

Insight

OCTOBER 2008

Campaigning for Sustainable, Secure and Affordable Energy

With rapidly rising energy demand and the rising costs of fossil fuels looming large among voters, energy is one of the top issues of this year's election cycle.

Enhancing America's energy security with offshore oil and natural gas drilling and expanding clean sources of electricity like nuclear and renewable energy sources are at the heart of the presidential debates and many of the congressional races.

In the race for the White House, both John McCain and Barack Obama support the expansion of nuclear energy as part of a climate-friendly energy policy. McCain advocates 45 new reactors by 2030; Obama supports a less aggressive expansion of new reactors.

Though there are nuances in the McCain and Obama approaches to nuclear energy, it is more than ever a non-partisan issue.

"It's time for U.S. progressives and Democrats to break the taboo on nuclear energy," says Will Marshall, president of the Progressive Policy Institute. "What better way to show we're serious about protecting our planet?"

In July, 27 former cabinet officials and policy leaders advocated a 13-point energy policy, including a commitment to expand nuclear energy. "Expansion of new nuclear power assets is essential to meet our projected growing demand while mitigating our emissions of CO₂," wrote the Democratic and Republican leaders.

Both presidential candidates also support

reducing U.S. reliance on imported oil and developing specific targets and timetables for reducing greenhouse gas emissions. There also are, of course, significant differences in their energy policies.

The table on page 3 compares the positions of both candidates.



AP PHOTOS

"Nuclear energy is safe, efficient, inexpensive and obviously a vital ingredient in the future of the economy of our nation and in our mission to eliminate over time our dependence on foreign oil."

Sen. John McCain



AP PHOTOS

"I will tap our natural gas reserves, invest in clean coal technology, and find ways to safely harness nuclear power. ...It is unlikely that we can meet our aggressive climate goals if we eliminate nuclear power as an option."

Sen. Barack Obama



ORNL Demonstrates New Nuclear Fuel Recycling Process

Researchers at Tennessee's Oak Ridge National Laboratory (ORNL) have successfully demonstrated a process to convert small quantities of used reactor fuel to a mixed plutonium-uranium fuel without separating pure plutonium from the used fuel.

The laboratory has a long history of research and development in the area of used fuel reprocessing. During World War II, researchers there developed processes to extract plutonium from the Oak Ridge Graphite Reactor. Subsequent improvements were developed into the PUREX process (Plutonium/URanium EXtraction), which is used in France, Japan and other countries to extract uranium and plutonium from used nuclear fuel.

However, this recycling technique produces a separate stream of pure plutonium, which is considered a potential proliferation threat by oppo-

nents of used fuel recycling.

A small-scale research program at ORNL continues the laboratory's long history of improving recycling processes.

A successful result reported recently by Sherrill Greene, director of ORNL's Nuclear Technology Programs, and researcher Elisabeth Walker is the laboratory-scale production of mixed-oxide (MOX) fuel containing plutonium and uranium oxides extracted directly from used fuel. Their demonstration shows that nuclear fuel can be recycled in a safe, effective manner.

Said Walker: "The U.S. does not want the proliferation risk that [PUREX] offers, and we have demonstrated a method that eliminates the separated plutonium stream."

The U.S. Department of Energy is funding the research. The next steps are to enhance the lab-

scale experiments to larger pilot-scale experiments, and ultimately to commercial-scale operations.

"It's a multi-decade program requiring a sustained effort," she said.

TECHNICALLY SPEAKING...

After separation from the fuel hulls, the uranium spent fuel segments are heated in oxygen to drive off the fission products ("voloxidation"). The resulting U_3O_8 powder is dissolved in nitric acid. A new "UREX+" extraction process separates the plutonium, neptunium and uranium into a single product that is then converted into a mixed uranium/plutonium oxide powder using ORNL's modified direct denitration process. This is then pressed or "sintered" into new fuel pellets.

