

US spent-fuel storage sites are packed

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This April 14, 1998 file photo shows the defunct Maine Yankee nuclear power plant in Wiscasset, Maine. The nuclear crisis in Japan has laid bare an ever-growing problem for the United States _ the enormous amounts of still-hot radioactive waste accumulating at commercial nuclear reactors in more than 30 states. The U.S. has nearly 72,000 tons of the stuff, according to state-by-state numbers obtained by The Associated Press. But the nation has no place to permanently store the material, which stays dangerous for tens of thousands of years. (AP Photo/Robert F. Bukaty, File)

(AP) -- The nuclear crisis in Japan has laid bare an ever-growing problem for the United States - the enormous amounts of still-hot radioactive waste accumulating at commercial nuclear reactors in more than 30 states.

The U.S. has 71,862 tons of the waste, according to state-by-state numbers obtained by The Associated Press. But the nation has no place

to permanently store the material, which stays dangerous for tens of thousands of years.

Plans to store nuclear waste at Nevada's Yucca Mountain have been abandoned, but even if a facility had been built there, America already has more waste than it could have handled.

Three-quarters of the waste sits in water-filled cooling pools like those at the [Fukushima](#) Dai-ichi nuclear complex in Japan, outside the thick concrete-and-steel barriers meant to guard against a radioactive release from a [nuclear reactor](#).

Spent fuel at Dai-ichi overheated, possibly melting fuel-rod casings and spewing radiation into the air, after Japan's tsunami knocked out power to [cooling systems](#) at the plant.

The rest of the spent fuel from commercial U.S. reactors has been put into dry cask storage, but regulators only envision those as a solution for about a century and the waste would eventually have to be deposited into a Yucca-like facility.

The U.S. [nuclear industry](#) says the waste is being stored safely at power-plant sites, though it has long pushed for a long-term storage facility. Meanwhile, the industry's collective pile of waste is growing by about 2,200 tons a year; experts say some of the pools in the United States contain four times the amount of spent fuel that they were designed to handle.

The AP analyzed a state-by-state summary of spent fuel data based on information that nuclear power plants voluntarily report every year to the Nuclear Energy Institute, an industry and lobbying group. The NEI would not make available the amount of spent fuel at individual power plants.

While the U.S. Department of Energy previously reported figures on overall spent fuel storage, it no longer has updated information available. A spokesman for the U.S. Nuclear Regulatory Commission, which oversees [nuclear power plant](#) safety, said the agency was still searching for a compilation of spent fuel data.

The U.S. has 104 operating nuclear reactors, situated on 65 sites in 31 states. There are another 15 permanently shut reactors that also house spent fuel.

Four states have spent fuel even though they don't have operating commercial plants. Reactors in Colorado, Oregon and Maine are permanently shut; spent fuel from all three is stored in dry casks. Idaho never had a commercial reactor, but waste from the 1979 Three Mile Island accident in Pennsylvania is being stored at a federal facility there.

Illinois has 9,301 tons of spent nuclear fuel at its power plants, the most of any state in the country, according to industry figures. It is followed by Pennsylvania with 6,446 tons; 4,290 in South Carolina and roughly 3,780 tons each for New York and North Carolina.

Spent nuclear fuel is about 95 percent uranium. About 1 percent are other heavy elements such as curium, americium and plutonium-239, best known as fuel for nuclear weapons. Each has an extremely long half-life - some take hundreds of thousands of years to lose all of their radioactive potency. The rest, about 4 percent, is a cocktail of byproducts of fission that break down over much shorter time periods, such as cesium-137 and strontium-90, which break down completely in about 300 years.

How dangerous these elements are depends on how easily can find their way into the body. Plutonium and uranium are heavy, and don't spread through the air well, but there is a concern that plutonium could leach

into water supplies over thousands of years.

Cesium-137 is easily transported by air. It is cesium-137 that can still be detected in a New Jersey-sized patch of land around the Chernobyl reactor that exploded in the Ukraine in 1986.

Typically, waste must sit in pools at least five years before being moved to a cask or permanent storage, but much of the material in the pools of U.S. plants has been stored there far longer than that.

Safety advocates have long urged the NRC to force utility operators to reduce the amount of spent fuel in their pools. The more tightly packed they are, the more quickly they can overheat and spew radiation into the environment in case of an accident, a natural disaster or a terrorist attack.

Industry leaders say new technology has made fuel pools safer, and regulators have taken some steps since the 9/11 terror attacks to reduce fuel pool risks. Kevin Crowley, who directs the nuclear and radiation studies board at the National Academy of Sciences, says lessons will be learned from the crisis in Japan. And NRC Chairman Gregory Jaczko says his agency will review how spent fuel is stored in the U.S.

