WINTER 2012
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Managing Change

By: Mike Gettle

The topics in this newsletter reflect the rapid changes stemming from events that are changing the nuclear industry. Each one of the changes impacts all of us to one degree or another. So the question posed is, "How is your organization set up to manage these changes?"

In some organizations, responding to change is reactive in nature. For example, this approach may result in copying another plant's processes or procedures for design changes. Other impacts may come from significant events at other plants. Implementing actions from these events and changes without due consideration of how it integrates with your current business approach will probably not get the results sought.

Other organizations have developed an approach to use events and changes as a tool to improve current business practices. These organizations consider how the impacts from these event and changes can be integrated into current practices. This is an 'adapt' rather than an 'adopt' approach to managing change – and increases the benefit of the lessons learned from other organizations.

NWI has the expertise to assist you in developing an approach to managing change that results in improvements being integrated into current business practices. Contact NWI for more information.

Inside this issue:

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Summary: On March 11, 2011, at 1446 (JST), a severe earthquake measuring 9.0 on the Richter Scale occurred 112 miles (180 km) off the coast of the Fukushima Daiichi Nuclear Power Station. The earthquake was the largest Japan has ever experienced. It caused all of the operating units (units 1, 2, and 3) to automatically scram on seismic reactor protection system trips. The earthquake damaged breakers and distribution towers, causing a loss of all off-site electrical power sources to the site. The emergency diesel generators automatically started and provided AC power to emergency systems. Three minutes after the earthquake, the Japan Meteorological Association issued a major tsunami warning, indicating the potential for a tsunami at least 3 meters high. Station workers were notified of the warning and evacuated to higher ground.

Forty-one minutes after the earthquake, at 1527, the first of a series of seven tsunamis arrived at the site. The maximum tsunami height impacting the site was estimated to be 46 to 49 feet (14 to 15 meters). This exceeded the design basis tsunami height of 18.7 feet (5.7 meters) and was above the site grade levels of 32.8 feet (10 meters) at units 1-4. All AC power was lost to units 1-4 by 1541 when a tsunami overwhelmed the site and flooded some of the emergency diesel generators and switchgear rooms. The seawater intake structure was severely damaged and was rendered nonfunctional. All DC power was lost on units 1 and 2, while some DC power from batteries remained available on Unit 3. Four of the five emergency diesel generators on units 5 and 6 were inoperable after the tsunami. One air-cooled emergency diesel generator on Unit 6 continued to function and supplied electrical power to Unit 6, and later to Unit 5, to maintain cooling to the reactor and spent fuel pool.

With no core cooling to remove decay heat, core damage may have begun on Unit 1 on the day of

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A Message from NWI...

Thank you for taking the time to read this season's newsletter. This newsletter covers the recent nuclear industry highlights. The impact of the Fukashima beyond design basis event and its ramifications to commercial nuclear power future development has and continues to have a profound effect. Due to the current natural gas prices in the US, the nuclear renaissance may be delayed (see the Fall NWI newsletter for details from the 2011 ANS Utility Working Conference). In addition, the NRC and INPO review of the Fukashima event and resultant design changes of operational and planned nuclear plants is anticipated to be significant from a cost and time perspective. These reviews along with economic pressures combine and are impacting the new builds in the U.S. With the exception of 2 utilities, some estimate that about a 10 year wait is the ultimate impact for new nuclear plant

In other parts of the world, the resurgence of nuclear power continues to be a large part of the energy mix (e.g., China, India, Eastern Europe, Malaysia and Russia). This is largely due to the recognition of the need for clean and realiable power in those countries. Although impacted by the event in Japan, plans are re-starting, though at an apparent slower pace due to a re-review of new generation designs coupled with limited available power alternatives.

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the event. Steam-driven injection pumps were used to provide cooling water to the reactors on units 2 and 3, but these pumps eventually stopped working; and all cooling water to the reactors was lost until fire engines were used to restore water injection. As a result of inadequate core cooling, fuel damage also occurred in units 2 and 3.

