

# Domino Effect: 12-Year Series of Failed Fixes at Fukushima

By John LaForge

Japan's record-breaking earthquake and tsunami waves of March 2011— which first smashed the reactors' foundations and the electrical grid, then destroyed back-up power generators — led to a “station blackout” and the meltdown of three large reactors at Fukushima Daiichi.

At the time, Tokyo Electric Power Co. (Tepco) had refused to upgrade its sea wall to a sufficient height, although the firm had been warned of the risk of extreme tsunamis. The result was a catastrophic, unprecedented simultaneous triple reactor meltdown: a radioactive pollution catastrophe that has never before been seen on Earth.

Although Tepco's cost-cutting on the sea wall was only the first in a string of pollution-intensive failures that have followed like dominoes, it led in July 2022 to convictions of four top Tepco executives for negligence and a fine of \$92 billion. Tepco itself had predicted in June 2008 that the site could be hit by a tsunami over 50 feet in height after a major earthquake.

In the 12 years since the meltdowns, Tepco's disaster response efforts, always heralded as “fixes,” have been a series of hugely expensive failures: the “advanced” wastewater filter system “ALPS” has failed; the groundwater “ice wall” barrier has failed; containers made for radioactive sludge left by ALPS have failed; and plans to deal with millions of tons of collected debris now kept in plastic bags are being fiercely resisted by Japanese citizens.

Tons of cooling water is still poured into Fukushima's triple wrecks every day to keep the hot melted fuel from again running amok. Additionally, groundwater continues to gush through countless foundation cracks and fissures caused by the earthquake, into what's left of the structures' sub-floors. All this water becomes highly radioactive as it passes over and through the three giant masses, some 880 tons, of melted and mangled uranium and plutonium fuel.

You read that right. Fukushima's destroyed reactor No. 3 was using “mixed oxide” fuel made with plutonium, which is a major piece of the three deadly corium masses. (See sidebar on this page.) This plutonium contaminates not just the cooling water and groundwater contacting the melted fuel, but the ALPS apparatus and its filters, and the containers used to store the highly radioactive waste sludge extracted by ALPS.

## Failed ALPS means million-tonne do-over

Tepco's jerry-rigged system dubbed Advanced Liquid Processing System (ALPS) has never worked as planned. “The ALPS system failed to reduce radioactive elements, as claimed by the owner,” *Power Technology*, reported June 2, 2021. Senior East Asia Greenpeace researcher Shaun Burnie wrote in June 2023, “The ALPS has been a spectacular failure.”

Tepco has repeatedly said ALPS would remove 62 radioactive materials — all but tritium and carbon-14 from the continuously expanding volume of wastewater. Some of the deadly isotopes picked up when the water runs over and through the three melted masses of reactor fuel include cesium, strontium, cobalt, ruthenium, carbon-14, tritium, iodine, plutonium, and over 54 others.

Consequently, Tepco says it will re-filter over 70 percent of the 1.37 million tonnes of wastewater stored in giant tanks on site. Approximately 875,000 tons of contaminated water must be put through the system again, a process that will leave behind more of the highly radioactive and corrosive waste sludge.

Shaun Burnie's reporting on ALPS is worth quoting at length:

“About 70 percent or 931,600 cubic meters of the wastewater needs to be processed again (and probably many more times) by the ALPS to bring the radioactive concentration levels below the regulatory limit for discharge. Tepco has succeeded in reducing the concentration levels of strontium, iodine, and plutonium in only 0.2 percent of the total volume of the wastewater, and it still requires further processing. But no secondary

processing has taken place in the past nearly three years. Neither Tepco nor the Japanese government [have] said how many times the wastewater needs to be processed, how long it will take to do so, or whether the efforts will ever be successful. Greenpeace reported on these problems and why the ALPS failed nearly five years ago, and none of these issues has been resolved.”

## Ice wall also melts

Tepco intended to reduce the volume of groundwater gushing into the reactor building foundations by digging a \$350 million “ice wall” into the earth between the destroyed reactors and the mountains behind. The company placed 1,568 heavy pipes filled with coolant 90 feet deep. It was to freeze the ground to form a deep impenetrable barrier, diverting groundwater to either side of the destroyed six-reactor Fukushima complex and prevent it seeping inside. It has failed to do so. In 2016, the



South Korean protesters lampooned Japanese authorities who said you could drink the 1.37 million tonnes of radioactive wastewater they intend to pump into the Pacific Ocean.

*Times of London* reported that the scheme had only a “minor impact” on the volume of groundwater rushing in, which at the time still averaged 321 tonnes a day. Tepco announced then that it would retrofit the system and fix the leaks, but *Science/The Wire* reported in January 2022 that the company had admitted that its ice wall was “partially” melting. About 150 tonnes per day still gushes in.

