Fall 2012
Volume 8
Issue 4

Lessons Learned from the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station

NWI -CONSULTING-SERVICES-PRODUCTS

Lessons Learned from a Global Event

Visitors to Fukushima Daiichi quickly recognize that something is very different when they enter the guarded and controlled evacuation zone 20 kilometers (12 miles) from the site. The roads are empty, with the exception of cars and trucks traveling to and from the site; and most people seen within the zone are wearing anti-contamination clothing and paper masks or respirators.

In the buses carrying visitors to the plant, there is little conversation—just silent reflection as the rural countryside passes by the window. Previously pristine villages and rice paddies are abandoned and overgrown. Earthquake and tsunami damage to homes, commercial buildings, and other structures has not been repaired. The bus must slow occasionally because of earthquake damage to the roads, which were hastily repaired. Undamaged homes are empty and are beginning to show signs of neglect; and commercial properties, with their inventories still intact, sit just as they did on March 11, 2011. In the Fukushima Prefecture, about 1,000 residents lost their lives during the earthquake and tsunamis, including two operators performing their duties at Fukushima Daiichi Unit 4 who were trapped when flood waters partially filled plant buildings. It is estimated that more than 140,000 residents of the prefecture were displaced from their homes because of the nuclear accident that followed.

At Fukushima Daiichi, conditions have improved significantly since the March 11 event. Much of the debris from buildings, equipment, and vehicles that was left following the tsunami and explosions has been removed, and a large temporary wall has been constructed to help protect against future tsunamis. In contrast, the wreckage of pumps, cranes, buildings, and large equipment that remains is a stark reminder of the power of the tsunamis that struck the site. Improved performance resulted in a high level of confidence in the ability to protect the core and the health and safety of the public given any of the anticipated accident scenarios. However, the Fukushima Daiichi and Daini events reveal the need to also be prepared for the unexpected, including circumstances that go beyond the design basis. No matter how well plants are operated and maintained, there is always the potential for unexpected and high-consequence situations. On reflection, it is evident that Tokyo Electric Power Company (TEPCO) and the broader commercial nuclear industry

(Continued on Page 2)

Inside this issue:

Lessons Learned from the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station

(Continued from Page 1)

were not prepared to respond to maintain critical safety functions or to implement effective emergency response procedures and accident management strategies under the extreme conditions encountered at Fukushima Daiichi. The addendum to INPO 11-005, *Special Report on the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station*.provides lessons learned that nuclear power plant operating organizations should consider in conjunction with action plans already established as a result of the Fukushima event. The addendum does not address regulatory or governmental factors that may have contributed to the event or to difficulties in response to the emergency. Those aspects are well described in other reports, including those developed by the government of Japan, the International Atomic Energy Agency, and TEPCO. The following are the highlights of this document.

A. Prepare for the Unexpected

1. **Lesson Learned: When periodic reviews or new information indicates the potential for conditions that could significantly reduce safety margins or exceed current design assumptions, a timely, formal, and comprehensive assessment of the potential for substantial consequences should be conducted. An independent, cross-functional safety review with a plant walkdown should also be conducted to fully understand the nuclear safety implications. If the consequences could include common-mode failures of important safety systems, compensatory actions or countermeasures must be established without delay.**
2. **Lesson Learned: Plant design features and operating procedures alone cannot completely mitigate the risk posed by a beyond-design-basis event. Additional preparations must be made to respond if such an event were to occur.**
3. **Lesson Learned: Corporate enterprise risk management processes should consider the risks associated with low-probability, high-consequence events that could lead to core damage and spread radioactive contamination outside the plant.**

B. Core Cooling

1. **Lesson Learned: Ensure that, as the highest priority, core cooling status is clearly understood and that changes are controlled to ensure continuity of core cooling is maintained. If core cooling is uncertain, direct and timely action should be taken to establish conditions such that core cooling can be ensured.**
2. **Lesson Learned: Early in the response to an event, clear strategies for core cooling and recovery actions should be developed and communicated to control room and ERC personnel. In addition, leaders should establish clear priorities and provide direction and oversight to enable the strategy to be implemented effectively.**