Challenges in venting containments contributed to containment pressures exceeding design pressure, which may have caused containment damage and leakage. Hydrogen generated from the damaged fuel in the reactors accumulated in the reactor buildings either during venting operations or from other leaks ignited, producing explosions in the Unit 1 and Unit 3 reactor buildings and significantly complicating the response. The hydrogen generated in Unit 3 may have migrated into the Unit 4 reactor building, resulting in a subsequent explosion and damage. The loss of primary and secondary containment integrity resulted in ground-level releases of radioactive material. Following the explosion in Unit 4 and the abnormal indications on Unit 2 on the fourth day of the event, the site superintendent directed that all nonessential personnel temporarily evacuate, leaving approximately 70 people on site to manage the event.

During releases, dose rates as high as 1,193 millirem per hour (mrem/hr) (11.93 mSv/hr) were measured at the site boundary, approximately 0.6 miles (1 km) from units 1̃4. The windows for the emergency response center had to be covered with lead shielding to reduce dose rates in the center. Organized off-site radiation surveys began on March 16.Radiation levels off site at that time ranged from 0.1 mrem/hr (1 μSv/hr) to 20 mrem/hr (200 μSv/hr). Thirty-seven miles (60 km) northwest of the station, the dose rate was 0.8 mrem/hr (8 μSv/hr). Water and soil samples indicated the presence of strontium, iodine, and cesium. Food and water restrictions were implemented in some areas as a result of radioactivity. People within the 12.4 miles (20 km) surrounding the station were evacuated, and those living up to 18.6 miles (30 km) away were directed to shelter inside their homes as the releases of radioactive gases and materials increased as the event progressed and more fuel damage occurred.

Potassium iodide tablets and powder were distributed to local governments beginning March 21. Because the evacuations had already been completed, however, the potassium iodide was not issued to the population. Radiation surveys of the on-site areas surrounding units 1 and 3 showed dose

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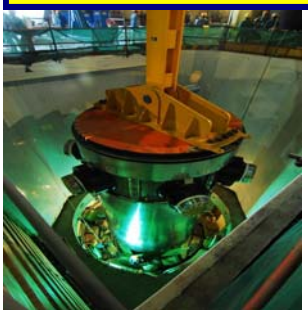
Some Industry News Bites...



December 28, 2011: Calif. nuclear plant continues safety enhancements for earthquakes. Pacific Gas and Electric is taking the necessary safety measures at its Diablo Canyon nuclear plant in California in the aftermath of the Fukushima Daiichi incident in Japan to allay the public's concerns, the company said. Aside from delaying its license-renewal efforts for Diablo Canyon, the utility is also continuing its seismic surveys of areas surrounding the facility. The Nuclear Regulatory Commission has maintained that the plant can handle earthquakes that could be produced by nearby faults. Perhaps Diablo Canyon's best defense against a disastrous tsunami is the geography around the plant. Faults near the plant are strike-slip faults in which tectonic plates move horizontally past one another. This type of ground movement does not displace large amounts of ocean water, the cause of a tsunami. Additionally, the plant sits atop an 85-foot-tall bluff, an elevation above where a tsunami is likely to reach.

December 28, 2011: Various news outlets in Japan, including NHK and Kyodo have now reported that the Fukushima Prefecture Governor, in a meeting with TEPCO officials, has stated that he will not allow further nuclear plant operation in Fukushima. The impact on TEPCO will be considerable. Not only does this mean that TEPCO will be dismantling and scrapping the four damaged plants, it means all of them in the prefecture. This includes two more at the Fukushima Daiichi site and still four others located to the south at the Fukushima Daini site. A quick and rough figure in terms of cash to perform this job is possible if we take an NRC report from 1979 covering the decommissioning of a standard GE BWR plant and convert the dollars in that report to today's. The report, completed in 1980, gives a figure for one plant at $43.6 million US dollars - that's using 1978 dollar value. Converting this with an online currency converter to 2010 dollars and multiplying to give six reactor plants (all six undamaged ones) gives us a new additive figure imposed on TEPCO by Fukushima's decision of about $864 million dollars US. The above figure is staggering, especially when one realizes that TEPCO cannot derive any electric generating revenue from the six plants it will now be tearing down which are not at the end of their normal economic lives. It is for the above reasons that many are speculating on the nationalization of TEPCO, and in fact the Japanese Government (through Industry Minister Yukio Edano) has clearly suggested to TEPCO that it consider at least temporary nationalization. This comes in the face of TEPCO making a request to the Japanese Government for further capital to the tune of $88.6 million US (equivalent.)

