

US report points to serious dangers at Japanese nuclear plant

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A confidential assessment of the Fukushima nuclear disaster drawn up by the US Nuclear Regulatory Commission (NRC) paints a far bleaker picture than the limited, sanitised reports being made public by the plant operator, Tokyo Electric Power Company (TEPCO) and Japanese nuclear authorities. The American document has not been publicly released but was leaked to the *New York Times*, which published some details on Tuesday.

Three of the six reactors at TEPCO's Fukushima Daiichi plant were seriously damaged by overheating after their cooling systems failed during the March 11 earthquake and tsunami. In a desperate attempt to prevent a meltdown, TEPCO initially poured salt water into the primary containment vessels of the three reactors and also spent fuel rod pools that were in danger of overheating. Hydrogen gas produced by the oxidation of the zirconium cladding around reactor fuel rods led to a series of explosions that badly damaged reactor buildings.

Current reports from TEPCO, Japan's nuclear regulator and the International Atomic Energy Agency (IAEA) provide little more than day-by-day updates on measures implemented, together with the temperatures and pressures of the three damaged reactors, and some readings of radioactivity in the land and sea around the site. The NRC document, however, points to the ongoing and possible dangers that are clearly being discussed behind closed doors in Japan and internationally.

Among the risks identified by the NRC are:

* There is the possibility of further explosions caused by hydrogen produced inside the damaged reactor cores that has the potential to rupture the primary containment vessels enclosing the cores. The NRC recommended the injection of nitrogen, an inert gas, into the containment

vessels to try to purge them of accumulated oxygen and hydrogen.

* Fresh water is now being injected continuously into the containment vessels of reactor units 1, 2 and 3 in order to cool the reactor cores, but this process has the potential to compromise these vessels. The report warned "when flooding containment, consider the implications of water weight on seismic capability of containment". In other words, the stress created by the huge weight of water could make the vessels more prone to damage in the event of aftershocks. Former General Electric reactor designer Margaret Harding told the *New York Times*: "If I were in the Japanese's shoes, I'd be very reluctant to have tons and tons of water sitting in a containment whose structural integrity hasn't been checked since the earthquake."

* The NRC report recommended the addition of boron to the cooling water being pumped into the reactor cores. Boron acts as a moderator, that is, it absorbs neutrons and can be used to shut down the nuclear fission process inside reactor cores. This function is normally performed by control rods that are inserted directly into the reactor core. Engineers who prepared the NRC report emphasised to the *New York Times* that the proposal was a precaution and that there was no evidence of sustained nuclear fission, also known as criticality. The recommendation does, however, indicate both the danger of criticality and serious concerns over the extent of damage to the reactor cores, which at this stage can only be estimated.

* The spent fuel rod pools associated with reactor units 1, 2, 3 and 4 are a further danger. At the end of their useful life, fuel rods are removed from the reactor core and placed in cooling pools for a lengthy period. The initial hydrogen explosions may have been caused because water drained out of the pools, the rods

overheated—damaging the zirconium cladding—and hydrogen was generated after the pools were flooded with salt water. Unlike the reactor cores, the spent fuel rod pools are not protected by extensive shielding and are now exposed to the atmosphere in the damaged reactor buildings.

The *New York Times* added: “The document also suggests that fragments or particles of nuclear fuel from the spent fuel pools above the reactors were blown ‘up to one mile from the units,’ and that pieces of highly radioactive material fell between two units and had to be ‘bulldozed over,’ presumably to protect workers at the site. The ejection of nuclear material, which may have occurred during one of the earlier hydrogen explosions, may indicate more extensive damage to the extremely radioactive pools than previously disclosed.”

The NRC report has been regularly updated since it was produced on March 26, but, according to the *New York Times*, the original version still reflected current thinking among the nuclear experts involved.

Union of Concerned Scientists (UCS) scientist David Lochbaum, who was not involved in the report, told the newspaper that the document revealed serious ongoing problems. “I thought they were, not out of the woods, but at least at the edge of the woods,” he said. “This paints a very different picture, and suggests that things are a lot worse. They could still have more damage in a big way if some of these things don’t work out for them.”

Yesterday, more than a week after the NRC report was drawn up, TEPCO announced that it was preparing to pump nitrogen into the containment vessel of Unit 1. TEPCO officials played down the dangers, declaring it was only a precaution. Hidehiko Nishiyama, spokesman for Japan’s Nuclear and Industrial Safety Agency (NISA), told a press conference there was “no immediate risk of a hydrogen explosion occurring.”

Yet a NISA engineer speaking anonymously to the *Wall Street Journal* explained that the risk of a hydrogen explosion could increase as the reactor core cooled and the pressure inside the containment vessel dropped, drawing in air from outside. The containment vessels were meant to be airtight but some of the vents and pipes running into and out of the reactor were believed to be damaged, he said, and could thus allow air to seep in,

creating conditions for a hydrogen explosion.

The reassurances offered by TEPCO and NISA are highly questionable given that the condition of the containment vessels and the cores of three reactors is not known with any precision. TEPCO has said that 70 percent of fuel rods in the core of reactor 1 are damaged, as well as 20-30 percent of fuel rods in reactors 2 and 3. However, even if these estimates are accurate, the state of the fuel rods is only one element of the complex problem in fully stabilising the reactors.

The NRC assessment pointed to the danger that the initial use of saltwater to cool the reactor cores may have led to deposits of salt and blocked the circulation pathways, particularly in reactor 1. The report stated that water flow in that reactor “is severely restricted and likely blocked.” Inside the core itself “there is likely no water level” and therefore “it is difficult to determine how much cooling is getting to the fuel.” Similar, though less severe, problems probably affected reactors 2 and 3 as well. The switch from salt water to fresh water last week may have eased the dangers by washing away some of the salt, but the actual situation was not known.

None of the dangers identified by the NRC assessment has been aired by TEPCO, NISA or indeed by the IAEA—the international nuclear regulatory body. The very fact that the NRC document has not so far been made public points to a conspiracy of silence aimed at playing down the extent of the Japanese nuclear disaster and ongoing dangers, so as to allow business as usual in a highly profitable industry.



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