Massive Cleanup Will Follow in Wake of Japanese Nuclear Plant Stricken by Earthquake, Tsunami

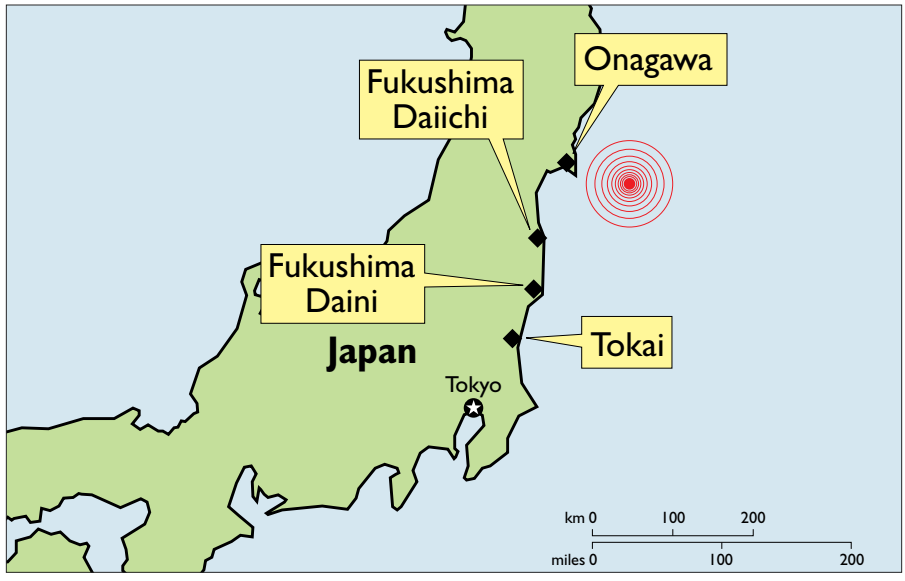
Japan's Fukushima Daiichi six-unit nuclear power plant, located on the east coast of the country and owned by Tokyo Electric Power Co. (Tepco), will be facing massive cleanup and decommissioning work in the wake of the March 11 9.0 earthquake and 45-foot tsunami that knocked out the plant's emergency backup power systems and sent four units into dangerous instability. Efforts to bring the operating reactors to cold shutdown and to maintain spent fuel pool cooling were hampered by the effects that the tsunami had on plant property and on nearby infrastructure.

Radioactive material was released into the environment as a result of the venting of the containments to relieve pressure; hydrogen explosions, which resulted in major damage to the external structures of three of the reactor buildings, also caused radioactivity release. Authorities have concluded that fuel has been damaged in all three of the reactors that were in operation before the earthquake (Unit 4 had shutdown, and its core had been offloaded to the Unit 4 spent fuel pool, shortly before the earthquake), and a containment breach is assumed to have occurred in the vicinity of the Unit 2 suppression pool. The released radioactive material has been attributed to fuel damage within the three reactors and perhaps in the Units 3 and 4 spent fuel pools.

At this writing in late April, the plant had restored power to the units, a water leak in a concrete conduit had been plugged, and workers had pumped some 3 million gallons of water contaminated with low levels of radioactivity out of the reactor into the ocean, to make room for storing more highly contaminated water that was dumped and pumped into the plant in an effort to cool both the reactor cores and the spent fuel pools and has since filled up the cavities in the buildings, preventing worker access to damaged areas. Occasional earthquake aftershocks have had little effect on work at the plants, although one aftershock did knock out power for close to an hour, leading Tepco to temporarily evacuate staff from the site. On April 19, Tepco began transferring water from the basement of a Unit 2 turbine building into a holding tank.

People living within 18 miles of the plant have been evacuated, and while some agencies in other countries are recommending widening the evacuation zone, so far Japan has seen no need to do so.

Tepco has already made the decision that the four plants most affected by the natural disasters (Units 1 through 4) will never operate again. Two other units at the site, Units 5 and 6, were shutdown at the time of the disaster and essentially remained stable during the ensuing crisis. The utility also has stated that it does not expect the four damaged plants to achieve cold shutdown until autumn or even early winter.



Onagawa was the nuclear plant closest to the epicenter of the earthquake, but it was not significantly affected by the tsunami that inundated northeast Honshu, and it was quickly taken to cold shutdown. The one operable reactor at Tokai also reached cold shutdown without incident. Two reactors at Fukushima Daini experienced pressure control problems, but eventually all four reached cold shutdown.