December 27, 2011: NRC approves uprate request for N.Y. nuclear plant. Constellation Energy Group secured the Nuclear Regulatory Commission's approval to boost the capacity at Unit 2 of its Nine Mile Point nuclear plant in New York. The uprate will raise the facility's power by approximately 160 megawatts, which will be enough to supply about 80,000 residences.

December 23, 2011: NRC approves Westinghouse's AP1000 reactor. Westinghouse Electric's amended design for its AP1000 reactor secured the Nuclear Regulatory Commission's approval. "The design provides enhanced safety margins through use of simplified, inherent, passive, or other innovative safety and security functions, and also has been assessed to ensure it could withstand damage from an aircraft impact without significant release of radioactive materials," NRC Chairman Gregory Jaczko said in a statement. Southern Co. plans to use the technology for its Vogtle expansion project in Georgia.

December 6, 2011: NRC clears turnover of Progress Energy's reactors to Duke Energy. The indirect control of Progress Energy's four nuclear facilities will be transferred to Duke Energy now that the Nuclear Regulatory Commission has approved the action. The ruling is in anticipation of the merger between the two utilities, which is expected to be finalized by year's end.

December 6, 2011: EDF again criticizes proposed Exelon-Constellation merger. Electricite de France has reiterated its

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rates as high as 13 rem/hr (0.13 Sv/hr) in areas around units 2 and 3. More detailed surveys performed over the following weeks discovered localized dose rates greater than 1,000 rem/hr (10 Sv/hr) around equipment and debris outside units 1 and 3. Some personnel who responded to the event received high doses of radiation. Two control room operators received the highest doses at a calculated internal and external dose of 67.8 rem (0.678 Sv) and 64.3 rem (0.643 Sv). The majority of dose received by these workers was internal (85-87 percent).

Potassium iodide was provided to some station personnel on March 13. As of the end of March, approximately 100 workers had received doses of greater than 10 rem (0.1 Sv).

The Fukushima event was rated as a level 7 event on the International Nuclear and Radiological Event (INES) scale. The Nuclear Safety Commission of Japan estimated approximately 17 million curies (6.3 E17 Bq) of iodine-131 equivalent radioactive material was released into the air and 0.127 million curies (4.7 E15 Bq) into the sea between March 11 and April 5. The 1986 accident at Unit 4 of the Chernobyl nuclear power plant was the only other nuclear accident to have a level 7 INES rating. According to the IAEA, the Chernobyl accident resulted in approximately 378.4 million curies (14 E18 Bq) of radioactive material being released into the environment. The combination of the earthquake and tsunami caused considerable damage to the Japanese coast. According to the government of Japan's report to the IAEA, almost 500,000 residential buildings were damaged or destroyed. There was considerable damage to roads, railways, and public and industrial utilities. Approximately 4 million homes lost electricity. The total area inundated by the tsunami was approximately 217 square miles (561 square km). As of October 7, 2011, the Japanese Red Cross reports that almost 16,000 people are confirmed dead, and almost 4,000 remain missing. Approximately 90 percent of the deaths were reported to be caused by drowning.

Site Background: Fukushima Daiichi was the first of three nuclear generating stations operated by TEPCO. The station is located on an 860-acre site in the Fukushima prefecture, approximately 160 miles (260 km) from Tokyo, on the northeast coast of Japan. It was one of the largest generating stations in the world, consisting of six boiling water reactors capable of generating 5,480 MWe total. The units are designed such that units 1 and 2, 3 and 4, and 5 and 6 share common facilities and structures, such as a shared control room and turbine building. The station also has a shared spent fuel pool and dry cask

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Some Industry News Bites... (Continued from Page 3)

opposition to the proposed merger between Exelon and Constellation Energy Group. EDF, which owns almost half of Constellation's nuclear unit, said the deal would stifle the development of new reactors and stunt the growth potential of Constellation.