C. Containment Venting

1. **Lesson Learned: Emergency and accident procedures should provide guidance to vent containment to maintain integrity, purge hydrogen, and support injection with low-pressure systems. Procedures should also provide guidance for performing venting under conditions such as loss of power and high radiation levels and high temperatures in areas where vent valves are located.**

D. Accident Response

1. **Lesson Learned: Nuclear operators must establish the necessary infrastructure to respond effectively to severe accident conditions, mitigate core damage, and stabilize the units if core damage does occur. This infrastructure includes necessary personnel, equipment, training, and supporting procedures to respond to events that may affect multiple units, last for extended periods, and be initiated by beyond-design-basis events. Provisions should also be made to allow an effective corporate and industry response in support**

(Continued on Page 8)

Feds say design flaw led to Calif. nuke plant woes

Published June 19, 2012, Associated Press, San Juan Capistrano, Calif. – Federal regulators said Monday that a botched computer analysis resulted in design flaws that are largely to blame for unprecedented wear in steam tubes at the San Onofre nuclear power plant, but it isn't clear how the problems can be fixed.

The preliminary findings by a team of Nuclear Regulatory Commission investigators were disclosed nearly five months after the seaside plant was shut down following a break in a tube that carries radioactive water. There is no date to restart either of its two reactors. The problems center on excessive tube wear in steam generators that were installed at San Onofre during a $670 million overhaul in 2009 and 2010. Tests found some tubes were so badly **corroded** that they could fail and possibly release radiation, a stunning finding inside the virtually new equipment. Long unknown was what was causing tubes to vibrate and rub against each other inside the massive machines, manufactured by Mitsubishi Heavy Industries.

Greg Werner, who headed the federal team, said a Mitsubishi computer analysis vastly misjudged how water and steam would flow in the reactors. Also, changes intended to improve manufacturing were never thoroughly reviewed in the context of the generator design, resulting in weaker support around bundles of tubes that contributed to vibration, he said.

The plant's operator, Southern California Edison, could face penalties, while problems at the plant have raised fears of a nuclear accident in Southern California and cut off one of the region's important sources of power. "The ultimate responsibly resides with them ... because they are responsible for safety," said Regional Administrator Elmo Collins, the agency's top official in the western U.S. When the generators were designed, the crucial tool Mitsubishi used, a computer model, failed to predict conditions inside the machines and resulted in the tube shaking, Collins said. Edison agreed with the findings. In an interview with The Associated Press on Sunday, Collins said missteps in fabrication or installation were considered as possible sources of the rapid tube decay but "it looks primarily we are pointed toward the design" of the generators. Collins didn't rule out that one or more of the generators might have to be replaced. "We think it's too early to tell," he told reporters. The findings were released during a three-hour meeting Monday in which officials also faced sometimes-testy questions from local citizens concerned about safety.

Outside the hearing, protesters from Friends of the Earth and other groups critical of the nuclear industry displayed signs that said "Not another Fukushima" and "Shut unsafe San Onofre." The group on Monday filed a petition asking the NRC to keep the plant offline until the company amends its license to reflect design changes in the generators. **"This is a safety problem," said Friends of the Earth consultant Arnie Gundersen, a former nuclear industry executive and licensed reactor operator who has written several reports on the San Onofre generators. "These changes put the public at risk."** So far, a fix has remained elusive.