Power Player: Elisabeth Walker, ORNL Researcher



Elisabeth Walker leads the team at ORNL's Nuclear Science & Technology

Division which is demonstrating direct conversion of separated fissile materials from used fuel into nuclear fuel pellets.

Given this demonstration of recycling used fuel without separating plutonium, how do you think this breakthrough will affect fuel cycle innovation?

The demonstration shows that spent nuclear fuel can be recycled in a safe, effective manner.

Other countries that recycle spent nuclear fuel create a stream of pure plutonium in the process. The U.S. does not want the proliferation risk that those techniques offer, and we have demonstrated a method that eliminates the separated plutonium stream.

What was your personal role in the research?

My role as a researcher on the project was to demonstrate the viability of ORNL's modified direct denitration (MDD) conversion process, which allows for a one-step conversion of the uranium, plutonium and neptunium with no separation of the elements. My colleague Ray Vedder and I took streams of uranium and uranium/plutonium/neptunium which had been separated via chemical processing, and converted them to oxide powder using the modified direct denitration process. We then pressed and formed the mixed oxide into fuel pellets.

This breakthrough was accomplished more quickly than most people thought possible. What were the major challenges?

The development work for the separation of elements in dissolved spent fuel has been a collaboration of multiple national laboratories. Work on the MDD conversion process began at ORNL in

the 1980s. What our research over the past two years has done is to demonstrate the coupling of all these steps and to identify potential issues and areas needing further development.

How important is the work being done in fuel cycle R&D to the future of the nuclear industry?

R&D work to close the nuclear fuel cycle is very important to the future of the industry. A comprehensive energy plan for the future stability and energy independence of the U.S. needs to include nuclear power. In order to continue to gain public support for nuclear energy, we need to continue to show that it is a safe, clean form of energy, that additional energy value can be obtained by recycling, and that waste streams can be effectively managed for long-term disposal.

"Power Player," a regular feature in Nuclear Energy Insight, provides perspectives on nuclear energy from industry leaders and other decision-makers.

Westinghouse, Shaw Gear Up On New Build Venture

Louisiana Plant to Build AP1000 Modules

Westinghouse Electric and The Shaw Group have formed a joint venture company to build and assemble components for Westinghouse AP1000 nuclear power plants.

The new venture, Global Modular Solutions, will build a 600,000 square-foot facility at the Port of Lake Charles, La., and is expected to begin production next year. The facility will bring up to 1,400 jobs to Louisiana at an average salary of \$50,000.

In addition, The Shaw Group, which is the nation's largest manufacturer of industrial piping,

has committed to add 1,500 jobs at its Baton Rouge, La., headquarters.



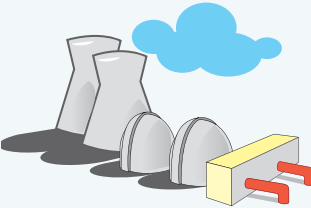

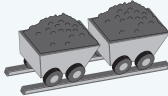
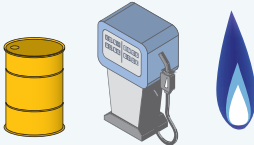


"We know we have to invest more in alternative domestic energy sources like wind, ethanol, solar and nuclear energy," Louisiana Gov. Bobby Jindal said. "This announcement shows that Louisiana is harnessing the future of the energy industry and the most innovative thinking of the next generation."

Westinghouse executive Dan Lipman said Westinghouse and The Shaw Group are providing

four new AP1000 reactors to China, and at least 12 plants here in the United States. "It is imperative that we move decisively to develop the infrastructure to meet the needs of our fast-growing and essential industry," Lipman said.

Toshiba Corp., majority owner of Westinghouse, is forming partnerships with other component suppliers, such as Doosan Heavy Industries of South Korea. In June, Doosan contracted with Westinghouse to supply major equipment for two AP1000s to be built in South Carolina.

