

# insight

JUNE 2000

## Oconee Plant's License Is Renewed For Second Time, NRC Grants 20-Year Extension

**D**uke Power's Mike Tuckman is "tickled pink." On May 23, the Nuclear Regulatory Commission renewed the licenses for the company's three-unit Oconee nuclear plant for an additional 20 years.

Between July 1998 and last month, the NRC staff reviewed literally thousands of pages documenting information about the plant's equipment, systems maintenance and component replacement programs.

Tuckman praised the agency for the discipline it displayed in sticking to the schedule over the 22-month review process—and for its "diligence" in ensuring public safety. Duke Energy Chairman Richard Priory called the process "the most thoughtful, deliberate" one he had seen in terms of regulatory issues.

Oconee is the second U.S. plant to have its license renewed, following Constellation Energy's Calvert Cliffs by a month—indicating that license renewal isn't a one-time thing. On the other hand, Tuckman cautions, "just because it's been done once or twice, it's not automatic for others."

Each company must do the proper engineering, says Tuckman. But the process is expected to become more streamlined.

"Once you discover one thing, you don't have to rediscover it a hundred times." As an example, he points to Unit 1 at Entergy's Arkansas Nuclear One plant, a sister in design to the Oconee units. The NRC staff, which is reviewing the license renewal application for ANO now, should look at what is different from Oconee, suggests Tuckman.

joined the license renewal queue can have "a high degree of certainty that the process will reach a timely conclusion," says Tuckman. That means they can make investments in their plants—such as installing new steam generators—that they might not have considered for a plant expected to operate for 40 years. With license renewal, "you start looking at



PHOTO COURTESY OF DUKE POWER

*Oconee's license renewal is cause for celebration by the plant's friends*

your plant as a 60-year capable plant," says Tuckman. Capital improvements will help ensure reliability while reducing maintenance costs.

In the end, license renewal has succeeded because of all the stakeholders who helped to make it possible, says Tuckman. He credits the U.S. Congress, the Electric Power Research

When Duke Energy first broached the subject of license renewal, there were a number of unknowns, says Tuckman. "We didn't know how long it would take or how expensive it would be." Nor was it even clear that license renewal was possible, given the industry's uncertain outlook at the time.

But now, company executives who have

Institute (EPRI), the NRC, the Energy Department and the industry, including NEI.

In congratulating Duke Energy on its achievement, NEI President and CEO Joe Colvin said that license renewal "ensures a continued, reliable, clean supply of electricity to satisfy the increasing demands of the digital economy."



# Chernobyl Plant To Close

In an announcement long awaited by the world, Ukraine's president said earlier this month that the Chernobyl nuclear power plant would close in December.

For much of the past decade, the Group of Seven industrialized nations, including the United States, used carrot and stick in an effort to bring about the plant's shutdown. In the end, Ukrainian President Leonid Kuchma essentially kept to a 1995 agreement with the G-7 to shutter Chernobyl by 2000.

Kuchma announced the decision during talks June 5 with President Bill Clinton. The Ukrainian president also made clear that there would be no backing down. "Everything will be done as I have said," he told a seminar for regional journalists on June 6.

## CHERNOBYL'S HEALTH EFFECTS

Fourteen years after the accident at the Chernobyl plant, only one radiation-related health effect has been observed, according to a United Nations group. A sharp rise in the incidence of thyroid cancer among children in areas of Belarus, Ukraine

and Russia has been firmly established. But in an exhaustive review of data, the U.N. Scientific Committee on the Effects of Atomic Radiation has found no other evidence of increased cancer incidence or death that could be attributed to the accident.

Although reports abound stating that thousands of people—mainly accident cleanup workers—died as a result of the April 1986 explosion, the U.N. committee said that 28 workers at the plant died of radiation and thermal burn injuries within three months of the accident. Three children reportedly have died of thyroid cancer, which—if detected early—can be treated with surgery.

While the committee could find no scientific proof that the accident caused an increase in cancer, apart from childhood thyroid cancer, it did note that many thousands of lives were disrupted. A 1996 international conference cosponsored by the European Commission, the International Atomic Energy Agency and the World Health Organization concluded that—because of mental stress caused by the accident—anxiety and despair were likely to be Chernobyl's main legacy.

# Nine Mile Point Plant Is Open for Bids

U.S. nuclear plants' market value is growing. The latest sign: a decision to seek bids for the Nine Mile Point plant.