(Continued on Page 6)

FALL 2012
VOLUME 8 ISSUE 4

Feds say design flaw led to Calif. nuke plant woes

"It's not too hard to frame up the problem," Collins told AP. "The answers are very difficult, or they already would have emerged." The disclosure will rivet new attention on a series of alterations to the equipment design, including the decision to add 400 tubes to each generator and installing V-shaped supports that were intended to minimize tube wear and vibration. According to company documents, each of the replacement generators weighed nearly 24 tons more than the original generators. The generators were designed to meet a federal test to qualify as "in-kind," or essentially identical, replacements for the original generators, which would allow them to be installed without prior approval from federal regulators. The agency is reviewing how that was handled. Inside the guts of the machinery, the original steam generators and the replacements "look substantially different," Collins said. Company officials and Collins said safety would remain the first consideration at San Onofre. About 7.4 million Californians live within 50 miles of San Onofre, which can power 1.4 million homes. "These are significant technical issues. They are not resolved yet," Collins said.

The company said in a statement that the Unit 2 reactor likely would remain offline at least through August, pending NRC approval for a restart. It did not project a restart date for Unit 3, where tube damage has been more severe. The company is expected to submit a plan to the NRC later this summer to restart one, or both, reactors, which would have to outline how the company can control the tube damage. "We know that the outage and the tube wear issue have generated concern in our community," Edison President Ron Litzinger said.

Cracked and corroded generator tubing has vexed the nation's nuclear industry for years. Decaying generator tubes helped push **San Onofre's Unit 1** reactor into retirement in 1992, even though it was designed to run until 2004. The following year, the **Trojan** nuclear plant, near Portland, Ore., was shuttered because of microscopic cracks in steam generator tubes, cutting years off its expected lifespan. Westinghouse Electric Corp. weathered a legal battle with five utilities in the 1990s that wanted the company to replace steam generators it manufactured for the **Beaver Valley** nuclear power plant in Pennsylvania after tubing corroded. But the troubled San Onofre generators, manufactured by Mitsubishi Heavy Industries, might be a unique case because of the extensive modifications. Only one other U.S. nuclear plant uses Mitsubishi generators, the **Fort Calhoun Nuclear Station**, about 20 miles north of Omaha, Neb., but its generators are smaller than those at San Onofre and have not displayed excessive tube decay, federal officials say.

The cause of the unusual wear has been eagerly anticipated, as Edison prepares to submit a proposal to the NRC to restart one or both of the reactors. The company has suggested the reactors would run for a test period under reduced power to reduce vibration. "The phenomenon that we think causes this tube-to-tube interaction is definitely proportional to the power," Collins said. "At least in some theoretical sense, that might be part of the answer." The company has announced that 510 tubes have been plugged, or retired from use, in the Unit 2 reactor, and 807 tubes in its sister, Unit 3. Each of the generators has nearly 10,000 tubes, and the number retired is well within the limit allowed to continue operation.

The steam generators — two in each reactor — function something like a car radiator, which controls heat in the vehicle's engine. The generator tubes circulate hot, radioactive water from the reactors, which then heats non-radioactive water surrounding them. That makes steam, which is used to turn turbines to make electricity.

(Continued on Page 5)

Feds say design flaw led to Calif. nuke plant woes

The tubes have to be thin enough to transfer heat, but thick enough to hold up under heavy pressure. They represent a critical safety barrier — if a tube breaks, there is the potential that radioactivity can escape into the atmosphere. Also, serious leaks can drain protective cooling water from a reactor.

The trouble began to unfold in January, when the Unit 3 reactor was shut down as a precaution after a tube break. Traces of radiation escaped at the time, but officials said there was no danger to workers or neighbors. Unit 2 had been taken offline earlier that month for maintenance, but investigators later found unexpected wear in tubes in both units. Edison has been facing pressure from some nearby communities and anti-nuclear activists that have raised safety concerns, while the company looks for a solution to the tube problem and a path to restarting the plant. The design of the generators is also under congressional scrutiny. The plant is owned by SCE, San Diego Gas & Electric and the city of Riverside. The Unit 1 reactor operated from 1968 to 1992, when it was shut down and dismantled. (Associated Press - 6/19/12)

California Law to be Tested by Utility Customers

The longest outage ever at San Onofre's two existing nuclear reactors is set to test provisions and principles of California law designed to free utility customers from paying to operate power plants that are no longer useful. Offline since January, the reactors are almost certain to stay shut through November, triggering an evaluation by state regulators of whether to reduce customer rates associated with the plant. Consumer advocates have begun urging the California Public Utilities Commission to suspend billing customers for San Onofre's operations, upkeep and mortgage — an $835 million annual obligation called a revenue requirement. While provisions for significant "rate base" reductions are enshrined in California law, in practice they are seldom if ever called upon. Nationwide, concessions to ratepayers during outages are rare and can take years to negotiate.