Energy Policies from page 1

		
Nuclear energy 	<p>Calls for 45 new nuclear plants to be built by 2030, and up to 100 in total.</p> <p>Supports the Yucca Mountain repository.</p> <p>Supports research into used fuel recycling.</p>	<p>Existing nuclear plants should continue to be part of U.S. energy mix. Supports new plant construction if proven "clean and safe."</p> <p>Opposes Yucca Mountain.</p> <p>Opposes used fuel recycling.</p>
Renewable energy 	<p>Supports tax credits for wind, solar and hydroelectric power.</p> <p>Supports increased use of biofuels but with no specific targets.</p>	<p>Supports 10% of U.S. electricity from renewables by 2012, 25% by 2025.</p> <p>Supports \$150 billion, 10-year plan to develop biofuels, wind, solar, hybrid and electric cars.</p>
Coal 	<p>Supports \$2 billion program to develop carbon capture, advanced coal technologies.</p>	<p>Supports advanced coal, opposes traditional coal plants.</p>
Oil, gasoline, natural gas 	<p>No new taxes on oil companies.</p> <p>Would suspend 18 cent/gallon federal gasoline tax.</p> <p>Opposes use of Strategic Petroleum Reserve.</p>	<p>Proposes 50% tax on windfall profits of 5 largest oil companies to finance tax rebate.</p> <p>Opposes gas tax suspension.</p> <p>Supports releasing 70 million barrels of oil from Strategic Petroleum Reserve.</p>
Offshore drilling 	<p>Would repeal drilling bans in all offshore waters beyond 50 miles.</p> <p>Opposes drilling in Alaskan National Wildlife Refuge.</p>	<p>Would consider lifting drilling bans in some offshore federal waters.</p> <p>Opposes drilling in Alaskan National Wildlife Refuge.</p>
Climate change 	<p>Supports market-based cap-and-trade system to reduce CO₂, other greenhouse gases by 60% from 1990 levels by 2050.</p>	<p>Supports market-based cap-and-trade system for mandatory reductions of CO₂, other GHGs by 80% from 1990 levels by 2050.</p>

Public Support for New Nuclear Clear, Consistent

A consensus of public opinion research reveals a majority support for building new nuclear power plants, whether as a way to increase U.S. energy independence, to meet future electric power needs or as an energy source that doesn't contribute to global warming.

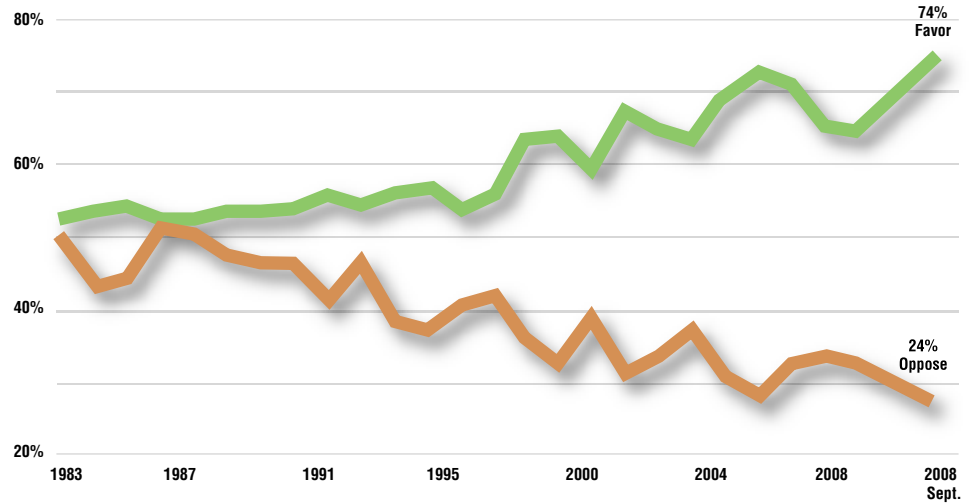
Recent polls by NBC News/Wall Street Journal, Fox News, Zogby, Deloitte/ICR and Moore Information all show solid public support for building new reactors.

