Nowhere to Use Japan's Growing Plutonium Stockpile

ROKKASHO, Japan (AP) — How is an atomic-powered island nation riddled with fault lines supposed to handle its nuclear waste? Part of the answer was supposed to come from this windswept village along Japan's northern coast.

By hosting a high-tech facility that would convert spent fuel into a plutonium-uranium mix designed for the next generation of reactors, Rokkasho was supposed to provide fuel while minimizing nuclear waste storage problems. Those ambitions are falling apart because years of attempts to build a "fast breeder" reactor, which would use the reprocessed fuel, appear to be ending in failure.

But Japan still intends to reprocess spent fuel at Rokkasho. It sees few other options, even though it will mean extracting plutonium that could be used to make nuclear weapons.

If the country were to close the reprocessing plant, some 3,000 tons of spent waste piling up here would have to go back to the nuclear plants that made it, and those already are running low on storage space. There is scant prospect for building a long-term nuclear waste disposal site in Japan.

So work continues at Rokkasho, where the reprocessing unit remains in testing despite being more than 30 years in the making, and the plant that would produce plutonium-uranium fuel remains under construction. The Associated Press was recently granted a rare and exclusive tour of the plant, where spent fuel rods lie submerged in water in a gigantic, dimly lit pool.

The effort continues on the assumption that the plutonium Japan has produced — 45 tons so far — will be used in reactors, even though that is not close to happening to a significant degree.

In nearby Oma, construction is set to resume on an advanced reactor that is not a fast-breeder but can use more plutonium than conventional reactors. Its construction, begun in 2008 for planned operation in 2014, has been suspended since the March 2011 Fukushima nuclear meltdowns, and could face further delays as Japan's new nuclear watchdog prepares new safety guidelines.

If Japan decided that it cannot use the plutonium, it would be breaking international pledges aimed at preventing the spread of weapons-grade nuclear material. It already has enough plutonium to make hundreds of nuclear bombs — 10 tons of it at home and the rest in Britain and France, where Japan's spent fuel was previously processed.

Countries such as the U.S. and Britain have similar problems with nuclear waste storage, but Japan's population density and seismic activity, combined with the 2011 Fukushima Dai-ichi nuclear disaster, make its situation more untenable in the eyes of the nation's nuclear-energy opponents. Some compare it to building an apartment without a toilet.

"Our nuclear policy was a fiction," former National Policy Minister Seiji Maehara told a parliamentary panel in November. "We have been aware of the two crucial problems. One is a fuel cycle: A fast-breeder is not ready. The other is the back-end (waste disposal) issue. They had never been resolved, but we pushed for the nuclear programs anyway."

Nuclear power is likely to be part of Japan for some time to come, even though just two of its 50 functioning reactors are operating and Japan recently pledged to phase out nuclear power by the 2030s. That pledge was made by a government that was trounced in elections Dec. 16, and the now-ruling Liberal Democratic Party was the force that brought atomic power to Japan to begin with.

Liberal Democrats have said they will spend the next 10 years figuring out the best energy mix, effectively freezing a nuclear phase-out. Japan's new prime minister, Shinzo Abe, said he may reconsider the previous government's decision not to build more reactors.

Construction at Rokkasho's reprocessing plant started in 1993 and that unit alone has cost 2.2 trillion yen ($27 billion) so far. Rokkasho's operational cost through 2060 would be a massive 43 trillion yen ($500 billion), according to a recent government estimate.

The reprocessing facility at this extremely high-security plant is designed to extract uranium and plutonium from spent fuel to fabricate MOX — mixed oxide fuel, a mix of the two radioactive elements. The MOX fabrication plant is set to open in 2016.

Conventional light-water reactors use uranium and produce some plutonium during fission. Reprocessing creates an opportunity to reuse the spent fuel rather than storing it as waste, but the stockpiling of plutonium produced in the process raises concerns about nuclear proliferation.

Fast-breeder reactors are supposed to solve part of that problem. They run on both uranium and plutonium, and they can produce more fuel than they consume because they convert uranium isotopes that do not fission readily into plutonium. Several countries have developed or are building them, but none has succeeded in building one for commercial use. The United States, France and Germany have abandoned plans due to cost and safety concerns.

The prototype Monju fast-breeder reactor in western Japan had been in the works for nearly 50 years, but after repeated problems, authorities this summer pulled the plug, deeming the project unworkable and unsafe.

Monju successfully generated power using MOX in 1995, but months later, massive leakage of cooling sodium caused a fire. Monju had another test run in 2010 but stopped again after a fuel exchanger fell into the reactor vessel.

