

[A Nuclear Hail Mary – Seawater or Disaster](#)

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By Roger Witherspoon

The announcement by the Japanese government that sea water is being pumped into the damaged reactor building at the Fukushima signals the failure of all contingency plans to prevent a meltdown of the fuel in the reactor itself.

It leaves open the question of the safety of the hundreds of tons of spent fuel stored nearby in pools 40 feet deep. It is not clear if the structural integrity of the pool has been maintained or if the explosion has damaged the irradiated fuel bundles or the water flow systems serving them.

David Lochbaum, nuclear safety engineer of the Union of Concerned Scientists and a consultant to both industry and the Nuclear Regulatory Commission said in an interview this evening that the declaration by the government that the massive hydrogen explosion had not destroyed the reactor vessel itself was only part of the story.

“The control room is in the vicinity of the explosion,” Lochbaum said. “You could definitely have lost control room equipment, power cables, and safety system control cables. In addition, it looked from the film that there was a fire after the explosion. The fact that anything inside the dry well containing the reactor vessel wasn’t directly affected is not the full story because so much of the equipment that cools the dry well is outside and vulnerable.”

The use of Sea water or river water, he added “is at the bottom of the list of tactics, and you have basically used up all other options if you turn to that. It means you have had a very bad day, and you are going to pump water into the primary containment building until it is flooded and you allow that to cool the reactor vessel.”

By flooding the containment building above the level of the reactor, it is nearly impossible to manually reach systems designed to service it. The vessels contain about a dozen relief valves used to protect the pipes from bursting due to excessive pressure. If these are left manually opened, there is a path for water to flow into the reactor vessel itself.

“But the flow rate by that route is very small,” said Lochbaum. “It’s about 40 gallons a minute.”

The government has not explained why it is adding boric acid and if the acid is being used to prevent criticality in the reactor or in the spent fuel pool. A spokesman for the Embassy of Japan in Washington, DC said the boric acid was being added as a “precautionary measure,” but he did not know what the precaution was for.

The reactor’s control rods are made of boron, and these were inserted when the trouble began to stop the ongoing fission. Under normal circumstances, therefore, no additional boric acid would be needed.

If, however, some of the fuel bundles were damaged and broken, those pieces would lie on the bottom of the reactor vessel and can approach criticality – unless they are neutralized. Boric acid could be inserted to prevent those broken pieces from reaching critical mass within the reactor.



They could also be used to help prevent a far more serious melt down in the spent fuel pool. The explosion, said Lochbaum, as dramatic as it was, was not likely to have been strong enough to destroy the walls of the spent fuel pools, which usually consist of about five feet of reinforced concrete.

But water containing boric acid has to continually circulate in the pool to keep the bundles cool. When the power was lost at the site, the cooling system for the pools stopped. And the batteries used to try and restore cooling to the reactor vessel itself

are not strong enough to also operate cooling systems for pool. On average, the water in these pools would heat up and evaporate to the point where the tops of the fuel bundles were exposed about 24 hours after the cooling system shut down.

In addition, if the explosion knocked debris from the roof into the pool, it could interfere with natural convection cooling some of the fuel bundles, or even break some of them, sending the irradiated fuel chunks to the bottom of the pool where they could reach critical mass. Boric acid could be added to the pools to help prevent that development.

“They got a one-two punch,” said Lochbaum. “If it had just been the earthquake, or just the tsunami, we wouldn’t even be talking about this. But the combination of nature was more than they could handle. It doesn’t seem that they have lost control yet. But they have definitely run out of options. If those solutions – the sea water and the boric acid – don’t work, there are no more arrows in the quiver. They have shot everything they have, they have run out of options and there is nothing left.”