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A Safer Nuclear Crypt

By MATTHEW L. WALD

MARSEILLES, Ill. — Watching intently as a huge white steel container surfaced from a 42-foot-deep canal, workers set upon it with long-handled tools, like sailors wrestling a flailing whale to the deck of a ship.

Yet this catch was far more menacing: 57,000 pounds of spent nuclear fuel at the LaSalle nuclear plant here, stored for decades in a pool and, if unshielded, powerful enough to deliver a lethal dose of radiation within seconds.

The fuel had just been moved into a capsule the size of a small silo, called a dry cask. Welded shut after it came out of the water, the cask was pumped full of inert gas, placed in an outer cask and moved outdoors to a concrete pad where it will sit until a disposal site is found. Spent fuel must be isolated from the environment for hundreds of thousands of years before it loses its potency.

The nuclear calamity at Japan's Fukushima Daiichi plant has refocused attention on the vulnerability of spent fuel pools at the 104 operating American nuclear plants.

The pools are generally far more packed than the damaged ones at Fukushima. Some scientists argue that the crowding raises the risk of a fire and makes the pools a tempting target for terrorists.

Several members of Congress are calling for the fuel to be moved from the pools into dry casks at a faster clip, noting that the casks are thought to be capable of withstanding an earthquake or a plane crash, they have no moving parts and they require no electricity.

"We should not wait for an American meltdown to beef up American nuclear safety measures," Representative Edward J. Markey of Massachusetts, who advocates greater reliance on casks, said after the accident in March in Japan. "We must heed the lessons to be learned from the nuclear meltdown in Japan and ensure nuclear safety here."

But transferring the fuel to dry casks involves risks of its own, some industry experts say. "It's a very complex discussion," said Neil Wilmshurst, a nuclear power expert and a vice

president of the Electric Power Research Institute, a nonprofit utility consortium. “Every time you move spent fuel, there’s always a risk of human error. How much of this do you want to do if you don’t need to do it?”

The discussion is unfolding amid a far broader and more divisive debate over nuclear waste disposal. A half-century after the American nuclear industry was born, the nation still lacks a dedicated repository for such waste because of maneuvering driven by not-in-my-backyard politics.

In 1987 Congress designated Yucca Mountain, a desolate volcanic ridge in the Nevada desert, as a national disposal site, ruling out sites in Texas and Washington State. But the political landscape shifted, and the Obama administration canceled the project in 2009 under pressure from Senator Harry Reid of Nevada, leader of the Senate’s Democratic majority.

Then came the earthquake and tsunami at Fukushima, which cut off power to four reactors and caused three cores to melt. The melting fuel in the reactors released hydrogen gas that then exploded, throwing debris into the fuel pools, destroying a barrier that had prevented the release of radioactive materials to the outdoors and leaving the pools exposed to the rain.

Suddenly, the Nuclear Regulatory Commission was under pressure to explain whether crowded American pools faced parallel risks.

Gregory B. Jaczko, chairman of the commission and a former aide to Senator Reid, contends that both fuel pools and dry cask storage are relatively safe, with any differences being fractional. “It’s like the difference between buying one ticket in the Powerball lottery and 10 tickets,” he said in an interview, referring to the odds that something will go wrong.

But Robert Alvarez, a former senior adviser to the secretary of energy and expert on nuclear power, points out that unlike the fuel pools, dry casks survived the tsunami at Fukushima unscathed. “They don’t get much attention because they didn’t fail,” he said.

In addition to the United States and Japan, plenty of other countries make extensive use of casks, usually storing them at reactor sites. Germany has gone a step further, placing them in installations designed to protect the casks from airplane crashes.

After Japan’s disaster, the Tennessee Valley Authority said it would study the possibility of moving more fuel to casks, but so far other American operators have not followed suit. Moving all of the nation’s fuel once it has cooled in the pools for at least five years could cost $7 billion, Mr. Alvarez said.

Exelon Nuclear, operator of the twin-reactor LaSalle plant, says it pays about $1 million for each cask and that loading each one with fuel costs another $500,000. It has filled six casks so far, and the concrete pad on which they sit outdoors cost the company another $1 million.

The assumption is that the fuel will remain in the casks for "years, maybe decades," said Peter Karaba, the plant manager. The fuel that was loaded the other day dates from the mid-1980s, when Mr. Karaba, 42, was still in high school.

Back in the 1960s, when most of today's reactors were designed, the consensus was that fuel would emerge from the reactors, cool for a few years in the pools, and then go to a factory where it would be chopped up. That process would take the unused uranium and plutonium created during the reactor's operation, purify them and fashion them into new fuel.

Although France and Japan do some of that recycling, Presidents Ford and Carter banned the practice in the United States for fear of encouraging a global trade in plutonium, a bomb fuel.

So American utilities turned to casks, but only when fuel pools were close to capacity, as is the case at LaSalle. Some industry specialists say that that policy should continue, partly to limit the risks posed whenever spent fuel is moved.

Industry experts acknowledge that working with casks poses some radiation risks. That is why several workers who gathered around the cask emerging from the pool at LaSalle wielded long poles with probes and Geiger counters; when they find an area of contamination, another worker with a mop on a long pole cleans it up.

The dozen or so workers who move a cask receive a collective radiation dose of about 500 millirem, or one-quarter of the maximum annual radiation exposure that regulators allow for workers at any American nuclear plant.

Plant managers made a visiting reporter watch the procedure from a monitoring room filled with flat-panel displays until the cask had been scanned by radiation detectors. "We treat this as a significant activity" requiring caution, Mr. Karaba said.

Exelon has sought to minimize the risks in other ways, too. Workers avoid hoisting a cask directly over the fuel in the pools, so that if it does fall, it will not damage the fuel rods. Work stops during thunderstorms in case electric power is interrupted.

Some nuclear engineers argue that it would be far riskier to leave the fuel in the crowded pools. Noting that the utilities have converted the pools over the years to squeeze in more fuel, a 2003 study commissioned in response to the 9/11 attacks suggested that the new

configurations raised the risk of fire. That research led Congress to ask for the National Academy of Sciences to study the pools' safety.

In 2005 the academy reported that terrorists could plausibly mount a successful attack on the pools and recommended that federal regulators evaluate whether more of the fuel should be moved to dry casks.

The Nuclear Regulatory Commission adopted one recommendation from the study, ordering that the used fuel be shuffled inside the pools in a way that would even out the heat load, but it did not tell the utilities to remove any.

Mr. Alvarez contended that this precaution was not enough to prevent an accident. "A single reactor has five to 10 times more radioactive material in the pool than was released in the Chernobyl accident" in 1986, he said in a telephone news conference on the fuel pools in May.

Once the fuel enters a cask and has left the pool at the LaSalle plant, it joins others on a concrete pad a short walk from the reactor buildings. Maintenance is relatively simple. A worker checks twice a day to ensure that nothing is blocking the vents at the bottom of the outer cask so that air can circulate past the sealed steel capsule inside, carrying away the heat generated by the fuel.

Cask manufacturers anticipate decades of healthy demand for their product. "I joke my children will be doing my job," said Joy Russell, a corporate development director at the manufacturer Holtec International.