At the Crystal River Unit 3 reactor in Central Florida, idled since a generator replacement project went awry in 2009, a utility-bill rebate of $228 million was negotiated this year in return for guarantees of future rate increases and other incentives to restart the plant. Charles Rehwinkel, an attorney for Florida's Office of Public Counsel who helped negotiate the intricate settlement on behalf of consumers, said the compromise was distasteful to some but avoided years of protracted litigation. "You weren't going to get an agreement where you say (the utility) is paying for all of the costs because you're into the hundreds of millions" of dollars, he said.

Southern California confronted similar issues a generation ago during an extended outage at San Onofre's original Unit 1 reactor, which operated from 1962 to 1992 and has been dismantled. Taken offline for a routine inspection in February 1982, Unit 1 stood idle for nearly three years as plant operator Southern California Edison made modifications to meet new earthquake-safety standards.

The San Francisco-based Utility Reform Network urged state regulators to remove the reactor — a machine less than half the size of each current reactor — from utility bills. The utilities commission set a Jan. 1, 1985, restart deadline, after which utility company stockholders would have to start paying about 20 percent of plant revenue requirements based on a complex rebate formula. That never happened. Edison restarted the unit weeks ahead of the deadline, while deferring some earthquake improvements. It was finally retired in 1992.

The Division of Ratepayer Advocates has urged state regulators to follow a different historic example — from 1982, when the utilities commission declined to start charging ratepayers before the

(Continued on Page 6)

California Law to be Tested by Utility Customers

(Cont. from p. 5)

delayed opening of new Unit 2 and Unit 3 reactors. The current shutdown at San Onofre Nuclear Generating Station began in January with a radiation leak that was traced to rapid wear among steam generator tubes carrying radioactive water. The faulty replacement generators were installed in 2010 and 2011. Edison hopes to submit restart plans in early October for running Unit 2 at reduced power, while setting aside the analysis of more extensive damage to Unit 3.

Federal safety regulators say it will take months to review the restart plans. California's Division of Ratepayer Advocates, meanwhile, has urged the utilities commission not to wait before removing plant revenues from utility rates. The commission deferred action in August and will take up the issue again in late October. Edison, the plant operator, declined to comment on the matter. In a written statement in August, San Onofre's chief nuclear officer, Pete Dietrich, acknowledged "that the extended outage has been a challenge for our customers" and said Edison was cooperating with regulators. Edison owns 78.21 percent of San Onofre, while Sempra — parent of San Diego Gas & Electric — owns 20 percent and the city of Riverside owns 1.8 percent. Until recently, SDG&E relied on the plant for one-fifth of energy needs in San Diego and southern Orange counties.

Radioactivity from Japan's 2011 Fukushima Daiichi Nuclear Event Found in California Blue Fin Tuna

Chris Park / Associated Press - Pacific bluefin tuna carried radioactivity from Japan's 2011 Fukushima Daiichi nuclear disaster all the way across the ocean to the shores of California, scientists reported Monday. They didn't bring much — the levels were far lower than, for instance, levels of naturally occurring potassium 40 that have existed in the ocean for centuries — but the radioactivity was enough to survive the fishes' migration east to North America from the Western Pacific, which they undertake when they're around a year old, said doctoral student Daniel Madigan, who studies the migration patterns of tuna at Stanford University. Last year's March 11 quake and tsunami set off meltdowns at the Fukushima Daiichi nuclear power plant. **"We showed that a blue fin tuna is capable of picking up radioactive material and transporting it across the ocean. That's new. Traditionally people don't think of migratory animals as transport vectors for radioactive materials," he said.**