Details on the evolving plant situation can be found in this magazine's sister publication, *Nuclear News.* Both the April and May 2011 issues contain lengthy discussions of the unfolding of the event and of the efforts to stabilize the plants.

Wisconsin Electric Agrees to $45.5 Million Settlement with DOE

Wisconsin Electric Power Co. has agreed to a $45.5 million settlement with the U.S. Department of Energy over the government failure to take possession of spent fuel from the Point Beach nuclear power plant in 1998. Wisconsin Electric had filed a lawsuit over the issue in the U.S. federal claims court in November 2000, and in 2009, the court found in favor of the utility, awarding an amount of some $51 million. The government, however, appealed the decision, and that case is still pending.

In the latter half of 2010, Wisconsin Electric has revealed, the government initiated discussions with the utility and offered to settle the lawsuit. On February 8, the parties signed an agreement that the government will pay Wisconsin Electric $45.5 million in full and final settlement of the lawsuit. Wisconsin Electric has said it intends to return the $31 million net proceeds after litigation costs to its customers.

U.S. Nuclear Waste Fees Coming Under Attack

In early March, the Nuclear Energy Institute (NEI) and the National Association of Regulatory Utility Commissioners (NARUC), acting on behalf of their respective members, filed a lawsuit against the U.S. Department of Energy for continuing to charge for the now-abandoned Yucca Mountain project. The NEI represents nuclear utilities, while NARUC represents the state public service commissions.

Funding for the Yucca Mountain project has come from a 1 mill (0.1 cent) per kilowatt-hour surcharge on nuclear generated electricity. This currently generates about $700 million per year for the project. Since the Nuclear Waste Policy Act of 1982 (NWPA) instituted this fee, nuclear utility customers have paid more than $31 billion into the Nuclear Waste Fund.

"It's time for the DOE to suspend consumer payments into the Nuclear Waste Fund," stated NARUC President Tony Clark. "We want to work with the DOE to find a solution to the nation's nuclear waste problem, but consumers should be given a break until such a solution is found."

An earlier lawsuit from NARUC, based on the DOE's failure to produce an annual assessment of the adequacy of waste fees for the needs of the project, was rejected by the court after the DOE submitted a late justification for the continued collection of fees. The new lawsuit challenges that justification under rights granted to it by the original court ruling.

- In related news, the U.S. Court of Appeals for the District of Columbia Circuit heard oral arguments on March 22 in the consolidated lawsuit challenging the DOE's efforts to shut down the Yucca Mountain project. The suit—being brought by Aiken County, S.C.; the states of South Carolina and Washington; and three Washington state residents—claims that the DOE does not have to legal authority to terminate the program, which is mandated under the NWPA.

WIPP Celebrates 12th Anniversary, But Cutbacks Loom

The U.S. Department of Energy's Waste Isolation Pilot Plant, which disposes of the nation's transuranic (TRU) defense waste, celebrated its 12th anniversary on March 26. Since opening in March 1999, the facility has disposed of more than 73 000 cubic meters of legacy TRU waste. (It would take more than 410 large-sized railway box cars to hold all of the waste that is now safely disposed at WIPP.) WIPP drivers have traveled more than 11 million loaded miles and transported more than 9300 shipments to WIPP. Legacy waste cleanup has been completed at 17 DOE sites around the country.

During the upcoming year, WIPP expects to receive its 10 000th shipment and to begin receiving shipments of large boxed waste in the TRUPACT-III containers, a new shipping package scheduled for delivery this summer. On the disposal site of the project, WIPP will complete waste emplacement in Panel 5 of the underground repository. The panels in WIPP's underground each consist of seven waste disposal rooms that are 300 feet long, 33 ft wide,

and 13 ft high. Panel 6 is already prepared to receive waste.

On April 6, however, the WIPP management and operating contractor, Washington TRU Solutions (WTS), announced plans to restructure its workforce "to align its scope of work with existing budgets." The company said it has developed a restructuring plan to minimize impacts to employees and to assure a workforce skill mix to safely accomplish DOE goals at the plant. In a worst-case scenario, the company said, the plan may impact up to 90 people. "It is our hope that we can identify enough cost savings through the voluntary separation program and in other areas that it won't be necessary to have layoffs. Departmental budgets, overtime pay, and other areas are being evaluated for cost savings," stated Farok Sharif, WTS president and general manager.

