Fukushima Waste Filter Leaves Corrosive Radioactive Sludge

Ever wonder what happens with the radioactive materials that Tokyo Electric Power Co. said it would remove using a filter system from its 1.25 million tons of Fukushima waste water? The cesium-137, strontium-90, cobalt-60, ruthenium-106, carbon-14, tritium, iodine-129, plutonium-239, and dozens of other isotopes end up as highly radioactive sludge collected by the Advanced Liquid Processing System. And although the ALPS system has failed to remove these deadly isotopes from 70 percent of the water, the "clean-up" system has so far produced some 3,000 large containers filled with the radioactive sludge. Approximately 875,000 tons of waste water stored in large tanks must be refiltered, which will produce more "hot" sludge.

In June, Japan's Nuclear Regulation Authority announced that 31 of the 3,000 containers holding this deadly sludge were corroded badly enough that they must be replaced, the daily *Mainiichi Japan* reported. The authority also warned that another 56 cylinders would need replacing within two years.

Each waste cylinder is reportedly about 5 feet in diameter and 6.2 feet tall. So, with about 30 cubic feet of hot sludge each, the 3,000 cans hold at least 90,000 cubic feet of highly radioactive waste that will require expensive permanent isolation.

Because of its corrosiveness and extremely long-lived radioactivity, this waste will require monitoring and repeated re-packaging in perpetuity — an expense not included when nuclear power advocates report electric rates to customers.

Uproar over Japan's Decision on Waste Water

— Continued from cover

ruthenium-106, cobalt-60, and many other radionuclides that the system had failed to adequately remove." Safecast is an international nonprofit that conducts citizen monitoring of environmental radiation and other hazards.

Japan's Nuclear Regulatory Agency said that radioactivity in the released yet continuously accumulating waste water will be "within international limits," and Deputy Prime Minister Taro Aso went so far as to say the waste would be "safe to drink." (See p. 4) However, Prof. Steiner also reported that Tepco had admitted its waste water contains significant amounts of radioactive carbon-14. "As carbon-14 has a half-life of 5,730 years, and is known to bio-accumulate in marine ecosystems and cause cellular and genetic impairment, this is a very serious concern. Fukushima carbon-14 will be added to the elevated radioactive carbon-14 load in the oceans from nuclear weapons tests last century — "bomb carbon" — now found in organisms even in the deepest part of the ocean, the Marianas Trench," he wrote.

Japan's dumping decision means that alternatives recommended by experts were rejected in favor of the cheapest choice. Other options include expansion and long-term tank storage to allow the waste's radioactivity to decrease, replacing the ALPS filter with a system that removes tritium and all the rest, or evaporation of the waste water.

Kazue Suzuki, a climate and energy campaigner at Greenpeace Japan, said the government had "discounted the radiation risks and turned its back on the clear evidence that sufficient storage capacity is available on the nuclear site as well as in surrounding districts."

Korean experts warned that "radioactive materials not properly filtered and discharged into the sea could be hazardous to those living in Korea and its neighboring China," the *Korea Herald* reported. Choi Yoon, a professor at South Korea's Kunsan National University, told Al Jazeera April 24, "When radioactive materials such as cesium or tritium flow into the ocean, they are absorbed into living things, mainly plankton. And through the food chain, radioactive materials accumulate in bigger fishes that eat lots of plankton or smaller fishes."

"Through the sea's currents, it can affect fishes near the Korean Peninsula, East Asia and even the entire world although the degree of dilution may vary," Yoon said.

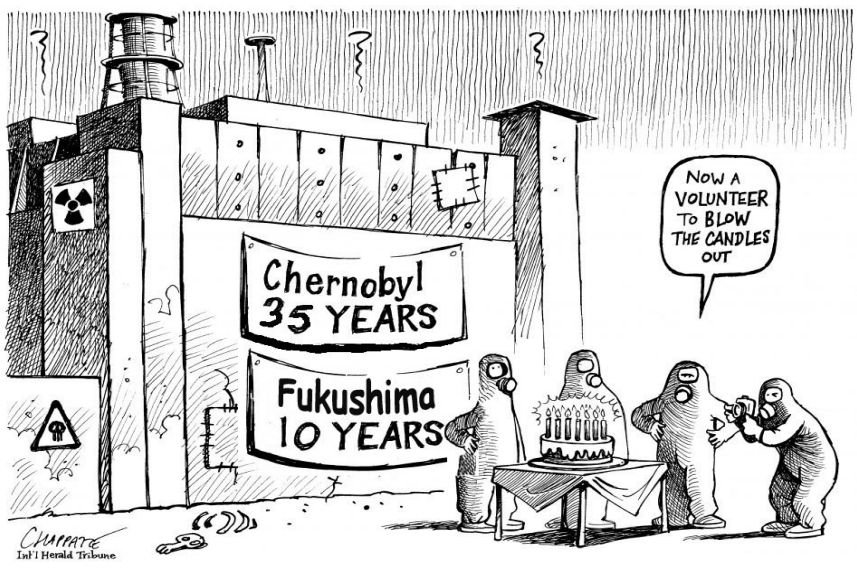
From the South Pacific the *Guardian* reported that Motarilavoa Hilda Lini, a Vanuatu [Pacific island nation] stateswoman and member of the Nuclear-Free and Independent Pacific movement said, "If it is safe, dump it in Tokyo, test it in Paris, and store it in Washington, but keep our Pacific nuclear-free."