Madigan made the discovery in samples of fish he collected during the summer of 2011, about five months after the disaster, when "Fukushima was on everyone's mind." Not sure what he'd find, he collected bits of Pacific blue fin tuna flesh from the catches of fishermen in San Diego and sent 15 samples from smaller fish (which, being younger, would have been the most recent migrants from Japan) to Nicholas Fisher's laboratory at Stony Brook University in New York. There they were analyzed for the presence of radioactivity from Fukushima. Madigan said neither he nor Fisher thought they'd see much. They assumed the radioactivity would have been diluted as the fish got away from the coast. "We thought it was unlikely they'd pick up enough of a signal and hang onto it long enough to reach California," he said. But upon analysis, the researchers found signals from Fukushima—isotopes called Cesium-134 and Cesium-137 — in all 15 samples they tested. When the team tested for the isotopes in blue fin tuna

(Continued on Page 7)

Radioactivity from Japan's 2011 Fukushima Daiichi Nuclear Event Found in California Blue Fin Tuna

(Cont. from p. 6)

that migrated to California before the disaster and yellow fin tuna that are native to California waters, the radioactivity wasn't present, which indicated that it came from Fukushima, Fisher said. **The amount of Cesium 134 and 137 detected in the fish "didn't come close to exceeding safety limits," Madigan said, noting that what was in the fish, per gram, is lower than the amount of naturally occurring radioactive potassium found per gram in a banana.** He said he hopes to measure radioactive cesium levels in blue fin tuna again this year, looking at a wider range of blue fin sizes, as well as radiation in other species. The measurements could help researchers study migration patterns in the animals, he added.

The research was published in the journal, Proceedings of the National Academy of Science.

No Public Health Concern From Radiation Levels in Blue Fin Tuna

Multiple media outlets reported that trace levels of radioactive Cesium had been found in Blue Fin Tuna caught off the coast of California. The radioactive particles had been picked up from the Fukushima Daiichi nuclear power plant, according to a report from the National Academy of Sciences. Before anyone thinks twice about eating tuna, there are a couple of facts that you should keep in mind:

- The report did not conclude that there was any food safety or public health concern related to radiation from tuna of any kind. The trace amount of radiation found in the tuna is less than radiation that is found naturally in the Pacific Ocean from Potassium 40.
- The species of tuna mentioned in the report, Blue Fin tuna, is not used in the canned tuna sold in your local supermarket. In fact, Blue Fin is only served as sushi, and most Americans don't eat much of it at all. According to the National Fisheries Institute, per capita, Americans only eat a few paper clips worth of Blue Fin Tuna every year.
- According to Dr. Robert Emery of the University of Texas Health Science Center, a person would have to eat 2.5 to 4 tons of Blue Fin tuna in a year to ingest enough cesium to cause a health problem.

If anything, the report should be seen as reassuring. "The finding should be reassuring to the public. As anticipated, the tuna contained only trace levels of radioactivity that originated from Japan. These levels amounted to only a small fraction of the naturally occurring radioactivity in the tuna, and were much too small to have any impact on public health," said Timothy J. Jorgensen, associate professor of radiation medicine at Georgetown University. "Thus, there is no human health threat posed by consuming migratory tuna caught off the west coast of the United States." (By Eryn Brown, Los Angeles Times, May 28, 2012)

Lessons Learned from the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station

(Continued from Page 2)

of the affected nuclear operating organization.