State polls also show support for new nuclear plants. Fifty percent of California residents support building more nuclear plants in their state; 60 percent of Pennsylvania residents support government efforts to increase the use of nuclear energy.

Given the information that nuclear plants produce no greenhouse gas emissions, a survey of Washington, D.C. policy makers in May found that more than three-quarters believed greater reliance on nuclear energy would contribute "a great deal" toward a climate change solution.

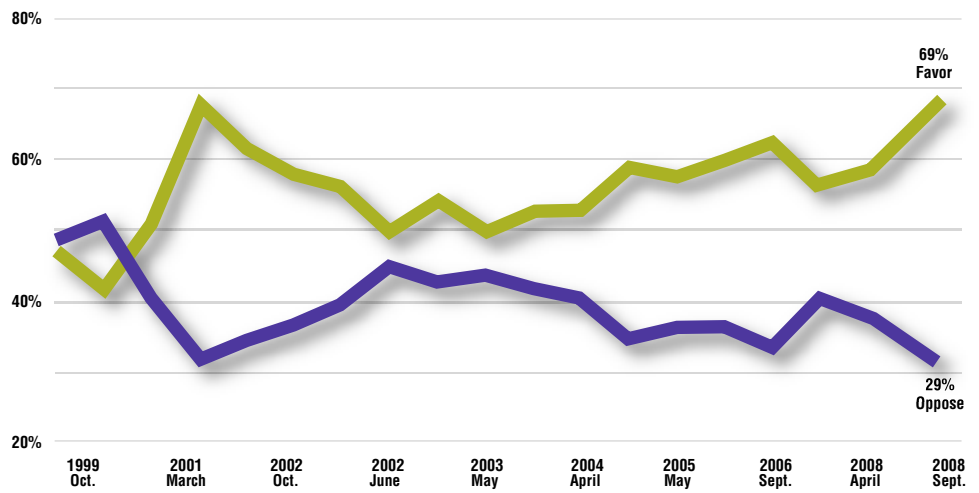
The latest NEI surveys find increasing levels of support for both nuclear energy in general, and for building new nuclear plants. The NEI data, compiled by Bisconti Research, showed a 10 percentage point jump in both numbers between April and September 2008.

Steady Growth in Public Support for Nuclear Energy



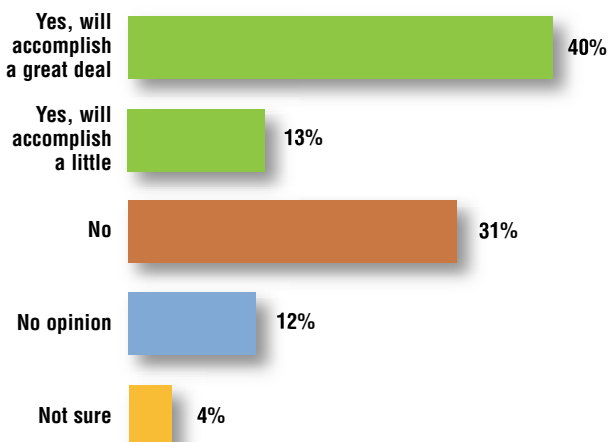
SOURCE: BISCONTI RESEARCH INC.