December 2, 2011: New reactor projects expected to spur revival of U.S. nuclear energy. Two nuclear-expansion projects in Georgia and South Carolina could secure final license approvals from the Nuclear Regulatory Commission somewhere between this month and March, if reviews go as expected. The construction of the reactors would generate thousands of jobs during construction and hundreds of permanent positions when the units come online between 2016 and 2019. Although the biggest reactor parts have to be manufactured abroad, most of the billion-dollar ventures are sourced in the U.S., said Marvin Fertel, president and CEO of the Nuclear Energy Institute.

December 5, 2011: Ohio nuclear plant is allowed to resume operations. FirstEnergy can restart its Davis-Besse nuclear plant in Ohio, but the utility must continue to probe the cause of several hairline cracks found in the facility's concrete shield building, according to the Nuclear Regulatory Commission. FirstEnergy has provided the agency with "reasonable assurance that the shield building is capable of performing its safety functions," said

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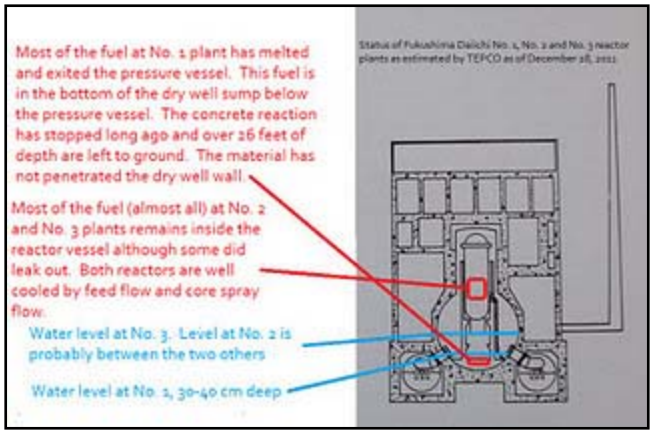
storage facility. The shared spent fuel pool is located on the inland side (west) of Unit 4. The dry cask storage facility is located between units 1 and 5 along the coast.

Fukashima Plant Status and Future:

Fukushima Daiichi No. 1, No. 2, No. 3: All three plants experienced serious reactor accidents and are in a prolonged process of control, mitigation, containment, cooldown, and decommissioning. There is now a very seriously thought out body of evidence which TEPCO has presented to the world concerning the actual status of the reactor cores, reactor pressure vessels, primary containments (dry wells) and reactor buildings of the three Fukushima Daiichi plants that have experienced reactor accidents. TEPCO has produced a long and somewhat complicated video describing this work in detail.

Fukushima Daiichi No. 1: Most of the fuel has been destroyed by melting. Most of the fuel has exited the reactor pressure vessel and has deposited in the area of the dry well directly below the reactor, inside the reactor support pedestal area and in the drain sumps. This fuel did cause a corium-concrete reaction whose effects in terms of gases given off were only all too obvious during the accident. This fuel has not reached the dry well wall; the reaction is stopped; the mass of fuel is properly cooled. Around 25 feet of depth consisting of reinforced concrete remains underneath the dry well and some further depth of concrete inside the dry well under the melted fuel mass. About one foot of water covers the melted fuel mass in the dry well.

Fukushima Daiichi No. 2: Most of the fuel is still inside the reactor pressure vessel with a majority of it melted and relocated. Some melted fuel has exited. Water level inside the reactor vessel is not detectable due to proximity of water legs to heat. Water level in the dry well is not known but is estimated to be deeper than that at No. 1 and less than at No. 3. The core is suitably cooled by feed flow and core spray flow. There are reports on NHK that beginning soon, TEPCO will prepare to insert a television camera using a device like an endoscope which is only 8mm wide into the No. 2 plant dry well to attempt to view the conditions inside. This will be the first actual visual assessment of the interior portion of any of the three damaged reactor plants.