Niagara Mohawk Power Corp. had agreed a year ago to sell its share in the plant—all of Unit 1 and 41 percent of Unit 2—to AmerGen Energy Co. But the New York Public Service Commission staff said the \$163.2 million sale price was too low, and the two sides eventually ended their purchase agreement.

Earlier this year, two other New York nuclear plants—Indian Point 3 and James A. FitzPatrick—were sold to Entergy Nuclear for a record \$976 million.

Last month, Niagara Mohawk and four of the five owners of Unit 2 agreed to a competitive bidding process for the plant. Only the Long Island Power Authority, an 18 percent owner of Unit 2, will not participate in the auction. Bids for the plant are due in the next two months.

# Midwest Plants Consolidate Their Expertise

Mention the term "nuclear consolidation," and most people think of the selling—and buying—of nuclear power plants or the merging of companies. But there's another kind of consolidation going on in the industry today.

Four nuclear utilities in the Midwest have pulled together the expertise, best practices and resources of the seven nuclear units they operate at five plant sites, creating a single nuclear operating company.

Last month, the Nuclear Regulatory Commission gave approval to the Nuclear Management Co. to operate the seven units. The company will be responsible for operations and maintenance at:

- Duane Arnold (previously operated by Alliant Energy-IES Utilities)
- Monticello and Prairie Island units 1 and 2 (previously operated by Northern States Power Co.)
- Point Beach units 1 and 2 (previously operated by Wisconsin Electric Power Co.)
- Kewaunee (previously operated by Wisconsin Public Service Corp.)

The new company "is dedicated to helping these plants sustain long-term safety, optimize reliability, control costs and improve performance," said Mike Sellman, president of Nuclear Management Co. He said the company would play an increasingly important role "in meeting our region's need for low-cost, reliable, emission-free electricity."

# Making Tomorrow's Nuclear Plants Competitive

## DOE-Supported Research Team Seeks To Reduce Cost

In terms of electricity cost, today's nuclear power plants give coal-fired power plants a run for their money. And they leave other fossil plants—fueled with natural gas and oil—in the dust.

Nuclear plants produced electricity at an average cost of 2.13 cents per kilowatt-hour in 1998—the most recent data available. Electricity from coal-fired plants cost an average 2.07 cents/kWh, while plants using natural gas generated electricity at an average 3.30 cents/kWh and oil-fired plants, an average 3.24 cents/kWh.

What's more, today's nuclear plant can beat a brand new gas- or coal-fired plant hands down. Constellation Energy Corp., which recently received permission to operate its Calvert Cliffs nuclear plant for an additional 20 years, looked at alternatives to license renewal. The company

found it would get 20 more years of Calvert Cliffs' 1,700 megawatts of capacity at \$11 a kilowatt. Building a new 400-megawatt advanced gas combined cycle plant would cost about \$580/kW, according to the Energy Department's Information Administration. A new 400-megawatt coal-fired plant would cost about \$1,100/kW.

But how will the cost of electricity from a new nuclear plant stack up against that of its fossil competitors—mainly natural gas?

America's three new certified plant designs—GE Nuclear's Advanced Boiling Water Reactor and Westinghouse's System 80+ and AP600—were developed to be safer and simpler. By incorporating the latest technologies, they'll be easier to operate and faster to build. The AP600 "passive" design relies on natural forces like convection and gravity, and incorporates improved automatic safety features. With far fewer valves, pipes, pumps and control cable than today's plants, it will reduce construction time and cost. But whether it will

reduce them enough isn't known.

"Being close isn't good enough," says George Davis, director of government programs at Westinghouse. In the deregulated environment of the future, electricity prices will be set by what competing technologies offer. "Today's plants are reducing production costs, a trend that is likely to continue. We need to focus on driving down capital costs of new plants," he says.

To tackle the challenge, a team of three companies, two national labs and three universities has launched three related research and development

*"Today's plants are reducing production costs. ... We need to focus on driving down the capital costs of new plants."*

George Davis  
Director, Government Programs  
Westinghouse Electric Co.

projects. The team members are Westinghouse, Duke Engineering & Services, Egan & Associates, Sandia National Laboratories, Idaho National Engineering & Environmental Laboratory, Massachusetts Institute of Technology, North Carolina State University and Pennsylvania State University.

