The Washington Post

Prices may vary in areas outside the Washington

K MODCVA SU V1 V2 V3 V4

Mainly cloudy 66/48 • Tomorrow: Shower 57/39 • DETAILS, B10

TUESDAY, OCTOBER 22, 2013

washingtonpost.com • $1.25

DAIAR SAGOLI/REUTERS

A washout of a nuclear cleanup

POOL PHOTO VIA REUTERS

TOP: A doctor conducts a thyroid check on Maria Sakamoto, 4, in Iwaki last month amid radiation-related health concerns. ABOVE: Prime Minister Shinzo Abe, in red helmet, is briefed on tanks containing radioactive water at the Fukushima plant.

On washingtonpost.com View an interactive graphic of the efforts to stem the flow of toxic water at the Fukushima Daiichi nuclear plant.

As Japan's crippled Fukushima plant struggles with buildup of toxic water, many blame operator

BY CHICO HARLAN
IN TOKYO

Two and a half years after a series of nuclear meltdowns, Japan's effort to clean up what remains of the Fukushima Daiichi power plant is turning into another kind of disaster.

The site now stores 90 million gallons of radioactive water, more than enough to fill Yankee Stadium to the brim. An additional 400 tons of toxic water is flowing daily into the Pacific Ocean, and almost every week, the plant operator acknowledges a new leak.

That operator, Tokyo Electric Power Co., known as Tepco, was put in charge of the cleanup process more than two years ago and subsequently given a government bailout as its debts soared. The job of dismantling the facility was supposed to give Tepco an opportunity to rebuild credibility.

But many lawmakers and nuclear industry specialists say that Tepco is perpetuating the kinds of mistakes that led to the March 2011 meltdowns: underestimating the plant's vulnerabilities, ignoring warnings from outsiders and neglecting to draw up plans for things that might go wrong. Those failures, they say, have led to the massive buildup and leakage of toxic water.

"Tepco didn't play enough of these what-if games," said Dale Klein, a former chairman of the