Growing Support for Building More Nuclear Power Plants



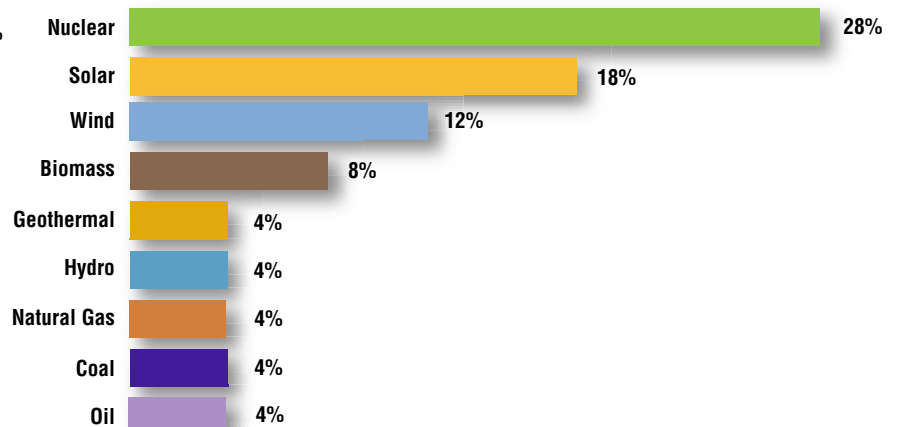
SOURCE: BISCONTI RESEARCH INC.

Should We Build More Nuclear Power Plants?



SOURCE: NBC/WALL STREET JOURNAL

Sources That Should Receive the Most Federal Government Financial Support



SOURCE: ZOGBY INTERNATIONAL

FDA Approves Irradiation of Leafy Vegetables to Enhance Consumer Safety

Fresh spinach and iceberg lettuce can be irradiated for the control of food-borne pathogens, according to the U.S. Food and Drug Administration.

The government authorized the procedure in August in response to petitions filed by the Grocery Manufacturers' Association in 2000.

After the 2006 E. coli outbreak from contaminated spinach, grocers asked the FDA to respond to its request to approve irradiation of spinach and iceberg lettuce.

The FDA is continuing to review the use of irradiation for other items in the original petition, including preprocessed meat and poultry, raw and preprocessed vegetables and fruits, and other multi-ingredient products containing cooked or uncooked meat or poultry.

Government regulations have been amended to include loose and bagged fresh spinach and iceberg lettuce for the control of food-borne

pathogens, such as E. coli and salmonella, as well as for the extension of the shelf life of these items.

The FDA previously allowed spinach, lettuce and some other foods to be irradiated to kill insects or slow spoilage. The doses for these purposes, however, are lower than what is required to kill most disease-causing bacteria.

Irradiation of iceberg lettuce and spinach, conducted in accordance with good manufacturing practices, "will reduce or eliminate bacterial populations with no increased microbial risk from pathogens that may survive the irradiation

process," the FDA said. After studying the safety of irradiating these items, the FDA determined that "these greens, when irradiated under the conditions specified in the final rule, retain their nutrient value and are safe to eat."

For consumer information on this issue, visit www.fda.gov/consumer/updates/irradiation082208.html.



Food Irradiation Proven Over 45 Years

Food irradiation could prevent hundreds of deaths and up to 75 million illnesses that occur each year as a result of bacteria and other pests in food.

Irradiation of food using nuclear technology reduces the levels of pathogens in food, but does not substantially alter the texture, color or flavor of the foods treated.

The irradiation process does not make food radioactive or affect its nutritional value. However, it will not prevent re-infestation or contamination after irradiation. At all but the highest doses, food is not sterilized, and irradiated foods must still be handled in a sanitary manner.

Food irradiation facilities use x-ray machines or cobalt-60 gamma sources to expose food products to radiation, usually after packaging and before shipment to market.

At low doses, irradiation can kill insects, delay sprouting of root vegetables and ripening of fruit. Medium doses can extend the shelf life of foods. High doses sterilize packaged meat and poultry, allowing storage without refrigeration.

The FDA first approved the use of irradiation in 1963 for wheat and wheat flour. Since then, other foods have been approved for such treatment, including potatoes and other vegetables, fruits, spices, herbs, meat products and eggs.

Food irradiation has been endorsed by the World Health Organization, the American Medical Association and the Surgeon General. It is accepted by the European Union and used by several countries including South Africa, Australia, Japan and Canada.