Supported by grants from the Energy Department's Nuclear Energy Research Initiative, the team seeks to:

- apply risk-informed safety principles to further simplify new plant designs
- develop computer technology applications that make nuclear plant equipment "smarter"
- find applications—especially computer-based—for advanced processes and tech-

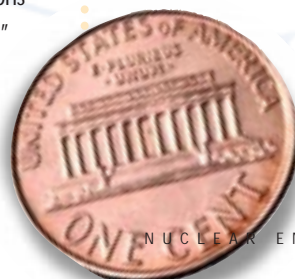
nologies adapted from other industries.

Michael O'Connell of Duke Engineering & Services is investigating improvement strategies in other industrial sectors. The team selected capital-intensive firms like Caterpillar because the scale of expenditures and time required for their projects is similar to that of a nuclear plant, he says. For example, "Caterpillar reduced the time to bring new equipment to market from 78 months to 39—and now it's shooting for 24 months," he says. "We're trying to translate these kinds of improvements into real action." Taken together, they "can help us shrink the time and cost associated with building new nuclear power plants."

At the conclusion of the three R&D projects in 2001, the team expects to have three "virtual" models—one that represents the physical design of the plant, one that represents the construction schedule and one that represents the cycle of activities needed to bring a plant to completion. "You'll be able to take a virtual plant and a virtual construction schedule, introduce the strategies we've identified, and produce a result that tells you whether you've achieved your goal," says O'Connell.

That goal, says Westinghouse's Davis, "is a product that can compete economically in a deregulated marketplace.

"By combining the three models with a more risk-based regulatory process and 'smart' equipment, the industry should be able to simplify new nuclear plants enough to ensure an expanded role for nuclear energy in the future," he says.



# World's Plants Are Safer, More Efficient

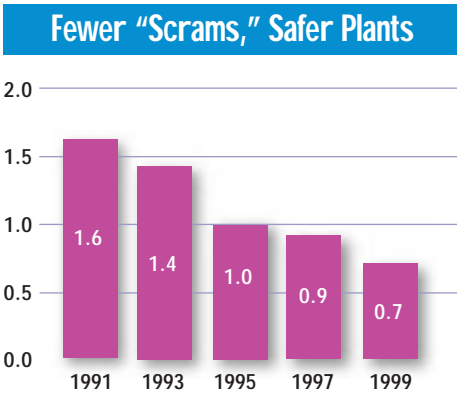
## Performance Indicators for 1999 Are Best Ever

It's not just U.S. nuclear plants that are getting better and better. Performance is rising around the globe. In terms of safety and efficiency, the world's 432 nuclear generating units had their best year ever in 1999.

Since 1990, the World Association of Nuclear Operators has collected plant performance data in 10 key areas. One area of safety significance is the median number of unplanned automatic shut-downs, which tracks the median scram rate for approximately one year. That number has plunged from 1.8 scrams in 1990 to 0.7 last year for the 418 nuclear units reporting the data.

Safety is also measured in terms of the industrial safety accident rate. That rate has declined sharply from 1.04 lost-time accidents per 200,000

worker-hours in 1990 to 0.43 in 1999, as reported by 206 units.



*The number of unplanned, automatic scrams—the sudden shutdown of a plant's reactor—has fallen steadily worldwide.*

In terms of power production, plants are boosting output by minimizing unplanned energy losses and optimizing planned maintenance and refueling outages.

The global industry's unit capability factor—which measures the percentage of maximum electricity generation a plant is capable of supplying to the electrical grid—rose to 84.5 percent last year from 77.2 percent in 1990, according to the 422 units reporting the data.

In 1993, reporting of data began for all reactor types. The level of reporting has grown, with 100 percent of world operating nuclear plants reporting at least four indicators and 98 percent reporting at least seven.

# The 'New' Nuclear Industry

## It's Safer, Stronger, Leaner, Says Industry Executive

Consolidation "just makes good business sense," Donald Hintz told more than 200 executives attending the Nuclear Energy Institute's annual meeting last month.



Donald Hintz  
President  
Entergy Corp.

*Nuclear energy can be successful "in the new world of competitive power generation."*

We are "rapidly becoming an industry of a few large nuclear operators," said the president of Entergy Corp. These operators are demonstrating that nuclear energy can be successful "in the new world of competitive power generation"—benefiting consumers and the public alike. What's more, Hintz said, it's not just the owners and operators of nuclear power plants that are consolidating. The major nuclear plant designers and major equipment vendors are doing it, too.

"It's a natural business response," he said. "And, as a result, we are seeing a safer, stronger, leaner nuclear industry, better able to compete."