Only 30 percent of 1.25 million metric tons of Tepco's filtered radioactive waste water, which passed through the Advanced Liquid Processing System, has been cleared of high-risk radioactive materials. Dangerous isotopes have been found in up to 875,000 metric tons of the stored waste. Ingestion of "strontium-90 increases the risk of developing leukemia and bone cancer, according to a report by the Korea Energy Information Culture Agency," the *Korea Herald* warned.

Suzuki, with Greenpeace Japan, said, "The Japanese Government has taken the wholly unjustified decision to deliberately contaminate the Pacific Ocean with radioactive wastes." The group's international executive director Jennifer Morgan added that the plan for wastewater disposal "is a violation of Japan's legal obligations under the United Nations Convention on the Law of the Sea, and will be strongly resisted over the coming months."

For years leading up to Japan's announcement, government officials, Tepco and nuclear power lobbyists have claimed that tritium, the radioactive form of hydrogen, is not harmful in small amounts. This statement is untrue; see "Reassessing" below and "UN Experts" on p. 3.

In dozens of reports on Japan's decision, officials repeatedly acknowledged that radioactive tritium is routinely released into public waters by operating reactors, and that this has been a permitted industrial practice for six decades.



The "we do this all the time" admissions appeared to be presented as a kind of reassurance, as if polluting the Great Lakes and major rivers like the Ohio, Missouri, Arkansas, Tennessee, and Mississippi is blasé. It continues because the nuclear industry and most government and regulatory agencies deny a connection between environmental radioactive pollution and the alarming rate of cancer incidence in humans.

— Apologies to artist P. Chappatte on this page as we added the Fukushima banner to his 2006 cartoon.

Reassessing Tritium's Threats to Humans and the Environment

By Ian Fairlie

Tritium decays via beta particle emissions and can be more dangerous than most X-rays. It has a radioactive half-life of 12.3 years. While most of its atoms will have decayed in ten half-lives (123 years), many scientists believe it might take 20 half-lives (246 years) or more to reach safe levels. The safety of tritium after centuries depends partly on how much was emitted, since a small fraction of a large amount can still be very hazardous.

Tritium's gaseous form, tritium oxide (i.e., radioactive water or radioactive water vapor), enters the body by inhalation, ingestion, or absorption through the skin. Tritium in the body immediately mixes with body fluids and is dispersed widely because water is found everywhere in our bodies. Once inside the body, it becomes organically bound and can concentrate in cells and certain organs.

Because of its long half-life, it resides in tissues and organs for extended periods. This can increase cancers and congenital malformations for those living near nuclear facilities.

For most of the 20th century, tritium was often dismissed as a "weak" radionuclide which led many to underestimate its hazards. All this changed in the 21st century when scientists began to realize that tritium is much more dangerous than previously suspected. Although tritium is a low-range beta [particle] emitter, it can be very harmful as an internal emitter (when it gets inside the body). ... It is also quite dangerous because it remains in the body for long periods.

Studies reveal that tritium is one of the most common internal emitters found in humans. As an internal emitter, tritium can alter cellular DNA and cause a variety of damaging health effects. One of the most significant effects is cancer which sometimes takes years to develop. Many epidemiological studies have reported increases in cancers and congenital malformations among people living near nuclear facilities.

The new concern about tritium is partly because all nuclear facilities emit very large amounts of tritium. In its elemental form, tritium diffuses through most containers, including those made of steel and concrete. Tritium is difficult to contain, and in its oxide form it is generally not detected by commonly used survey instruments. … large amounts are produced in nuclear reactors. It contaminates the concrete structures at nuclear power reactors so that the older the station, the more the contamination. Large amounts of tritium continue to be released for decades after a reactor is closed.

We now know that tritium has an exceptionally high molecular exchange rate with stable hydrogen atoms thus making it extremely mobile in the environment. Emissions from nuclear facilities can rapidly contaminate all biota in adjacent areas. Tritium binds with organic matter to form organically bound tritium.

Tritium is the only one of the three hydrogen isotopes that is radioactive. It is an essential component of every nuclear weapon.

— Dr. Ian Fairlie is a radiation biologist and author of "The Other Chernobyl Report," updated as "TORCH-2016: An independent scientific evaluation of the health-related effects of the Chernobyl nuclear disaster," of March 2016