Fukushima Daiichi No. 3: Most of the fuel is still inside the reactor pressure vessel with a majority of it melted and relocated. Some melted fuel has exited. Water level inside the reactor vessel is not detectable due to high radiation preventing work. Water level in the dry well is perhaps almost half way up the large spherical dry well chamber.

Fukushima Daiichi No. 4: This plant was damaged by secondary causes from the other plants and will be decommissioned. Almost no damage occurred to nuclear fuel at this plant, all of which was in the spent fuel pool.

Fukushima Daiichi No. 5, No. 6: These two plants received some tsunami damage but no secondary damage from the accidents at the other plants, being sited far enough north to be spared. However, it is a practical certainty these plants would never have restarted and now with the Fukushima Prefecture decision, they will also be decommissioned.

Fukushima Daini No. 1, No. 2, No. 3, No. 4: This separate nuclear generating site is somewhat south of Fukushima

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Daiichi and did not receive as much quake and tsunami damage. With the new Fukushima Prefecture decision, these four still operable plants will now be decommissioned.

Click here to see the Fukushima Daiichi tour, December 2011 @ APR YouTube.

Some Industry News Bites...

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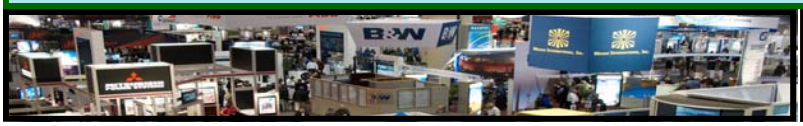
Cynthia Pederson, the NRC's acting regional administrator. "We are wrapping up our outage activities, and beginning the restart," said Jennifer Young, a spokeswoman for the utility.

November 29, 2011: North Anna reactors are running at full power. Dominion Virginia Power has restored full power at its North Anna Power Station, after the second reactor was brought back to full operation Monday. The facility went offline following a 5.8-magnitude earthquake that struck the East Coast on Aug. 23. The plant sustained only minor damage, based on inspections by the Nuclear Regulatory Commission and Dominion.

October 28, 2011: TVA touts opportunities in small-reactor projects. The Tennessee Valley Authority is keen on paving the way for the emergence of small modular reactors, which cost less to build and can be transported to a location. "We thought the small modular reactors would be a good opportunity, not just for TVA as a future option, but for the country," said Jack Bailey, vice president of nuclear development at TVA. The utility has invested about $6 million in small-reactor studies, and has allocated an additional $6 million to continue evaluating the construction of up to six of those units on the Department of Energy's Oak Ridge Reservation in Tennessee.

October 21, 2011: NRC to implement post-Japan-crisis safety recommendations. The Nuclear Regulatory Commission will soon implement seven of the 12 post-Fukushima Daiichi safety recommendations developed by a task force. The proposals cover plant personnel training, seismic and flooding studies, and "station blackout" standards. "Both industry and the NRC should focus on those matters that have the greatest safety significance and benefit," Nuclear Energy Institute spokesman Steve Kerekes said.

NWI Participates in Power-Gen Conference and Exhibition



NWI participated in this years Power-Gen International Nuclear Industry Conference and Exhibition December 13-15, 2011 in Las Vegas, NV. International participants of all energy sectors were present and provided a interesting perspective in status from developing countries to 3rd generation plant construction and operational testing. The POWER-GEN International 2011 conference program featured a comprehensive curriculum of courses covering a wide range of topics important to the further development of the industry. New product lines and consulting services as well as the major suppliers to the nuclear industry participated in this three day event.

NWI Provides Support in China

BEIJING—Exelon Corp. will provide consulting and training services to an arm of state-owned China National Nuclear Corp., in a signal that China's secretive state-owned nuclear companies are determined to learn Western safety practices and other expertise in the aftermath of Japan's nuclear incident in March.