Why the large operator today?—Hintz asked rhetorically. For a start, a large operator can bring "focused management" to its nuclear units. Other key reasons:

- sharing the industry's best practices "like never before"
- eliminating costly duplication
- realizing economies of scale—"in everything from buying fuel to the smallest supplies"
- sharing resources that a smaller operator "just couldn't afford"
- developing some of the most sophisticated management succession programs ever—and "getting some of the industry's best young talent as a direct result"
- having the resources to respond quickly to any problem—"whether technical, financial or regulatory."

The trends are clear, said Hintz. "The 'new nuclear' is here."

# Radioisotopes to the Rescue

## New Procedure Reduces Reblocking of Coronary Arteries

**H**earth disease is universal. More than 1.5 million people around the world undergo procedures to unblock their coronary arteries every year—one-third of them in the United States.

But between 30 percent and 50 percent of all those who are treated suffer from reblocking of the arteries, or restenosis. Retreatment is expensive. In the United States alone, it's estimated to cost \$1 billion to \$2 billion a year.

A problem of such global proportions warrants a global solution. Of the many approaches tested to inhibit restenosis, one shows particular promise—the use of radiation. And indeed, clinical trials using several different radioisotopes are under way in a number of countries. Preliminary findings indicate the procedure is safe and effective. It inhibits the uncontrolled growth of cells that tends to occur after angioplasty—the inflation of a balloon catheter in an artery to reduce a blockage.

One of those radioisotopes—rhenium-188—is being tested in six countries, including the United States. At Columbia University in New York City, Judah Weinberger is in the middle of a safety trial of the radioisotope. Similar studies are being carried out by Neal Eigler and his colleagues at the Cedars-Sinai Medical Center in Los Angeles.

"We look at safety first, then efficacy," says Weinberger, associate professor of medicine and director of research in interventional cardiology. "We've treated about 45 patients, with excellent safety results."

For the treatment, a balloon angioplasty catheter is filled with liquid rhenium-188 and inflated in a patient's coronary artery at the site of restenosis. "We're seeing a recurrence rate of approximately 15 percent," he says, which is in line with that of trials using other radioisotopes.

Once the procedure is shown to be safe for patients, Weinberger and his team will extrapolate any information on effectiveness. After that, they'll develop a second trial—what's known as a double-blind, randomized trial in which neither patients nor staff know who is receiving the experimental



PHOTOS COURTESY OF J. KROPP, M.D. AND K. REYNEN, M.D., UNIVERSITY HOSPITAL, DRESDEN, GERMANY

treatment—to determine how effective the procedure is. While the safety trial is physician-sponsored, in the United States the randomized trial must be supported by a company, says Weinberger.

The Columbia University team produces its own rhenium-188, using a radioisotope generator purchased from the Energy Department's Oak Ridge National Laboratory. The lab developed the generator and the methods required to concentrate the rhenium-188 solution, says Russ Knapp, head of the nuclear medicine program in Oak Ridge's Life Science Division. And Weinberger adds: "The clinical trial wouldn't be possible without the development work done by Oak Ridge."

Oak Ridge also is supplying the rhenium-188 generators for trials in Germany, Australia, China, Taiwan and South Korea, says Knapp. Joachim Kropp—a nuclear medicine physician at University Hospital in Dresden, Germany, who has worked with Knapp—said the hospital began a double-blind, randomized trial in early 2000 involving 300 patients. In a follow-up to an earlier pilot study, Kropp said that after six months, 11 of 15 patients were free of restenosis.

A trial at Australia's Perth Hospital has reported

***A new treatment to inhibit reblocking of coronary arteries uses a balloon angioplasty catheter filled with radioactive liquid rhenium-188.***

excellent safety and good results, says Weinberger. He says a team led by Dr. Byung-il Choi at South Korea's Ajou University has found lower restenosis rates after six months in a randomized trial.

Without DOE's support, Oak Ridge wouldn't be able to provide the rhenium-188 generator to hospitals and universities around the world, says Knapp. Under DOE's Advanced Nuclear Medicine Initiative, which supports research in therapeutic radioisotope applications, the agency provides research grants and affordable isotopes.

"DOE's support of research aimed at developing new methods of producing and applying radioisotopes in nuclear medicine complements the agency's isotope production and distribution program," says Knapp.