The FDA requires irradiated foods to bear the "radura" logo along with the statement "Treated with radiation" or "Treated by irradiation."



Irradiated ground beef at a supermarket is identifiable with clear labeling.

21 Companies Seek Loan Guarantees for Nuclear Projects

The U.S. Department of Energy said that in response to a solicitation for federal loan guarantees to support construction of new nuclear energy facilities, a total of 21 companies had submitted applications by the initial deadline. Nineteen of these were from 17 electric power companies intending to build up to 21 reactors. DOE also received two applications from companies intending to build fuel cycle facilities.

"DOE's loan guarantees are an integral step in building up our nation's nuclear infrastructure and will further the broader goal of enhancing national energy security through the advancement of nuclear power as a domestic, affordable and emissions-free source of energy," said Assistant Secretary for Nuclear Energy Dennis Spurgeon.

Congress in 2005 approved limited investment incentives for low-carbon energy sources, including new nuclear energy facilities. Among them, loan guarantees are available to jump-start the construction of innovative technologies such as advanced reactor designs. Gaining access to capital markets at slightly lower rates will translate to lower electricity rates for consumers.

Congress authorized DOE to issue \$38.5 billion in loan guarantees through the end of fiscal 2009. New nuclear plants are eligible for \$18.5 billion and advanced uranium fuel cycle facilities are eligible for \$2 billion. The remaining \$18 billion are for advanced coal projects and for renewable energy technologies such as wind, solar and biomass.

The companies all submitted the first part of their applications, which contain a project overview and project financial information. A second section, due December 19 for power plants and December 2 for fuel cycle facilities, will contain additional detailed information for due diligence evaluations that will be performed by the federal government.

The applicants are asking DOE to guarantee a total of \$122 billion for power plants and \$4 billion for the fuel cycle facilities, which significantly exceeds the amounts available under the program. DOE will evaluate the applications and then select the final projects for which the loan guarantees will be issued.

New Nuclear Plant License Applications Submitted to NRC			
	Company/Site	Reactor Design (No. of Reactors)	NRC License Submittal
1	NRG Energy-STPNOC/South Texas Project	ABWR (2)	September 2007
2	TVA/Bellefonte	AP1000 (2)	October 2007
3	Dominion/North Anna	ESBWR (1)	November 2007
4	Duke/William States Lee	AP1000 (2)	December 2007
5	Entergy/Grand Gulf	ESBWR (1)	February 2008
6	Progress Energy/Harris	AP1000 (2)	February 2008
7	Constellation-UniStar/Calvert Cliffs	EPR (1)	March 2008
8	Southern Company/Vogtle	AP1000 (2)	March 2008
9	South Carolina Electric & Gas/V.C. Summer	AP1000 (2)	March 2008
10	Ameren UE/Callaway	EPR (1)	July 2008
11	Progress Energy/Levy County	AP1000 (2)	July 2008
12	Exelon/Victoria County, TX	ESBWR (2)	September 2008
13	DTE/Fermi	ESBWR (1)	September 2008
14	Luminant/Comanche Peak	APWR (2)	September 2008
15	Entergy/River Bend	ESBWR (1)	September 2008
16	Constellation-UniStar/Nine Mile Point	EPR (1)	September 2008

5 More Companies Submit License Applications for New Nuclear Plants

Exelon Generation and Luminant Generation in September submitted license applications to the U.S. Nuclear Regulatory Commission for a total of four reactors in Texas. Exelon is planning to build two new reactors in Victoria County. Luminant filed for permits to build two additional reactors at its Comanche Peak plant in Glen Rose.

Also in September, Entergy announced its plans to add a new reactor to its River Bend nuclear plant in Louisiana, and DTE Energy intends to build one at its Fermi plant in Michigan. Constellation-UniStar submitted an application for a new reactor at Nine Mile Point in New York.