E. Staffing

1. **Lesson Learned: Establish strategies for staffing operating crews, other key plant positions, and site and corporate emergency response organizations quickly in the initial stages of a multi-unit event and over the long duration of the event response.**

F. Human Limitations

1. **Lesson Learned: Establish contingency plans, training, and guidance to help personnel cope with the emotional concerns that can impact decision-making and reduce personnel effectiveness during a natural disaster or nuclear accident**

G. Emergency Preparedness

1. **Lesson Learned: Ensure primary and alternative methods for monitoring critical plant parameters and emergency response functions are available. Use drills and exercises to ensure emergency response personnel are able to use the available monitoring tools and methods.**
2. **Lesson Learned: On-site and off-site facilities necessary for coordinating emergency response activities should be designed and equipped to remain functional in the event of a natural disaster and/or a nuclear emergency.**
3. **Lesson Learned: Ensure those who possess the expertise to operate specialized accident response equipment are available and are prepared to respond to a severe accident. This may be accomplished through contracts or by training and qualifying members of the station emergency response staff to perform these functions.**

H. Roles & Responsibilities

1. **Lesson Learned: Clearly define and communicate the roles and responsibilities of emergency response personnel to help ensure effective post-accident communications and decision-making.**

I. Communications

1. **Lesson Learned: Communication methods and equipment should support accurate and timely information exchange, consistent and clear communications with the public, and information-sharing between the utility and the government.**

J. Radiation Protection

1. **Lesson Learned: Radiation protection (RP) personnel must have established procedures, equipment, and staffing to support emergency response actions.**
2. **Lesson Learned: Station emergency response plans should allow for prompt RP support of operator actions needed to establish or maintain safe shutdown and should include the needed flexibility to support such actions.**
3. **Lesson Learned: Dose limits should allow some flexibility such that required actions can be performed during accident situations. In addition, workers should be trained or briefed on the relative risk of higher acute radiation doses.**

K. Off-Site Support

1. **Lesson Learned: Off-site resources and support should be provided on a priority basis following significant events such a loss of off-site power. Emergency response plans and other corporate guiding documents should clearly state that the needs of nuclear stations are to be given highest priority in the event of an emergency situation.**

L. Design & Equipment

1. **Lesson Learned: Equipment required to respond to a long-term loss of all AC and DC power and loss of the ultimate heat sink should be conveniently staged, protected, and maintained such that it is always ready for use if needed.**
2. **Lesson Learned: Plant modifications may be**

(Continued on Page 9)

Lessons Learned from the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station

(Continued from Page 8)

needed to ensure critical safety functions can be maintained during a multi-unit event that involves extended loss of AC power, DC power, and the ultimate heat sink.

M. Procedures

1. **Lesson Learned: Optimum accident management strategies and associated implementing procedures (such as emergency operating procedures and accident management guidelines) should be developed through communications, engagement, and exchange of information among nuclear power plant operating organizations and reactor vendors. Decisions to deviate from these strategies and procedures should be made only after rigorous technical and independent safety reviews that consider the basis of the original standard and the potential unintended consequences.**
2. **Lesson Learned: Conditions during and following a natural disaster or an internal plant event may significantly impede and delay the ability of plant operators and others to respond and take needed actions. The potential for such delays should be considered when procedures and plans for time-sensitive operator actions are being established.**

N. Knowledge & Skills

1. **Lesson Learned: On-shift personnel and on- and off-site emergency responders need to have in-depth accident management knowledge and skills to respond to severe accidents effectively. Training materials should be developed and training should be implemented using the systematic approach to training.**

O. Operating Experience

1. **Lesson Learned: Actively participate and make best use of operating experience information shared in international organizations and forums.**
2. **Lesson Learned: When considering the applicability of significant operating experience from international events, go beyond the event causes and transient initiators and consider the potential to experience the same consequences through other means. Take timely action to strengthen defenses to such vulnerabilities.**

P. Nuclear Safety Culture

1. **Lesson Learned: Behaviors prior to and during the Fukushima Daiichi event revealed the need to strengthen several aspects of nuclear safety culture. It would be beneficial for all nuclear operating organizations to examine their own practices and behaviors in light of this event and use case studies or other approaches to heighten awareness of safety culture principles and attributes.**

(Source: INPO 11-005 Addendum August 2012)

"For nuclear professionals, it is not possible to visit the Fukushima Daiichi site without coming away with a renewed commitment to ensuring nuclear safety." John Conway, Senior Vice President, Energy Supply, Pacific Gas & Electric Company