# Scaling Yucca Mountain

## NRC Says DOE's Used Fuel Program Appears To Be on Right Track

The Energy Department's used fuel program is on track to meet key milestones, according to DOE officials. What's more, DOE's used fuel program seems to be on the *right* track—so far, say Nuclear Regulatory Commission officials. NRC staff is satisfied with DOE's attention to resolving nine key technical issues, such as the possibility of earthquakes and the consequences of potential volcanoes affecting the repository and the integrity of the packages holding the used fuel.

"We've seen a breakthrough in DOE's ability to verify the quality of the data," notes Bill Reamer, chief of the NRC's High-Level Waste and

Performance Assessment Branch. He says there's a greater sense that DOE is committed to resolving all technical issues to the satisfaction of the NRC.

At a meeting in late April, staff from the two agencies agreed on the closure of some issues and developed plans for the rapid resolution of all outstanding issues. "Closure," says Reamer, "means that the staff has no further questions on the topic." Closure of an issue in the pre-licensing phase of the project is not legally binding, he says. "But it does mean that DOE's approach and available information acceptably address staff questions at this time. We would expect to be able to make

a regulatory decision on the topic if DOE submits a license application for the repository."

Through its new performance-based regulatory process, the NRC is giving DOE enough flexibility to get the job done in the best way, Reamer says. "Before, the agency's process may have chilled innovation due to a prescriptive approach on how each issue should be resolved," he adds. "Now, the burden is on DOE to decide how to proceed, although we'll provide guidance. DOE will be judged on the result, assuming it can explain how it got there. But it won't be required to do it a particular way."

## Chicago, Chicago...

The theme of NEI's annual meeting—*Perspectives on Mastering Change*—"hits the mark," said James Thompson, former governor of Illinois. "Of all the high-tech industries in the country, I can't think of any that has improved and continued to improve the way you have," he said, speaking at the Nuclear Energy Assembly in Chicago last month.

Illinois is the "center of the nuclear energy universe," Thompson said, home to more nuclear power plants than any other state. He reminded the meeting's participants that Chicago was the site of the first controlled nuclear chain reaction, in 1942.

Thompson noted that Illinois has many forms of energy within its boundaries, including oil and coal deposits. But of nuclear energy, he said, "There is no cleaner, no better, no safer, no more protective form of energy." Noting the environmental benefits of nuclear energy, he said, "How you manage your industry will have great impact on the quality of life."

Robert Wislow, chairman and CEO of U.S. Equities Realty LLC, told industry executives that his ability to develop commercial properties hinges in part on nuclear energy's clean-air attributes. Because nuclear energy does not emit pollutants into the atmosphere, it helps Chicago stay within federal and state air-quality limits, he said.

Exceeding those limits could trigger tighter restrictions on automobiles in downtown Chicago, thus limiting commercial development, Wislow said. Further industrial development in the region also could be affected.

"We come under a Clean Air Act here in downtown Chicago, and...we have to be concerned about the emission of pollutants from...automobiles that are coming downtown," Wislow said. "We have to find other ways to reduce pollutants. Nuclear power is obviously one of those ways."

# Want Clean, Reliable Electricity?

## Retain the Nuclear Energy Option, Say Three Reports

Increasingly, policymakers around the globe must consider the role of nuclear energy in providing reliable electricity and helping to reduce greenhouse gas emissions, say three recent reports.

### RECONSIDERING NUCLEAR ENERGY

"Mankind is facing a tremendous challenge with global climate change," according to Dutch physicist Bob van der Zwaan. To address that challenge, "we have to consider new energy sources, including nuclear," says the visiting Science Fellow at Stanford University's Center for International Security and Cooperation.

"Nuclear power can play a significant role in mitigating climate change, say van der Zwaan and William Sailor, also a visiting Science Fellow, in a May 19 *Science* magazine article. The two select a scenario under which, by 2050, carbon dioxide emissions would not have increased from their current level. They envision a world in which fossil fuels provide one-third of all energy, renewables provide one-third and nuclear energy, one-third.

"Once it's realized that we cannot make ends meet without nuclear energy," say the authors, public opinion may support it. But first, several challenges must be addressed: safety, cost, waste and proliferation.

"No technology, including nuclear, can be a panacea," says van der Zwaan. But he believes that the public must reconsider nuclear energy as part of the solution to global warming.

### ENERGY OPTIONS TO 2020

The World Energy Council sees "a significant role for nuclear power in meeting the goals of energy accessibility and energy availability between now and 2020."