FUKUSHIMA CONTINUED ON A8

Stanching the flow at Fukushima Daiichi

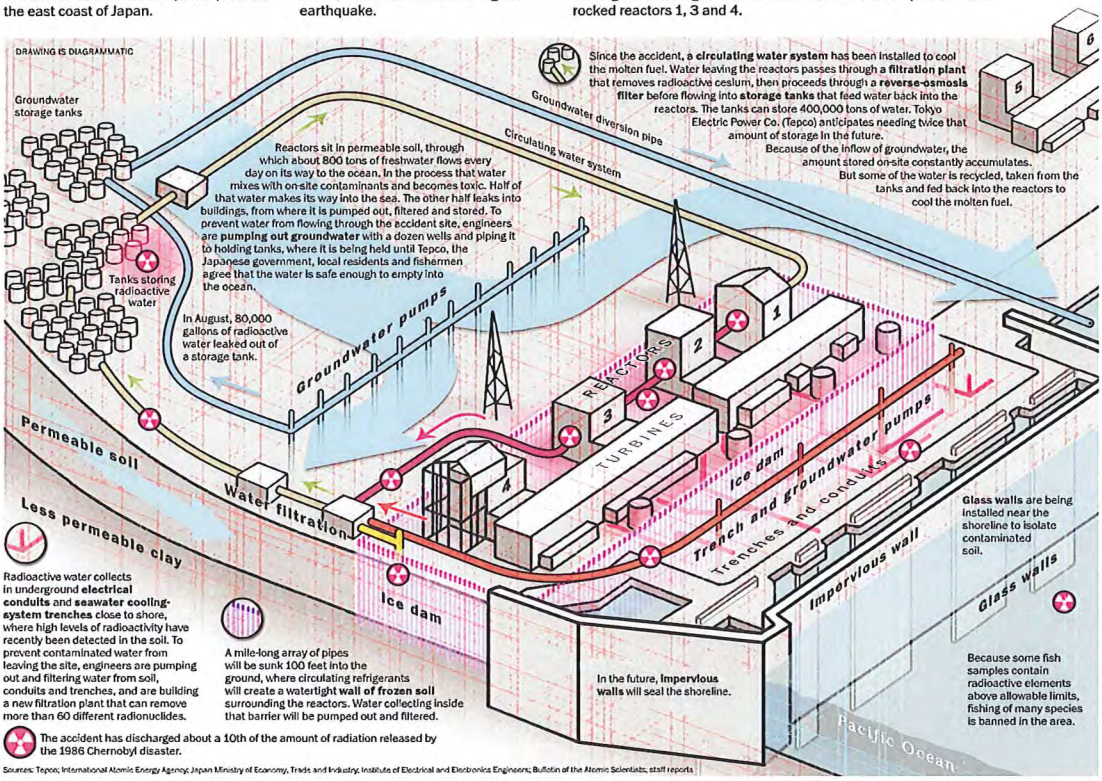
BY PATTERSON CLARK

Japan's nuclear catastrophe, triggered by an earthquake and tsunami, now enters a new chapter because of a relentless flow of subterranean freshwater that is becoming contaminated. A full cleanup and decommissioning of the Fukushima plant could take four decades.

On March 11, 2011, a 9.0-magnitude earthquake and 46-foot tsunami knocked out power and backup generators at the Fukushima Daiichi nuclear power plant on the east coast of Japan.

Reactors 4, 5 and 6 were shut down at the time of the earthquake. Fuel-core meltdowns occurred in reactors 1, 2 and 3, which were active during the earthquake.

A cascading series of events sent radioactive particles into surrounding areas. Radioactive nuclides escaped in several ways: by steam from overheating reactors and spent fuel pools; water leaking from damaged reactor vessels; smoke; and explosions that rocked reactors 1, 3 and 4.



Sources: Tepco; International Atomic Energy Agency; Japan Ministry of Economy, Trade and Industry; Institute of Electrical and Electronics Engineers; Bulletin of the Atomic Scientists; staff reports

Japanese plant awash in radioactive water

FUKUSHIMA FROM A1

U.S. Nuclear Regulatory Commission, who recently joined a Tepco advisory panel. "They didn't have enough of that questioning attitude" about their plans.

The leaks into the ocean are far less toxic than the radioactive plumes that emanated from the plant after the 2011 earthquake and tsunami, forcing 160,000 people to move out of the vicinity. Thanks to that quick evacuation, experts say, there are no expectations of a Chernobyl-style spike in cancer cases — although the government is conducting thyroid checks of thousands of children. But the flow of contaminated water amounts to a slow-burning environmental disaster with implications for Japan's wildlife and its food chain.

The problems have prompted the central government to step in with about $500 million to fund new countermeasures, including a subterranean "ice wall" designed to keep groundwater from flowing into irradiated buildings.

The latest government-led actions are particularly galling for some who say Tepco should have taken similar measures earlier. One lawmaker, Sumio Mabuchi, who was also an adviser to then-Prime Minister Naoto Kan, says Tepco, deep in debt, neglected to take important steps against the groundwater two years ago because of concerns about its bottom line. Tepco's president, Naomi Hirose, testified in parliament last month that the company hasn't "scrimped" on the cleanup, though he did say that Tepco is "majorly at fault" for its failure to manage the groundwater buildup.

The 40-year decommissioning is expected to cost 10 trillion yen, or about $100 billion — roughly two years' worth of Tepco's revenue — and the company says it is trying to save up and cut other costs. But for many Japanese, the company's assurances inspire little confidence. Two members of Japan's national legislature, speaking on the condition of anonymity to share what they describe as sensitive details, say Tepco continues to spend irresponsibly on lobbying politicians, offering them free trips to nuclear sites that include meals and lodging in hot springs resorts. A Tepco spokesman said the company does not offer such trips.

An improvised battle

The coastal Daiichi plant is on an old riverbed, its back yard a line of forested hills and mountains. Even before the 2011 disaster, rainfall from across the region would funnel toward the plant. Such inflow was rarely a problem, because a piping system collected groundwater and spit it into the ocean. Minor leaks would sometimes form in buildings built below sea level, but even that water, uncontaminated, was easy to pump out and dump.