MANTG Workshop — June 11-14, 2012

The Mid Atlantic Nuclear Training (MANTG) 2012 instructor workshop occurred in Gettysburg, PA at the Wyndham Gettysburg Hotel. NWI attended and hosted this conference, exhibiting along with other vendors. More than 25 years have passed since the inception of accrediting training programs. While the initial focus was on implementing the systematic approach to training, over the past few years strong focus has been given to both human performance and training to improve performance. Currently, the US industry is introducing new workers to our workforce. The workshop's theme was "Fundamentals for Training Professionals". These fundamentals provide the foundation for engaged, thinking organizations.

ANS Utility Working Conference— Aug. 5-8, 2012

NWI helped sponsor the American Nuclear Society's Utility Working Conference (ANS UWC) held at the Westin Diplomat in Hollywood, Florida this past August. TVA's Nuclear Group hosted the event having this year's theme being "Nuclear - Still the One! The Right Business - The Right Results - The Right Way Forward." Tom Kilgore, TVA's Chief Executive Officer, opened the meeting with a review of the basic reasons why nuclear energy is still a critical part of the energy mix in the US and the world. Numerous key industry topics were discussed by presenters with a full listing available at the ANS website, Topicals and Executive Conferences: http://www.new.ans.org/meetings/m_141.

NWI News Board

- Bill Cheever continued to assist Monticello in preparation for their upcoming EPU outage in the design engineering and project management areas.
- Mike Gettle supported the CAP/recovery team and Engineering at Susquehanna Steam Electric Station.
- Ernie Harkness continues to support Entergy's Nuclear Safety Review Board.
- Bill McNeill and Frank Tsakeres have provided causal analysis support at Entergy's River Bend Station.
- Tim Bostwick continues to lend his CAP expertise and insights to TVA's Browns Ferry nuclear plant.
- Steve Pettinger assisted the DC Cook site training team in writing an ILT NRC Exam.
- Pat O'Neil is providing CAP management and support at OPPD's Ft. Calhoun Station.
- Rick Westcott continues providing causal analysis and CAP recovery activities for Ft. Calhoun Station.
- Bill Poirier is providing root cause analysis and collective evaluation support at OPPD's Ft. Calhoun Station.
- Larry Searle, Dan Paxton, Ken Payne and Jim Sollis supported CENG's Calvert Cliffs Maintenance & Technical Training improvement efforts.
- Ken Davidson continues to assist Entergy's Fitzpatrick plant in the area of electrical maintenance training.
- Steve Telford and Frank Tsakeres provided an outage readiness review for ENW's Columbia Station.
- Paul Kirker is providing operations work management support for ENW's Columbia Station.

We wish to express special thanks to the following clients for recently making NWI a preferred full services company:

- **AEP's D.C. Cook Nuclear Station**
- **CENG's Calvert Cliffs Nuclear Power Plant**
- **Entergy's James A. Fitzpatrick Station**
- **Entergy's River Bend Station**
- **Exelon Nuclear Partners**
- **OPPD's Ft. Calhoun**
- **OOPD's Ft. Calhoun Station**
- **Xcel Energy's Monticello Plant**
- **PP&L's Susquehanna Steam Electric Station**
- **TVAN's Browns Ferry Nuclear Plant**
- **Energy NW's Columbia Station**

Editor: Frank S. Tsakeres

NWI Director of Operations

Associate Editor: Kate Hendrickson

NWI Director, Marketing

Our program specialties include: Human Performance, Training and Accreditation, Simulator Instructor Training, Operations Training, Engineering Services, Corrective Actions Program Improvement, Root Cause Analysis and Self-Assessment, NRC Exam Writing, CBT for Dry Cask Storage/ RadWaste Training, and many Human Performance Trainers.

NWI Consulting, LLC, PO Box 33117, Knoxville, TN 37930

(865)385-6166 (Office), Toll-Free Fax: (888)817-8890 or (865)769-5400