Vermont Yankee Receives License Renewal, But Plant's Future Still in Doubt

The U.S. Nuclear Regulatory Commission has renewed Vermont Yankee's operating license for a 20-year period, but Vermont is the only U.S. state that has a voice in the relicensing of nuclear power plants. In January 2010, in the wake of tritium leaks at the plant, the state had voted 26–4 against extending the plant's operating license, which will expire in March 2012.

Vermont's congressional delegation issued a statement calling for the plant's operator, Entergy, to abide by the state's decision on the plant's future. "We believe that Entergy should respect and abide by Vermont's laws, which require approval from the Vermont Legislature, and then the Vermont Public Service Board, for the plant to continue to operate beyond 2012," noted a statement by Vermont Sens. Patrick Leahy (D) and Bernie Sanders (Independent) and Rep. Peter Welch (D).

This same congressional delegation is also concerned that if the plant does shut down in March 2012, Entergy will put the plant into SAFSTOR to allow the decommissioning fund to accumulate enough money to complete decommissioning to a greenfield level. Instead, the legislators want decommissioning work on the plant to begin as soon as it closes down.

In the meantime, additional low levels of tritium have been detected in monitoring wells close to the area where other wells were found to be contaminated in 2010. The previous tritium leaks were traced to underground pipes. Entergy said a "thorough investigation" would be done to determine the source of this new tritium.

NRC's New Waste Confidence Ruling Allows Onsite Spent Fuel Storage for up to 60 Years

In late January, the U.S. Nuclear Regulatory Commission's revised waste confidence regulations went into effect, allowing the onsite storage of spent nuclear fuel for up to 60 years after reactor shutdown. The period had previously been limited to 30 years.

The NRC had released its revised waste confidence decision in late December. The new ruling places more emphasis on waste storage and less on permanent disposal.

The new ruling is important because, under federal law, the NRC must assert "waste confidence" before it can license new nuclear power plants that would add to the stockpile of spent nuclear fuel.

Many antinuclear groups have challenged the decision, calling for the NRC to conduct a full environmental impact statement before issuing any revision of the old 30-year limit. Three northeastern states (Connecticut, New York, and Vermont) have filed suit against the NRC, claiming that the agency "acted arbitrarily, abused its discretion, and violated the National Environmental Policy Act, the Administrative Procedure Act, and the Atomic Energy Act, as well as the agency's own policies and regulations" in making the change.

An NRC spokesman, speaking to the *New York Times,* characterized the NRC decision as a commission "opinion" on how long waste could be safely stored rather than a rule permitting any plant to store spent fuel for that period.

More Commercial Spent Fuel To Be Allowed at INL

A new memorandum of agreement between the State of Idaho and the U.S. Department of Energy means that the Idaho National Laboratory will be able to bring up to

880 pounds of spent fuel from commercial nuclear power reactors each year for research purposes. The fuel, however, will count against the overall limit of 55 metric tons of nuclear waste and material that the DOE is allowed to store at INL under a 1995 agreement between the DOE and the state. At the current time, the DOE is storing around 27.5 metric tons of material at the site, about half the legal limit.

INL is the DOE's lead laboratory on advanced nuclear power and waste disposal technologies. INL's testing capabilities are seen as critical to increasing the operating lives of today's nuclear power reactors and to the development of longer-lasting fuel types.

● In a related story, in an April 7 letter to the DOE made public on April 15, the U.S. Nuclear Regulatory Commission has expressed concern about the crumbing of concrete casks at INL that hold the spent fuel rubble from the Three Mile Island-2 reactor. The concrete casks, built in 1999, show "significant cracking and degradation," even though they were designed to last for 50 years. The degradation was likely due to water intrusion and the annual freeze/thaw cycle, the NRC said in an inspection report attached to the letter. The NRC asked the DOE to provide information about corrective measures, a scheduled for implementation, and a plan for monitoring the effectiveness of actions taken.