The 9.0-magnitude earthquake and 46-foot tsunami wave of March 11, 2011, threw the plant's groundwater system out of whack. Damaged pipes no longer corralled the inflow, meaning that the plant lost its first line of defense against water streaming in from the hillsides. Worse, the plant had become a disaster site, and any water that flowed under or through the area picked up toxicity of its own. Groundwater that made its way into the reactor buildings also mixed with a separate channel of intensely contaminated water that had been used to douse and cool the reactors.

No longer could the groundwater simply be discarded into the ocean.

The first months of the disaster were chaotic, an improvised battle that involved firetrucks, helicopters, robots and workers trying to cool melted nuclear fuel. As the emergency calmed and the groundwater problem emerged, Tepco was left with two options: It could either block the groundwater from entering the site, or it could pump the groundwater out and store whatever had leaked into buildings.

Tepco opted for the latter — a mistake, many outside researchers say. Atsunao Marui, a groundwater expert and member of a government-led panel that advises Tepco, said the company was slow to assess just how rapidly groundwater from mountains was flooding the buildings. At the time of the disaster, Tepco didn't have a single groundwater specialist among its 40,000 employees, Marui said.

Tepco also declined a June 2011 request from Mabuchi, the lawmaker and adviser to the prime minister, to build a special wall extending 100 feet underground around the reactor and turbine buildings, sealing them off from the groundwater flow. Tepco initially agreed to the project, Mabuchi said, but backed out because of concerns about the estimated cost of 100 billion yen, or $1 billion.

"We are already in a very severe financial situation," Tepco wrote to Japan's Ministry of Economy, Trade and Industry in a letter shared with The Washington Post. "And by taking on an additional 100 billion yen, the market could evaluate that we are one step closer to insolvency. That is something we'd like to avoid."

In the following months, Tepco never considered alternative options to cut off the groundwater, according to minutes from more than 10 hours of meetings, during which the company and a cabinet-formed team of advisers planned a "road map" for decommissioning the facility.

Tepco's plan, discussed in one of the meetings, was to pump toxic water from the reactor and turbine rooms and then cleanse it of radionuclides — isotopes that radioactively decay — using systems that worked like high-end Brita filters. The company would then have "clean water" that could be stored in tanks.

But Tepco's attempts to create clean water have been repeatedly derailed. Two systems have proved successful in filtering cesium. But others have been plagued by mechanical troubles — not surprising, experts say, because they have been constructed at a breakneck pace, often with parts shrunken and custom-built to accommodate Fukushima Daiichi's cramped spaces.

Because of those malfunctions, some water stored in hastily built tanks is laced with contaminants, including strontium, which can burrow into bones and irradiate tissue. More than 1,000 gray tanks, some the size of small apartment buildings, now form a patchwork on a cliff above the plant — an area where workers once spent their breaks taking nature walks. Enough toxic water accumulates each week to fill an Olympic-size swimming pool. One such tank has leaked, another overflowed, and regulators fear that more spills are

PHOTOS BY DAMIR SAGOLJ/REUTERS

TOP: The kitchen of a damaged house in Namie in Fukushima prefecture. All residents of the town were evacuated after the March 2011 nuclear disaster; former residents can visit once a month. ABOVE: Messages of support are written on a blackboard in a science class at a primary school in Namie, which is less than five miles from the stricken Fukushima Daiichi nuclear power plant.

inevitable. Tepco must constantly build more tanks to keep pace with the accumulating water.

"It's not sustainable," said Lake Barrett, a new adviser to Tepco who directed cleanup operations at Three Mile Island after the 1979 nuclear accident there.

Tepco estimates that 800 tons of water flows under the plant daily — half of it traveling into the ocean, the other half making its way into the facility's buildings and requiring storage. Tepco acknowledged the long-presumed ocean leaks in July; the company said it had held off on the disclosure because it didn't want to worry the public until it was certain of a problem.

