increase the limit again. "It would be unthinkable to raise it further than that, considering the health of the workers," health minister Yoko Komiyama said at a news conference.

Chief Cabinet Secretary Yukiyo Edano told reporters Wednesday that the Unit 3 reactor might have experienced an internal explosion of the kind that rocked Unit 2, possibly damaging the suppression pool beneath the primary containment, according to World Nuclear News. Alternatively, the radiation may have come from Unit 2.

The control plan for the crippled reactors involves pumping seawater into damaged reactor cores and periodically venting steam from the primary containment structure to prevent a dangerous pressure build-up, the Nuclear Energy Institute in Washington said. That creates a potential exit path for radiation in the steam.

TEPCO faced growing criticism in Japan for providing incomplete and sometimes inaccurate reports of the threat to a country devastated by Friday's earthquake and tsunami. Similar complaints have been lodged against the government.

Amano urged Japan to step up its communication efforts. "I would like to receive both more timely and more detailed information from our Japanese counterparts," Amano said.

Initial reports Tuesday that the fuel rods in the Unit 4 pool had ignited, sending radioactive smoke rising from the unit -- which were based on statements by Japanese authorities -- turned out to be inaccurate.

Prime Minister Naoto Kan's spokesman Noriyuki Shikata said Tuesday that there had been "a sign of leakage" in the pool while firefighters were at work, "but we have found out the fuel is not causing the fire." The fire, believed to be caused by an oil leak connected to a pumping system, according to the Nuclear Energy Institute, was reported extinguished.

Japanese Minister of Economy, Trade and Industry Banri Kaieda yesterday ordered TEPCO to replenish water in the spent fuel pool in Unit 4 because rising temperatures in the pool threatened to evaporate the existing water cover, exposing the fuel rods. Whether the fuel rods had in fact been uncovered was not clear from official statements or press reports.

Fire report later discounted

Unit 4 had been offline when the earthquake and tsunami struck Japan on Friday, but the loss of electric power to the plant and its backup generators and the exhaustion of emergency batteries, left the pool's pumped cooling system out of action, authorities said. The temperature of a 30-foot layer of water over the fuel rods has been rising as water evaporated.

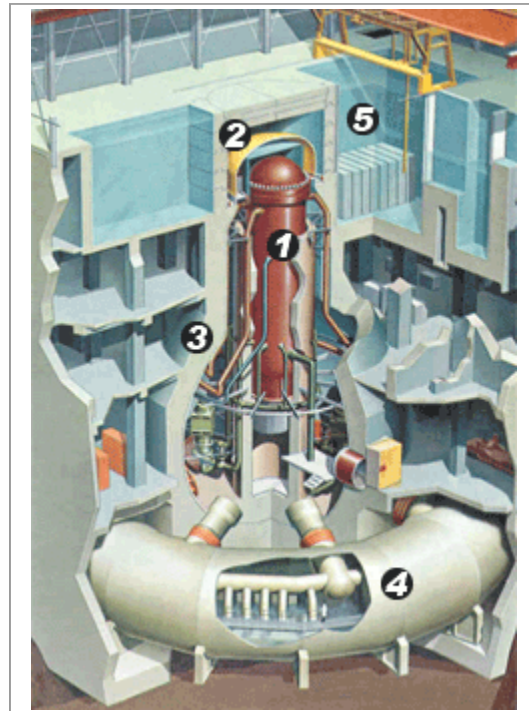
TEPCO considered using a helicopter to get water into the pool through two large holes caused by an explosion in Unit 4's outer secondary containment structure.

David Lochbaum, head of Union of Concerned Scientist's nuclear safety program, said "the helicopters and aerial water addition won't help core cooling on any of the innards. However some kind of delivery like that might help with the spent fuel pools."

The reports of a fire in Unit 4's spent fuel pool had raised frightening possibilities. The fuel rods, though depleted, hold dangerous amounts of fission products that could have ignited had the fuel been completely uncovered. Then, radiation from the pool would have been released into the atmosphere because the pool is not enclosed by a steel and concrete containment shell, as is the reactor vessel.

The International Atomic Energy Agency put a bulletin on its website Tuesday saying, "Japanese authorities also today informed the IAEA ... that the spent fuel storage pond at the Unit 4 reactor of the Fukushima Daiichi nuclear power plant is on fire and radioactivity is being released directly into the atmosphere."

GE Mark I containment reactor



Cutaway diagram of the General Electric Mark 1 reactor. The GE nuclear reactors involved in the incidents at Japan's Fukushima Daiichi nuclear complex have four major safety systems designed to prevent a meltdown and escape of highly radioactive materials. The nuclear reactor (1) is surrounded by a steel containment (2) designed to keep radioactive materials inside. The containment is, in turn, shrouded by a thick concrete "shield wall" intended to keep debris driven by hurricanes or airplane crashes from damaging the reactor. Overheated steam created in the reactor is sent into a "suppression chamber," where it is condensed by a large pool of water (4). Spent fuel assemblies removed from the reactor, which are highly radioactive, are kept in a pool outside the containment (5), covered by as much as 25 feet of water.

Graphic courtesy of the U.S. Nuclear Regulatory Commission.

News organizations carried the IAEA report yesterday, which worried and puzzled senior officials at the Nuclear Regulatory Commission, who were unable to get official confirmation of the serious development as late as Tuesday morning, according to people in touch with the commission. But officials of the Nuclear Energy Institute concluded Tuesday that the reported radiation levels at the site at the time of the Unit 4 fire were far too low to have resulted from an ignition of uncovered fuel rods.

One U.S. nuclear consultant commented, "A spent fuel fire would probably cause sizable release with dispersion driven by the smoke, and there would little question as to what is taking place."

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