D&D Updates

● The 75-foot-tall rusty-orange dome of the Heavy Water Components Test Reactor (HWCTR, or "Hector") at the U.S. Department of Energy's Savannah River Site was removed in early February, the first and most visible stage of the reactor's decommissioning. Removing the dome allowed access for the removal of the reactor vessel and two steam generators later in February. Remaining equipment will be moved to the cavity vacated by the reactor vessel, the below-grade portion of HWCTR will be filled with grout, and the 29-ft-high base from which the dome was cut will be removed. In the final stage, a concrete cover will be placed over the reactor's footprint, officially marking the end of HWCTR's decommissioning. Completion is expected this summer.

● Spent fuel began being unloaded from Unit 2 of Lithuania's shutdown Ignalina nuclear power plant on February 1. Some 500 spent fuel assemblies will be removed from the reactor and transferred to onsite storage pools. Subsequently, the spent fuel will be transferred to the interim spent fuel storage facility, which is due to be commissioned later this year. Unit 1 at Ignalina was shut down at the end of 2004, and Unit 2, at the end of 2009. Lithuania agreed to shut down the two units, both Soviet-built RBMK reactors, as a condition for its entry into the European Union.

● Four 250-foot-tall exhaust chimneys, several 90-ft-tall baghouses, a coal silo that once served the 284-East Power House, and two 140-ft water towers at the U.S. Department of Energy's Hanford Site were all brought down with explosives in mid-February and early March, changing the Hanford skyline and removing structures that had stood as site landmarks for more than half a century. The work clears the way for traditional demolition of the 284-East and West Power Houses themselves. The two power houses, which burned coal to provide power and heat for the plutonium processing plants in Hanford's 200 Area, have been idle since the mid-1990s. Their demolition was added to Hanford's near-term work scope because of American Recovery and Reinvestment Act funding. Both buildings should be completely demolished and removed by the end of this fiscal year.

● Now that the Sludge Retrieval Hood has been installed in the Pile Fuel Storage Pond (PFSP) at Sellafield, the bulk sludge removal project can begin. This retrieval is one of the priority decommissioning projects at the United Kingdom's Sellafield site. The PFSP was the very first nuclear fuel storage pond built at Sellafield, coming on line in 1948, and sludge in the form of corrosion products and wind-blown material has been accumulating in this open-air pond ever since. Sludge removed will be transferred into the Sludge Corral, where it will be stored pending treatment through the Local Sludge Treatment Plant, currently in the inactive commissioning phase.

● Engineers at the Hanford Waste Treatment Plant, also known as the "Vit Plant," recently completed the civil, structural, and architectural design for the High-Level Waste Facility. When complete, the building will consist of more than 87 000 cubic yards of concrete and more than 10 000 tons of structural steel. The 270-foot by 440-ft by 96-ft facility is currently 86 percent complete, while the overall Vit Plant is considered 80 percent complete. The High-Level Waste facility will house two 90-ton melters for the use of vitrification of high-level waste currently being stored in the Hanford site's tank farms.

● The U.S. Department of Energy is planning to sell off excess uranium over the next three years to fund the decontamination and decommissioning of the Portsmouth

uranium processing and gaseous diffusion enrichment plants. For fiscal year 2010, the DOE received close to $575 million for Portsmouth cleanup, and for fiscal year 2011, work is being funded at 2010 levels, given that Congress has yet to pass a 2011 spending bill. For fiscal year 2012, however, the DOE has requested no funds for Portsmouth D&D. Energy Secretary Stephen Chu has said there will be no adverse impact on domestic uranium industries from the DOE uranium sales.

● The emptying of the Dounreay Fast Reactor east pond in the United Kingdom is almost complete, the project reported at the end of February. The 6-meter-deep concrete chamber has been drained of its 500 cubic meters of water in preparation for removing the concrete and bitumen liner. Water and sludge removal in the west pond, however, is proving to be more challenging, due to high radiation from the pond walls, floor, and sludge. The project team feels that the majority of the radiation is coming from the sludge, so a project to collect and transfer the sludge while leaving the water in place is being planned.

● The U.S. Department of Energy anticipates laying off some 1600 cleanup workers at the Hanford Site once the American Recovery and Reinvestment Act funding runs out at the end of the current fiscal year. The CH2M Hill Plateau Remediation Co. has told workers that it plans a two-phase layoff, with voluntary and involuntary layoffs to cut some 1350 jobs between July and September. Mission Support Alliance expects about 300 involuntary layoffs by the end of September. Two other Hanford contractors, Washington Closure Hanford and Washington River Protection Solutions, do not expect any layoffs tied to the end of the stimulus money. One other Hanford contractor, Bechtel National, is constructing the Waste Treatment Plant, which did not receive stimulus money and so is unaffected by the layoff plans.

