

Widening global implications of Japan nuclear crisis

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The nuclear crisis at Fukushima is looking increasingly open-ended as teams of workers battling in dangerous and often life-threatening conditions fail to stem the flow of nuclear radiation into the surrounding environment. The longer the crisis goes on, the greater and more complex its environmental, social, economic and political implications become.

Radioactive iodine levels in the seawater samples near the plant were 3,355 times the legal limit late Tuesday, according to the Japanese safety agency NISA. Three days before, they were 1,850 times the limit. There is an exponential increase, and it points to a continuous flow of newly contaminated water from the plant.

The continuing levels of radioactive contamination have led some nuclear experts to suggest that the primary containment vessel, which is constructed of steel almost a foot thick, has been breached by a nuclear meltdown.

Professor Richard Lahey, who was head of safety for boiling water reactors at General Electric for many years, told the UK-based *Guardian* newspaper that the fuel rods at the core of reactor 2 may have melted through into the concrete dry well underneath the pressure vessel.

Workers at the site had “lost the race” to save the reactor from a meltdown, Lahey said.

If this is indeed what has happened, the incident at Fukushima has become more serious than that at Three Mile Island in 1979, when a nuclear reactor suffered a partial meltdown. It was the worst accident in the history of the nuclear power industry in the US. Radioactive material was released into the atmosphere by the venting of steam and hydrogen as has been done at Fukushima. But the reactor at Three Mile Island was eventually controlled and primary containment was not

breached.

The American Nuclear Regulatory Commission (NRC) describes what was avoided at Three Mile Island, and may have already happened at Fukushima, as a “worst case accident”. A full-scale meltdown would result in the “release of massive quantities of radiation to the environment,” according to the NRC.

The concern at Three Mile Island was that a hydrogen bubble building up in the pressure vessel would cause an explosion, sending huge amounts of radiation from the core of the reactor into the atmosphere. That danger was avoided. But in 1986, the number 4 reactor at Chernobyl in Ukraine did explode after a fire in its core, and huge amounts of radioactive material were dispersed across northern Europe, with health consequences that are still being assessed.

Lahey stressed that there was no risk of a similar explosion at Fukushima. This assumes that emergency cooling can continue until the fuel rods are cool enough to obviate the risk of fire. But the cooling itself presents increasingly complex problems. The “feed and bleed” cooling strategy seems to be the reason for the elevated levels of seawater contamination and the build-up of pools of contaminated water on site.

Murray E. Jennex, an associate professor at San Diego State University, told the *New York Times* that the efforts to cool the reactors and spent fuel ponds by dropping water from helicopters may have done more harm than good.

“They dumped water all over the place,” Jennex said. “They keep on generating more contamination. That’s the consequence of doing it. They got water on things that shouldn’t be wet.”

Important machinery had been damaged, he suggested. A photograph of the control room of one of the reactors taken after the power had been restored

seems to confirm Jennex's warning. None of the computer screens or warning lights that would normally be displayed in a control of this kind were showing any readings.

Hirohito Sakashita of Hokkaido University said that although the fuel rods would already have lost 99 per cent of their heat, they were still giving off enough heat to evaporate 200 tons of water a day. "They will just have to keep on pouring and pouring, but contaminated water will keep leaking out."

Sakashita envisaged the cooling would have to continue for quite a long period, for years to come. His opinion was confirmed by Hidehiko Nishiyama of NISA. "We will have to continue cooling for quite a long period," he said. "We should be thinking years."

As contamination builds up on the site, it is becoming increasingly difficult to find enough workers who are below even the newly raised levels of permitted radiation exposure to keep pumping and other essential work going. Workers have reportedly been offered 80,000 to 100,000 yen a day (£608 to £760) to work on the site in what are being dubbed "suicide squads."

Teams of workers are fighting to build sandbag dams in the tunnels under reactors 1, 2, and 3 to stop the flow of radioactive water into the sea. Radiation levels of 1,000 millisieverts an hour have been detected in the water that is flooding into these tunnels.

The extent of the danger from radiation on the site is evident from the growing international response. Peter B. Lyons, a senior safety engineer with the US Energy Department, said that special robots would be sent to Fukushima along with experts to instruct the Japanese in their use. The turn to robots suggests that Fukushima is rapidly becoming too dangerous to keep workers on site.

In another move that points to the growing threat of radioactive runoff, the French state-owned nuclear power company Areva has sent a team of specialist engineers to advise the Japanese on controlling the flow of water. The team is headed by Areva's chief executive, Anne Lauvergeon. Nicholas Sarkozy is also to become the first world leader to visit Tokyo since the disaster. Fukushima is a potential political and economic disaster for France, which is heavily dependent on nuclear power, not just Japan.

There are suggestions that water from the site may have to be pumped into tankers waiting offshore or into

specially constructed lagoons near the power station. With hundreds of tons of water needed daily, potentially for years to come, this would be a massive operation. A plan to cover the entire site in a membrane of material that would prevent gases from leaking into the atmosphere is under discussion. It would, like the pumping operation, be hugely expensive.

As the scale of the nuclear crisis grows, the economic implications are increasingly taking centre stage. Shares in TEPCO, the company that owns the Fukushima plant, dropped to their lowest level in 50 years on Tuesday and proceeded to fall still further on Wednesday. The company has secured 2 trillion yen (\$24 billion) from Sumitomo Mitsui Financial Group, but has said that this will not be enough to fund the emergency work at Fukushima.

When the costs of reparations to evacuated residents, to farmers and fishermen and other businesses is calculated, the cost of the crisis is expected to wipe out the company's shareholders. The scale of the financial implications of the crisis is being compared by Bloomberg News to the crash of Lehman Brothers, which initiated the 2008 financial meltdown from which the world economy is still reeling. This is why the Japanese government is moving toward what is being called nationalisation, but is in fact a bailout.



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