In a *Statement 2000* issued earlier this year, the council urged the countries of the world to keep all energy options—including nuclear energy—open. "Nuclear power is of fundamental importance for most [World Energy Council] members,"

*Even in the 1950s, Europe saw the benefits of nuclear technology—as celebrated by Brussels' Atomium*

said the council. It's the only energy supply that already has "a very large and well-diversified resource," doesn't emit greenhouse gases and has "either favorable or at most slightly unfavorable economics."

In fact, said the council, "should the climate change threat become a reality, nuclear is the only existing power technology which could replace coal in baseload electricity generation."

Total reliance on fossil fuels and large hydro won't satisfy the world's growing demand for electricity, said the council. "The role of nuclear therefore needs to be stabilized with the aim of possible future extensions. In parallel, efforts to develop intrinsically safe, affordable nuclear technology need to be encouraged."

### HORNS OF A DILEMMA

Increased reliance on nuclear energy involves a "delicate" trade-off, says a U.K.-based environmental and energy consulting firm. It can "significantly reduce" carbon dioxide emissions, but "at the cost of increased generation of waste."

Nonetheless, the European Union and the eight EU countries with nuclear power plants will find it extremely difficult to limit carbon dioxide emissions after 2010 without retaining nuclear energy's 23 percent share of electricity generating capacity, says ERM Energy.

In a study for the EU's European Commission, ERM Energy used the so-called "Dilemma" model to compare carbon dioxide emissions and wastes resulting from three different scenarios of nuclear energy development in the EU and its member states. Under the "business as usual" scenario,



carbon dioxide emissions would be 4 percent above 1990 levels in 2010, rising to 22 percent above in 2025. Under the low nuclear scenario—early retirement of nuclear plants—carbon dioxide emissions would be 12 percent above the 1990 level in 2010, rising to 40 percent in 2025. Under the high nuclear scenario—building new nuclear capacity—carbon dioxide emissions in 2010 would be roughly equal to the 1990 level, and 4 percent below the 1990 level in 2025.

"Given that the power sector is responsible for 30 percent of EU [carbon dioxide] emissions and that caps on carbon dioxide emissions have been agreed under the Kyoto Protocol, the future role of nuclear power must now be reevaluated," said Peter Wooders, ERM senior consultant.

Copies of the reports are available at: <<http://www.stanford.edu/dept/news/report/news/may24/nukepower-517.html>>, <<http://www.eur-opa.eu.int/en/comm/dg17/dilemma.pdf>>, and <[http://www.worldenergy.org/wec-geis/etwan/open.plx?file=exec\\_summary/exec\\_summary.htm](http://www.worldenergy.org/wec-geis/etwan/open.plx?file=exec_summary/exec_summary.htm)>.

# Want a TIP? Innovate!

This year's recipients of the Top Industry Practice Awards have at least one thing in common. They're innovators.

"No single person or company could think of all the innovations that we have collectively arrived at since the beginning of the TIP Awards in 1993," said Joe Colvin, NEI president and CEO, at the award ceremony in Chicago in May.

Each year, the TIP Awards go to the companies with the best new practice that other nuclear power plants can adopt. The criteria include improving safety, reducing costs and increasing productivity and efficiency. This year's winners are:

- Alliant Energy and its Duane Arnold Energy Center (Grand Prize and GE Nuclear Energy Vendor Award)
- Southern Nuclear Operating Co. and its



Joseph M. Farley Unit 2 (Grand Prize, Westinghouse Vendor Award and Equipment Process Reliability Award)

- Southern California Edison and its San Onofre Nuclear Generating Station (Combustion Engineering Fleet Vendor Award to the station's safety group and

Engineer Michelle Carr, a member of San Onofre's Safety Group, receives a TIP Award for Combustion Engineering plants from Michael Barnoski of Westinghouse. The group's innovation resulted in shorter, simpler and safer refueling outages.

- Operate Plant Process Award to station)
- Florida Power Corp. and its Crystal River Unit 3 (Framatome Vendor Award and Work Management and Configuration Control Process Award)
- Arizona Public Service and its Palo Verde Nuclear Generating Station (Administrative Support and Training Process Award)
- Tennessee Valley Authority and its Browns Ferry Nuclear Plant (Materials, Fuel and Support Services Process Award).

## NUCLEAR ENERGY insight

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For more information call 202.739.8000 or visit NEI's Web site at [www.nei.org](http://www.nei.org).

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