"This is an historic time as Texas moves toward more clean energy sources and keeps pace with growing energy needs," said Exelon Vice President Thomas O'Neill. "Nuclear energy is a safe, clean, reliable alternative, securing a diverse energy portfolio for both the state of Texas and the country."



THOMAS O'NEILL

By the end of this year, energy companies could file as many as 18 applications for a total of 27 new reactors with the NRC.

The vast majority of today's 104 nuclear power

plants were licensed during the 1960s and 1970s. Commercial nuclear energy was new, and the regulatory process evolved with the new industry. Plants were issued a construction permit based on a preliminary design. Safety issues were not fully resolved until the plant was essentially complete—a process flaw that had substantial financial implications. This flaw also meant that the public did not have access to the details of the design until construction was nearly complete.

A new approach to licensing nuclear power plants, approved by Congress in 1992, moves licensing and safety issues to the front of three processes: approval of standard reactor designs, early site permits, and combined construction permits and operating licenses. In addition, it provides greater opportunity for the public to be involved in the process.

All issues resolved in connection with the reactor design or siting processes will be considered resolved for purposes of a combined licensing proceeding. This makes the process more effective and efficient by allowing the NRC's review and subsequent public hearings to focus on remaining issues related to plant ownership and design issues not resolved earlier.

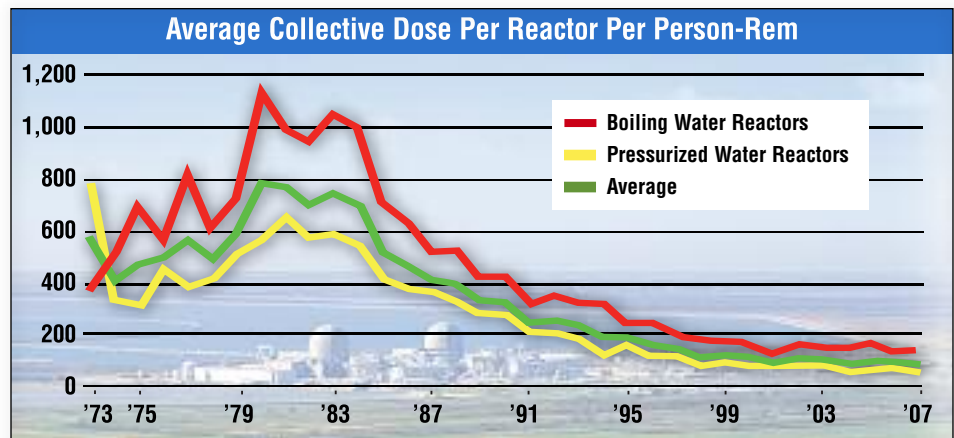
Nuclear Plant Workers' Radiation Dose Lowest Ever In 2007

The average annual collective radiation dose for nuclear plant workers was at a record low in 2007, according to a new U.S. Nuclear Regulatory Commission report. The annual collective dose last year was 97 person-rem per reactor—well within federal safety limits and a fraction of the dose recorded 10 years ago.

To determine a plant's collective radiation dose, hundreds of workers' individual doses are added up and expressed as person-rem. According to the NRC report, most of a plant's collective dose typically is incurred during refueling and maintenance outage work.

In 2007, nine plants had collective doses equal to or less than 10 person-rem, usually indicating that the plant operated the entire year without any maintenance outages. "These results show nuclear power plant operators remain focused on decreasing worker exposure while continuing to maintain and operate the plants safely, in accordance with NRC requirements," said NRC Chairman Dale Klein.

In light water reactors, basic design differences between pressurized water reactors (PWR) and boiling water reactors (BWR) account for differ-



SOURCE: U.S. NUCLEAR REGULATORY COMMISSION

ences in collective radiation doses. The annual collective dose of 69 person-rem in 2007 was the lowest ever recorded for PWRs; an annual collective dose of 154 person-rem for BWRs was the third lowest measurement.