● Even in the wake of a government austerity program, the U.K. Nuclear Decommissioning Authority (NDA) is planning an annual expenditure of about £2.9 billion ($4.6 billion) over the next four years, for a total of about £12 billion ($19.2 billion), for nuclear cleanup activity. Annual expenditures for work at Sellafield, the NDA's highest priority, will be around £1.55 billion (about $2.5 billion). Annual expenditures across the Magnox sites are planned at £650 million ($1.04 billion), and the NDA will focus on Trawsfynydd and Bradwell as lead sites for accelerated decommissioning. Decommissioning funding at Dounreay will come in at around £150 million ($240 million) annually.

International Briefs

● Sweden's nuclear fuel company, SKB, has applied for permission to build that country's first repository for spent nuclear fuel. SKB has also applied for permission to build a plant to encapsulate the fuel prior to disposal. A site at Forsmark was selected for the repository in 2009. Forsmark is also home to the country's permanent repository for low- and intermediate-level waste. The application will be reviewed by the Swedish radiation safety authority and the environmental court for the municipality of Nacka before policy decisions are made by the relevant municipalities and the government.

● The United Kingdom's latest estimated nuclear waste inventory (both waste that exists today and that which is forecast to be generated over the next century or so from existing facilities) totals some 4.7 million cubic meters, the U.K. Nuclear Decommissioning Authority has announced. A further 1 million cubic meters of nuclear waste has already been disposed. Of the 4.7 million cubic meters of waste, some 97 percent has already been produced, the NDA continued, while about 3 percent has yet to be produced. This waste is that forecast from future planned operations of the existing nuclear power industry, from ongoing defense programs, and from the continued use of radioactivity for medical and industrial purposes. Some 94 percent of the waste is categorized as low-level waste; intermediate-level waste is about 6 percent; and less than 0.1 percent is considered to be high-level waste. The waste inventory does not include all radioactively contaminated soil, because much of that material has yet to be characterized. The NDA cautioned that the total volume of such waste could add significantly to the figure of 4.7 million cubic meters.

● In Spain, the regional parliament of Catalonia (located in the northeast section of the country) has passed a resolution opposing the siting of a spent fuel storage facility at the Asco nuclear power plant. The Asco site was ranked second, after a site in Valencia, as the most suitable location for a spent fuel storage installation by a government inter-ministerial commission. Catalonia has three of Spain's eight operating reactors, plus another reactor that was shut down in 1989.

● The United Kingdom is setting up a new independent statutory entity to oversee the nuclear industry. The new body, the Office of Nuclear Regulation, will absorb all the elements of the U.K.'s Health and Safety Executive's Nuclear Directorate, including the Nuclear Installations Inspectorate, the Office for Civil Nuclear Security, and the

U.K. Safeguards Office. It will also include the Department of Transport's Radioactive Materials Transport Team, which deals with regulating the transportation of radioactive material.

- Even though the Canadian Nuclear Safety Commission (CNSC) granted Bruce Power a license in February to allow shipment of 16 steam generators from the Bruce A nuclear power plant to Sweden for treatment and recycle, the utility has announced that it is delaying the shipment to allow time for further discussion with First Nations, Metis, and other interested parties. The CNSC shipment license is valid until February 2012.
- The United Kingdom has released a report on the recycling of uranium and plutonium stockpiles. While four options are presented in the report (disposal of the material as waste; leaving Advanced Gas-cooled Reactor [AGR] fuel as waste, but recycling the plutonium into mixed oxide [MOX] fuel; extending the lifespan of the THORP facility to recycle the AGR fuel and use it as well as the plutonium to supply MOX fuel; or using a refurbished THORP facility to take on more overseas contracts), the report noted that designating the materials as waste is never the best scenario. So, in essence, the report shows that it makes sense to produce MOX fuel from the plutonium; the question is whether the country wants to offset the costs of this option with the potentially expensive refurbishment of THORP. The report concludes: "There is now an opportunity to develop a holistic approach to nuclear power—combining the assessment of the back-end legacy materials with the opportunities offered by new build development." ■