Critics of Japanese Storage System See a Worse-Than-Chernobyl Scenario Ahead

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> With attention focused on tons of radioactive spent fuel that may have ignited, some experts say the Japanese will be lucky if the stricken Fukushima plant creates a disaster only the size of Chernobyl in 1986.

These spent fuel rods are now being blamed for the radioactive releases over Japan. While the reactor cores are encased in bulky containment vessels, spent fuel is separated from the environment only by the water in the pools, said former nuclear engineer David Lochbaum of the Union of Concerned Scientists in Cambridge, Mass.

That those spent fuel rods were even kept at the Japanese plant is controversial. Some used rods remain hot enough to ignite their metal coatings and release dangerous plumes of radioactive gases and dust.

Critics such as Lochbaum argue this storage system, which is widely used in the United States, poses an unnecessary hazard. Indeed, most of the 62,500 metric tons of spent fuel in the United States is stored in similar pools on site at power plants, including Limerick in Montgomery County, Peach Bottom in York County, Oyster Creek plant in Ocean County, and the Salem and Hope Creek plants in Salem County.

Some experts argue the system is not inherently flawed.

Local nuclear plants are designed to withstand earthquakes, terrorist attacks, and other potential disasters, said Krishna "Kris" Singh, an engineer and chief executive officer of Marlton-based Holtec who designed the nuclear-waste storage systems used in most local plants.

Singh said people in the East should not panic, considering how astronomically unlikely it is that a tsunami or magnitude-9 earthquake would ever hit the Mid-Atlantic region.

His firm has been asked to reevaluate storage pools at the Diablo Canyon plant in California, where such a large quake remains possible. He said that plant's overall design was more earthquake-proof than was Fukushima.

Putting rods in swimming-pool-size concrete tanks was intended only to serve as temporary storage, Lochbaum said. Before the mid-1970s, much of the country's nuclear waste was sent for reprocessing, a type of recycling that has fallen out of favor because it produces weapons-grade plutonium.

Lochbaum said his opposition to the overuse of on-site "wet" storage led him to leave the industry and join the Union of Concerned Scientists, a group focused on nuclear safety and other environmental concerns.

Many pools at U.S. plants routinely store as much as 10 times as much waste as pools at Fukushima.

Singh and other experts said it was too early to tell why the water levels in the spent pools at Fukushima appear to have dropped enough to expose some of the fuel. The thick concrete that contains the water might have been damaged in the earthquake or water may have sloshed out.

The pools are put on the top floor of the reactor buildings - a placement that is considered an engineering choice, according to a spokesman for the Nuclear Energy Institute.

Several of the spent pools at Fukushima were reportedly losing water, but the one at Reactor 4 is causing the most concern because it carries the most fuel and the hottest spent fuel - 135 tons of rods, many of them removed just in December.

Although the fuel in these pools is considered spent, it's still so radioactive that without cooling, it will spontaneously heat up to between 1,500 and 1,800 degrees, enough to ignite the metal cladding that surrounds the fuel pellets. That burning releases explosive quantities of hydrogen gas, which can further damage the fuel and the storage pool.

As the rods heat up, Lochbaum said, gases laced with radioactive substances expand inside the rods. If the metal is breached, these gases are lofted into the atmosphere. If the temperature gets hot enough, fuel pellets will begin to crumble and release dust-size particles containing various radioactive by-products.

According to a briefing by the Physicians for Social Responsibility, those releases can contain strontium-90, which tends to concentrate in bones and cause bone cancer. Some of the fuel at Fukushima contains plutonium, which can cause lung cancer.

Also of grave concern is cesium-137, which has a long half-life and can persist in the environment for more than a century. Cesium-137 released in the Chernobyl disaster rendered huge swaths of the Ukraine uninhabitable.

The United States has never come to any agreement on how to deal with nuclear waste, which can remain radioactive for millions of years.

Singh said he still believed storage in pools can be done safely, especially as technology advances. "Clearly the earthquake was of much greater severity than the plant was designed for," he said.

Singh said his company was creating a new system that would shield the spent fuel. "We're designing it so you'll be able to walk into the building even if you had a horrible scenario like this one," he said.

He has designed aluminum racks that allow U.S. nuclear plants to store many more spent fuel rods in the same pools. Singh's company also supplies a system of dry storage, in which waste is sealed in casks. Lochbaum and others at the Union of Concerned Scientists consider this a much safer alternative in the face of earthquakes, terrorist attacks, or other threats still unknown.

Singh's nuclear-power innovations have led to more than 17 patents. His company's storage systems are used at 80 of the country's 104 nuclear plants. A technological optimist, Singh has recently donated $20 million to his alma mater, the University of Pennsylvania, for a new building devoted to nanotechnology.

Until the 1970s, spent fuel rods were partially recycled, the various components were separated out, leaving behind weapons-grade plutonium and uranium. But once the United States had enough

plutonium to destroy the world 100 times over, the government prohibited reprocessing.

The Nuclear Energy Institute, an industry group, favors a combination of reprocessing, dry storage, and transfer to an ultimate resting place at Yucca Mountain in Nevada. For years, public opposition prevented any waste from being stored there, and in 2009 the Obama administration ruled against using the site. But the utilities and industry group continue to push for it.

Whatever happens to the nuclear energy industry in the wake of the Fukushima disaster, some 60,000 metric tons of nuclear waste will remain with us.

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http://www.philly.com/philly/health_and_science/118286854.html

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