When compared with the average American, the average nuclear plant worker in recent years received an additional 160 millirem (mrem) each year. The NRC's annual limit for occupation exposure is 5,000 mrem.

The majority of a collective plant dose usually is

incurred when the reactor is shut down for refueling or maintenance, when more work is performed in the portions of the plant that have higher radiation levels. Therefore, the overall collective dose usually will be lower in a year when more plants have been operational for a full year than in a year when more plants have been shut down for maintenance work.

The full report is available on the NRC's ADAMS database by entering ML081780671 at www.nrc.gov/reading-rm/adams/web-based.html.

Nuclear Power Plants Unscathed In Back-to-Back Storms

All of the nuclear plants in Louisiana and southern Texas operated by Entergy and South Texas Project Nuclear Operating Co. were unscathed after two hurricanes surged through the Gulf Coast states in September.

South Texas Project—its two reactors, vital equipment and used fuel protected by steel-reinforced concrete walls 4 to 7 feet thick—operated safely throughout Hurricane Ike. The plant is located about 60 miles southwest of where Ike made landfall in Galveston, Texas.

Entergy's River Bend and Waterford 3 nuclear power plants sustained no damage, but the company shut down both facilities to help maintain the stability of the electricity grid as Hurricane Gustav blew through Louisiana. The eye of the hurricane came ashore about 70 miles southwest of the city

of New Orleans.

Nuclear power plants are designed and built to withstand severe natural events like hurricanes. Moreover, operating procedures require U.S. reactors to shut down as a precaution within 2 hours of winds at the reactor reaching hurricane force (over 74 miles per hour). Winds at the South Texas site did not reach those levels.

After restoring power to customers affected by Hurricane Gustav at the fastest rate in the company's history, Entergy continued its heroic efforts to restore power to customers affected by Ike. As of the end of September, Entergy's utilities had restored electricity to all of their customers who were able to receive it through undamaged power lines.

As part of the recovery efforts, Entergy Corp.



The paths of hurricanes Ike and Gustav in relation to area nuclear power plants

and the Foundation for the Mid South formed the Entergy Hurricane Relief Fund. Grants ranging from \$5,000 to \$25,000 are available to nonprofit groups helping disaster victims who reside within Entergy's service area.

Early Defense Nuclear Site Opened to Public

The world's first industrial-scale nuclear reactor, the Hanford B plant, has been designated a U.S. National Historic Landmark by the U.S. Department of the Interior.

The B Reactor at the U.S. Department of Energy's Hanford site in eastern Washington was an original Manhattan Project facility that manufactured plutonium in the earliest days of the atomic age.

The reactor was built toward the end of World War II and produced fissionable material from 1944 until it was shut down in 1968. It served as a model for U.S. nuclear reactors until 1952.

"For its role in the events that ended World War II, the B Reactor holds a powerful historic significance" said Deputy Secretary of Interior Lynn Scarlett.

Five of the nine plutonium production reactors at the Hanford site have been dismantled. The Department of Energy announced in March

it would preserve the B Reactor because of its historical significance.

In response to growing public interest, DOE also intends to enable the public to visit the reactor starting next year.

The National Historic Landmark designation signifies a site, building, structure or object of special significance to the heritage of the United States. There are fewer than 2,500 such designated sites in the country. Other than B Reactor, there are four other Manhattan Project sites – Los Alamos Scientific Laboratory and



PHOTO COURTESY OF EXELON CORP.

Completed in September 1944, B Reactor at Hanford was the world's first large-scale nuclear reactor of any kind.

Trinity Site in New Mexico, the X-10 Graphic Reactor at Oak Ridge, Tenn., and the famous Chicago Pile at the University of Chicago.

NUCLEAR ENERGY

Insight

Editor Christopher Charles	Graphic Designer Rafy Levy	Photographer Anna Gomez	Lynne Neal
Editorial Specialist Michael Fauver	Illustrator Calvin Haden	Contributing Editors Mark Flanagan	Deanne Perez

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