Both the government and Tepco say the ocean contamination is confined mostly to a man-made harbor around the plant. But some scientists say that assurance plays down significant long-term concerns about marine life and the food chain. Cesium levels are hundreds of times the pre-accident norm in areas beyond the harbor, said Ken Buesseler, a senior scientist with the Woods Hole Oceanographic Institution who has monitored waters around the nuclear plant, most recently last month.

Radionuclides also fall to the ocean floor, where they could be ingested by bottom-feeders. Many local fish species show high enough levels of radiation that the Japanese government bars their sale.

"I could swim in that water" outside the plant, Buesseler said. "But you might not want to eat those fish. It's a serious concern for internal doses. [Radionuclides] are now on the seafloor and could stay in the food chain for years, if not decades."

Tepco's fragile situation

Some nuclear industry executives who have worked with Tepco say the company shouldn't be faulted for prioritizing issues other than the groundwater. They note that Tepco has managed to cool the molten reactors while reinforcing damaged buildings against further earthquakes.

But the buildup of contaminated water also complicates other work at the plant.

"Right now, the groundwater is the biggest problem at the plant, and one Tepco needs to solve thoroughly," said Tsuneo Futami, who was superintendent of Fukushima Daiichi from 1997 until 2000. "Dealing with this is almost a prerequisite for decommissioning."

The remaining options to deal with the buildup are unpopular or flawed. The latest plan includes the ice wall, a new groundwater pumping system and yet another system to filter radionuclides. But the ice-wall technology is unproven, and taxpayers will foot the bill because Tepco lacks the funding to deal with major, unplanned problems at the plant.

Tepco can repair its fragile economic situation with a restructuring plan featuring major cost-cutting that was approved by the government last year. But the company says its profitability also depends on the restart of its largest nuclear power plant, Kashiwazaki Kariwa. A majority of Japanese, though, oppose nuclear power. All of the nation's 50 operable reactors are currently shuttered.

Some activists say Tepco should be allowed to go bankrupt, with the government taking full control of the Fukushima Daiichi decommissioning. But bankruptcy would cause "just one more disaster," this one economic, said Mana Nakazora, a Tokyo-based chief credit analyst at BNP Paribas. Bankruptcy might have been conceivable in the months immediately after the disaster, but Tepco has since been kept afloat with emergency loans from banks and cash injections from the government — debts that, if not paid, would rock Japan's financial system.

Some nuclear engineers and government officials say Tepco has one other option that would ease management of the site: It can dump the stored water into the ocean, provided it can be refiltered and its now-high radiation levels lowered to within legal limits. The International Atomic Energy Agency said in April that Japan should consider such "controlled discharges." The chairman of Japan's nuclear watchdog, Shunichi Tanaka, said last month that dumping might be necessary.

Japan's National Federation of Fisheries Cooperative Associations said its members are against any releases, no matter the level of the water's toxicity, and local governments also have voiced opposition.

Their stance highlights the enormous public distrust of Tepco: Few in Japan are willing to take the company at its word if it says the controlled releases would be safe.

"They're going to have to release the water eventually," said Barrett, the adviser. "No ands, if or buts about it in my view. But how they get there is a huge societal problem, not just for Tepco but for Japan."

chico.harlan@washpost.com

Yuki Oda contributed to this report.

"Tepco didn't play enough of these what-if games. They didn't have enough of that questioning attitude" about their plans.

Dale Klein, a former chairman of the U.S. Nuclear Regulatory Commission, referring to the plant operator

ISSEI KATO/REUTERS

CLOCKWISE FROM ABOVE: Workers move contaminated waste at a storage site in Naraha, which was evacuated after the nuclear disaster; the beach in the evacuated town of Namie is littered with tsunami barriers, wrecked cars and other debris; a vending machine was carried by the 2011 tsunami to a rice field near Minamisoma, a town inside the 12-mile exclusion zone around the nuclear power plant.

DAMIR SAGOLJ/REUTERS

DAMIR SAGOLJ/REUTERS