Some experts also suspect that the reactor sits on an active fault line. An independent team commissioned by the Nuclear Regulation Authority is set to inspect faults at Monju in early 2013.

Japan also burned MOX in four conventional reactors beginning in 2009. Conventional reactors can use MOX for up to a third of their fuel, but that makes the fuel riskier because the plutonium is easier to heat up.

Three of the conventional reactors that used MOX were shut down for regular inspections around the time three Fukushima Dai-ichi reactors exploded and melted down following the March 201l earthquake and tsunami. The fourth reactor that used MOX was among the reactors that melted down. Plant and government officials deny that the reactor explosion was related to MOX.

Japan hopes to use MOX fuel in as many as 18 reactors by 2015, according to a Rokkasho brochure produced last month by the operator. But even conventionally powered nuclear reactors are unpopular in Japan, and using MOX would raise even more concerns.

When launched, Rokkasho could reprocess 800 tons of spent fuel per year, producing about 5 tons of plutonium and 130 tons of MOX per year, becoming the world's No. 2 MOX fabrication plant after France's Areva, according to Rokkasho's operator.

The government and the nuclear industry hope to use much of the plutonium at Oma's advanced plant, which could use three times more plutonium than a conventional reactor.

Meanwhile, the plutonium stockpile grows. Including the amount not yet separated from spent fuel, Japan has nearly 160 tons. Few countries have more, though the U.S., Russia and Great Britain have substantially more.

"Our plutonium storage is strictly controlled, and it is extremely important for us to burn it as MOX fuel so we don't possess excess plutonium stockpile," said Kazuo Sakai, senior executive director of Rokkasho's operator, JNFL, a joint venture of nine Japanese nuclear plant owners.

Rokkasho's reprocessing plant extracted about 2 tons of plutonium from 2006 to 2010, but it has been plagued with mechanical problems, and its commercial launch has been delayed for years. The operator most recently delayed the official launch of its plutonium-extracting unit until next year.

The extracted plutonium will sit there for at least three more years until Rokkasho's MOX fabrication starts up.

Giving up on using plutonium for power would cause Japan to break its international pledge not to possess excess plutonium not designated for power generation. That's why Japan's nuclear phase-out plan drew concern from Washington; the country would end up with tons of plutonium left over. To reassure Japan's allies, government officials said the plan was only a goal, not a commitment.

Japan is the only nation without nuclear weapons that is allowed under international law to enrich uranium and extract plutonium without much scrutiny. Government officials say they should keep the privilege. They also want to hold on to nuclear power and reprocessing technology so they can export that expertise to emerging economies.

Many officials also want to keep Rokkasho going, especially those in its prefecture (state) of Aomori. Residents don't want to lose funding and jobs, though they fear their home state may become a waste dump.

Rokkasho Mayor Kenji Furukawa said the plant, its affiliates and related businesses provide most of the jobs in his village of 11,000.

"Without the plant, this is going to be a marginal place," he said.

But Rokkasho farmer Keiko Kikukawa says her neighbors should stop relying on nuclear money.

"It's so unfair that Rokkasho is stuck with the nuclear garbage from all over Japan," she said, walking through a field where she had harvested organic rhubarb. "... We're dumping it all onto our offspring to take care of."

Nearly 17,000 tons of spent fuel are stored at power plants nationwide, almost entirely in spent fuel pools. Their storage space is 70 percent filled on average. Most pools would max out within several years if Rokkasho were to close down, forcing spent fuel to be returned, according to estimates by a government fuel-cycle panel.

Rokkasho alone won't be able to handle all the spent fuel coming out once approved reactors go back online, and the clock is ticking for operators to take steps to create extra space for spent fuel at each plant, Nuclear Regulation Authority Chairman Shunichi Tanaka said.

"Even if we operate Rokkasho, there is more spent fuel coming out than it can process. It's just out of balance," he told the AP.

A more permanent solution — an underground repository that could keep nuclear waste safe for tens of thousands of years — seems unlikely, if not impossible.

The government has been drilling a test hole since 2000 in central Japan to monitor impact from underground water and conduct other studies needed to develop a potential disposal facility. But no municipality in Japan has been willing to accept a long-term disposal site.

"There is too much risk to keep highly radioactive waste 300 meters (1,000 feet) underground anywhere in Japan for thousands or tens of thousands of years," said Takatoshi Imada, a professor at Tokyo Technical University's Decision Science and Technology department.

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