As part of the deal disclosed on Friday, instructors from Chicago-based Exelon will be stationed at Qinshan Nuclear Power Station in China's eastern Zhejiang province. The initial consulting deal is a small one and is slated to last only through mid-December, though Exelon said it could subsequently grow to include a variety of services for China's progressive nuclear industry.

"It's our first real entry into supporting this nuclear market, which for us is huge," said Thomas P. Mundy, president of Exelon Nuclear Partners, in an interview. "We're dealing with one of the largest [state-owned enterprises] in the country ... to have their interest and their desire for our support and now having a contract with them gets our foot in the door."

Financial terms weren't disclosed. The deal is between Exelon Nuclear Partners, an Exelon unit that provides support services in the nuclear industry, and CNNC subsidiary China Nuclear Power Operations Management Co.

China was one of the world's fastest-growing nuclear markets before the March disaster at Japan's Fukushima Daiichi nuclear-power facility. In March, China's State Council, China's cabinet, ordered a suspension of approvals for new nuclear plants and began a nationwide nuclear-safety review as public fear over nuclear power widened after the Fukushima Daiichi incident.

China operates a relatively modern fleet of reactors, the oldest ones entering commercial operation in 1994. The country has 14 operating nuclear reactors, all scattered along its densely populated eastern coast. Dozens more are planned or under construction.

At the same time, industry experts say, it lacks enough experienced nuclear regulators and plant operators to keep up with the industry's torrid growth. Officials have estimated nuclear-production capacity output could grow to more than 80 gigawatts by 2020 from about 11 gigawatts today.

The agreement "can only strengthen our current focus on safe, reliable and efficient nuclear-power operations at all CNNC facilities and prepare us for the future expansion of nuclear power in China," said He Xiaojian, general manager of the CNNC unit, according to the statement.

Some experts expect Beijing to release its nuclear-safety review before the end of the year. Nonetheless, delays resulting from the review period will likely make it impossible for the government to meet its 2020 goal, according to experts, and China likely will have to rely more heavily on solar, thermal, hydro and other power sources during the next decade as a result.

The cooperation with Exelon appears to be a significant pivot for CNNC, which in recent years unsuccessfully lobbied Beijing against embracing foreign nuclear technology standards. The company is also responsible for developing military nuclear capabilities for the People's Liberation Army. China has embraced AP1000 reactor technology made by Toshiba Corp. unit Westinghouse.. (Friday, November 11, 2011: The Wall Street Journal.). NWI

NWI Products And Services

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NWI Consulting, LLC is a professional consulting firm specializing in power generation performance improvement services, specialized learning interventions, computer-based training, organizational development, accreditation renewal/recovery, and professional staff augmentation. NWI has a broad portfolio of U.S. and international clients in the electric generation industry and is headquartered in Knoxville, TN. NWI's power plant services includes supporting such areas as Operations, Training, Work Control, Outage Management, Performance Improvement, Nuclear Oversight, Maintenance, Radiation Protection, Chemistry, and Emergency Preparedness. NWI has assisted clients in other, more specialized efforts including Leadership/Management Development, Executive Coaching, Conflict Resolution, Multi-Discipline Assessments, Root Cause Analyses, NRC 95-003 Preparations and specialized Safety Analysis (50.59).

NWI News Update

The following key activities are being conducted by NWI professionals...

- CNNC/ENP Support
- DC Cook Training
- Progress Energy's HB Robinson Training and CAP/PI Support
- Xcel's Monticello Engineering EPU Support
- Entergy's Corporate Operations/Nuclear Oversight/Safety Review, Fitzpatrick Training Programs, Grand Gulf Outage Readiness and Work Management Support
- OPPD's Fort Calhoun Flood Recovery & Training Support
- Dominion's Millstone Plant's Mid-Cycle Review

Thank You

We wish to express special thanks to the following clients for making NWI a preferred consulting company.

- AEP's D.C. Cook Nuclear Power Plant
- Exelon Nuclear Partners
- Entergy's Grand Gulf, Pallisaides, Indian Point & Fitzpatrick Plants
- CNNC
- Dominion's Millstone Plant

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