## Filtered sludge burning through containers

The ALPS filter has produced over 4,000 large containers filled with highly radioactive slurry and sludge left from the treatment.

Like the use of the word “advanced” in the name of the failed ALPS machinery, the heavy cylinders used for the caustic, highly radioactive sludge are called “High Integrity Containers” or HICs. In fact they are made of plastic and have degraded far faster than Tepco anticipated.

## Plutonium Spread Long Distances from Fukushima

Very few reports of the Fukushima catastrophe have mentioned plutonium contamination. Yet plutonium was used in fuel rods in Fukushima's reactor 3 which was destroyed by meltdown and several hydrogen explosions.

Following the March 14, 2011 explosion at reactor 3, experts worried about the release of the extremely dangerous radioactive substances. Then a week later, on March 21 and 22, Tepco announced that it had detected plutonium in soil collected from its compound.

Plutonium is one of the most toxic substances known to science, and fine particles are far more biologically hazardous than larger particles.

Now, studies published in the journals *Science of The Total Environment*, Nov. 15, 2020, and *Chemosphere*, July 2023, report that researchers found that cesium and plutonium “were transported over long distances,” and that deposits of them were recorded in “downtown Tokyo,” about 142 miles from the meltdowns.

According to the authors, very high concentrations of radioactive cesium were released during the accident as particles referred to as “cesium-rich micropar-

By March 2, Tepco had filled 4,143 containers, according to the daily *Asahi Shimbun*. At 30 cubic feet each, the cylinders now store a total of about 124,290 cubic feet of the highly radioactive sludge that will soon require expensive repackaging and, eventually, isolation from the biosphere for thousands of years.

Over two years ago, on June 8, 2021, Japan's Nuclear Regulation Authority (NRA) announced that 31 of the containers had “exceeded their lifespans” and were corroded badly enough by the harsh toxic material that they must be replaced. The NRA also warned that another 56 cylinders would need replacing within two years.

Japan's *Mainichi* newspaper reported that the government regulators blamed Tepco for “underestimating the radiation the 31 plastic cylinders were exposed to.” The company then claimed it would start moving the contents to new containers.

The *Asahi Shimbun* reported April 27, 2023, that the HICs must be stored in concrete boxes that can block radiation.

## Rad waste to be dumped, deregulated

As we go to press, Tepco has begun testing its large tunnel, with which it intends to begin dispersing 1.37 million tonnes of contaminated wastewater into the Pacific Ocean. The government has steadfastly ignored fierce local and international opposition to the plan from the fishing community, marine scientists, Pacific Island nations, environmentalists, South Korea, and China. So far only South Korean politicians have suggested bringing international legal action against the dumping.

Since the 2011 meltdowns spewed radioactive materials broadly across Japan's main island, some 22-million tonnes of cesium-contaminated soil, leaves, and debris have been scraped from the ground and stored in large bags. Citizens are struggling desperately prevent authorities from using the radioactive waste in road building or burning it in incinerators. The bags are currently stacked in tens of thousands of piles all over the region.

Even more protest was raised last February when the NRA announced it would allow Tepco to severely weaken its monitoring of radioactivity in the dumped waste. The NRA said it reduced the number of radioactive elements to be measured from 64 to 34.

The environment minister of Hong Kong, a coastal metropolis of 7.5 million people, charged in June that Japan is “violating its obligations under international law and endangering the marine environment and public health.” Minister Tse Chin-wan wrote in the daily *Ta Kung Pao* that the city would “immediately prohibit imports of seafood caught off the coast of Fukushima prefecture.”

ticles” (CsMPs). The researchers say CsMPs they found are mainly composed of silicon, iron, zinc, and cesium, and minor amounts of radioactive tellurium, technetium, molybdenum, uranium, and plutonium.

The studies, involving scientists from six countries and led by Associate Professor Satoshi Utsunomiya, a researcher at Kyushu University, found that “plutonium was included inside cesium-rich microparticles that were emitted from the site.”

Radioactive CsMPs released from Fukushima are a potential health risk through inhalation. “Given the small size of the particles, they could penetrate into the deepest parts of the lung, where they could be retained,” Utsunomiya wrote. “The route of exposure of greatest concern is inhalation,” the authors reported, because plutonium, lodged in the lungs, can “remain for years.”

Utsunomiya summed up his team's work saying, “It took a long time to publish results on particulate Pu from Fukushima ... but research on Fukushima's environmental impact and its decommissioning are a long way from being over.” — *JL*