A 2004 report by the academy suggested that fresh spent fuel, which is radioactively hotter, be spread among older, cooler assemblies in the spent fuel pool. "You're buying yourself time, basically," says Crowley. "The cooler ones can act as a thermal buffer."

First Energy, which runs two nuclear power stations in Ohio and one in Pennsylvania, was able to reconfigure the spent fuel rods in its pools to make more room. Still, the company is now running out of space, says spokesman Todd Schneider. Ohio has 1,136 tons of spent fuel in pools and 37 tons in dry casks.

The casks in the U.S. are kept outdoors, generally on concrete pads, but industry officials insist they are safe. Unlike the pools, the casks don't need electricity; they are cooled by air circulation.

One cask model, selling for \$1.5 million, places spent fuel inside a stainless steel canister, which is placed inside an "overpack" - an outside shell composed of a layer of carbon steel, 27 inches of concrete and another layer of carbon steel. When in place, the system stands 20 feet tall and weighs 190,000 pounds, said Joy Russell, said spokeswoman for manufacturer Holtec International of Florida.

Russell said engineers have designed the system to withstand a crash from an F-16 fighter jet and survive the resulting jet fuel fire.

Plant operators in some states have moved aggressively to dry cask storage. Virginia has 1,533 tons of nuclear waste in dry storage and 1,105 tons in spent fuel pools. Maryland has 844 tons in dry storage and 588 tons in spent fuel pools.

Utilities in Texas, though, have not. There are 2,178 tons kept in spent fuel pools at reactor sites there, and zero in dry casks. In New York, 3,345 tons are in spent fuel pools while only 454 tons are in dry storage.

No cask is totally invulnerable, but the academy report found that radioactive releases from casks would be relatively low.

"If you attacked a fuel cask and managed to put a hole in it, anything that came out, the consequences would be very local," Crowley said.

Casks can be licensed for 20 years, with renewals, said Carrie Phillips, spokeswoman for the Atlanta-based Southern Co., which has a dozen such casks at its two-reactor Joseph M. Farley plant near Columbia, Ala. She said officials have "every expectation" the casks could last "in excess of 100 years by design."

But not the needed tens of thousands of years. For long-term storage, the government had looked to Yucca Mountain. It was designed to hold 77,160 tons - 69,444 tons designated for commercial waste and 7,716 for military waste. That means the current inventory already exceeds Yucca's original planned capacity.

A 1982 law gave the federal government responsibility for the long-term storage of nuclear waste and promised to start accepting waste in 1998. After 20 years of study, Congress passed a law in 2002 to build a nuclear waste repository deep in Yucca Mountain.

The federal government spent \$9 billion developing the project, but the Obama administration has cut funding and recalled the license application to build it. Nevadans have fiercely opposed Yucca Mountain, though a collection of state governments and others are taking legal action to reverse the decision.

Despite his Yucca Mountain decision, President Barack Obama wants to expand nuclear power. He created a commission last year to come up with a long-term nuclear waste plan. Initial findings are expected this summer, with a final plan expected in January.

"They are 13 years late," says Terry Pickens, Director of Nuclear Policy at Xcel Energy, the Minneapolis-based utility that operates three reactors in Minnesota. Xcel is building steel-and-concrete cask containers to hold old waste on site, and suing the government periodically to pay for them. "We would like them to get done with what they said they would get done."

Some countries - such as France, Japan, Russia and the United Kingdom - reprocess their spent fuel into new nuclear fuel to help reduce the amount of waste.

The remaining waste is solidified into a glass. It needs to be stored in a long-term waste repository, but reprocessing reduces the volume of waste by three-quarters.

Because reprocessing isolates plutonium, which can be used to make a nuclear weapon, Presidents Gerald Ford and Jimmy Carter put a stop to it in the U.S. The ban was later overturned, but the country still does not reprocess.

France produces 1,300 tons of nuclear waste per year, and reprocesses 940 tons. Still, fuel is only reprocessed once and then it, too, needs to be stored. France is expecting that engineers will eventually succeed in building a new type of nuclear reactor called a fast reactor that will use the waste it can't reprocess as fuel.

"They've kicked the can down the road," says Frank von Hippel, a director of the Program on Science and Global Security at Princeton University.

Other countries, such as Germany, store spent fuel in casks. Finland is building a repository it says will store waste safely for 100,000 years.

Even though there is no long-term storage in the U.S., utility customers and taxpayers have been paying for it - twice.

Customers have paid \$24 billion into a fund Congress established in 1982 to pay for such storage. The charge - a penny for every 10 kilowatt-hours - would typically add up to about \$11 a year for a household that received all its electricity from nuclear plants.

Users pay as taxpayers, too - for dry storage. Utilities that have run out of storage space in pools successfully sued the federal government for breach of contract, because it failed to keep to the 1998 deadline to

establish long-term storage. By law, the money for dry casks cannot come from the nuclear waste fund, and must come from the federal budget.

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