Nuclear Power's Role in Our Energy Future

Americans continue to use more energy. Mississippians continue to use more energy. We live in a society that depends on many different energy sources, but none is more important to our daily lives than electricity.

Without question, we will need electricity that remains available, reliable and economical. The U.S. Department of Energy predicts that the country's demand for electricity will increase by 45% in the next 20 years, which means that the electric industry will need to build hundreds of new power plants.

We must make wise use of all our energy sources and fuels—coal, natural gas, nuclear, wind, solar, hydro, and other renewables. We must develop new technologies. We also need to become more efficient. But all of this progress will require planning, imagination, initiative, funding, and a strong will, as there will many tough decisions to make along the way.

Nuclear power plants currently generate about 20% of the nation's base load electric supply. These plants meet demand 24 hours a day, using a fuel source that is cheaper and cleaner than any other currently available to us. There are 104 nuclear units operating—safely and reliably—in the U.S. today, but none has been built in the past 25 years. To maintain that 20% share as America's generation needs grow, more than 50 new nuclear units will need to be brought on line by 2030.

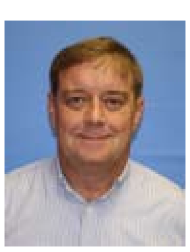
South Mississippi Electric and its eleven Member electric power associations own a 10% undivided interest in the Grand Gulf Nuclear Station, located near Port Gibson, Miss. The facility has proven to be an extremely valuable source of reliable, economical electricity for meeting the needs of SMEPA's Members.

Percentage of Power Generated by Nuclear Facilities per State

Alabama	23.7
Alaska	0.0
Arizona	23.7
Arkansas	28.1
California	16.8
Colorado	0.0
Connecticut	48.9
Delaware	0.0
Florida	13.0
Georgia	22.4
Hawaii	0.0
Idaho	0.0
Illinois	47.8
Indiana	0.0
Iowa	9.1
Kansas	20.7
Kentucky	0.0
Louisiana	18.4
Maine	0.0
Maryland	28.7
Massachusetts	10.8
Michigan	26.2
Minnesota	24.4
Mississippi	18.8
Missouri	10.3
Montana	0.0
Nebraska	33.5
Nevada	0.0
New Hampshire	46.0
New Jersey	50.7
New Mexico	0.0
New York	29.0
North Carolina	30.7
North Dakota	0.0
Ohio	10.1
Oklahoma	0.0
Oregon	0.0
Pennsylvania	34.0
Rhode Island	0.0
South Carolina	51.2
South Dakota	0.0
Tennessee	30.2
Texas	10.1
Utah	0.0
Vermont	73.7
Virginia	34.7
Washington	7.6
West Virginia	0.0
Wisconsin	20.4
Wyoming	0.0

Source: *Global Energy Decisions / Energy Information Administration Updated: 4/08*

A View from Grand Gulf – Mississippi's Only Nuclear Facility *by J. Brad Edwards*



Across the country, political leaders are joining those of us in the electric industry in calling for ways to meet our rapidly growing need for safe, dependable and economical electric resources. The need is great and time is short, but we have one answer readily available to us now if we will think about it logically: the nuclear facilities that already provide 20% of our overall power.

As an engineer who has spent my entire career in the nuclear power field, I have witnessed the industry make many improvements over the past 25 years. Following the incident at the Three Mile Island nuclear facility in 1979 and during the early 1980s, the industry faced many difficult issues. Construction cost over-runs were widespread, interest rates were in the double digits, inflation was rampant, and utilities operating nuclear units sometimes struggled to keep those units on-line. Capability factors, a measure of unit availability, averaged around 60%, and maintenance and refueling outages were unpredictable, often requiring 60 to 90 days for completion.

After Three Mile Island, the Institute of Nuclear Power Operations (INPO) was founded and funded by the industry. Its mission was to serve as a centralized organization dedicated to promoting plant assessment and improvement, sharing industry experiences and good practices, and assessing and grading individual plant performance. Today, nearly 30 years later, the industry's capability factors average around 93%, and refueling/maintenance outages are routinely completed in less than 30 days. Reliability has improved dramatically and, in fact, some units are running continuously for nearly two years between refueling outages.

Our dependence on foreign oil and the rising cost of energy have brought about much debate about the best course of action to achieve national energy independence and price stability. It is a very difficult problem, but when all is said and done, the solutions must realistically address what can be accomplished and at what price.

We know there is a very real need for new sources to generate electricity. What makes nuclear power especially attractive for new base load generation is its predictability and cost stability. While initial capital costs for construction are higher than traditional sources, the industry is working to identify new designs and reduce building costs. Fuel costs for nuclear plants, however, constitute only 26% of their total production costs, unlike other facilities that may use 50-90% of their budgets to buy fuel, making the cost to produce nuclear power much less susceptible to fluctuations compared to the market prices of other fuels.

(continued on page 4)

News Co-op Members Need to Know

This is the fourth of a series of inserts to help members understand the many issues that affect their electric power supply. South Mississippi Electric produces and delivers the electricity that its eleven member-owner cooperatives provide to their consumers. Together, our responsibility is to deliver reliable, not-for-profit electric service to more than 400,000 homes and businesses in 56 Mississippi counties. Every day—as a system—we work to demonstrate The Power of Twelve.

The Power of 12

SOUTH MISSISSIPPI ELECTRIC

GROWING MISSISSIPPI

History of the Industry

1951 – *Electricity was generated for the first time by a nuclear reactor at the EBR-I experimental station near Arco, Idaho, which initially produced about 100 kW (enough to light 1000 100-watt light bulbs).*

1954 – *The first nuclear-powered submarine, USS Nautilus, was launched by the U.S. Navy.*

1956 – *The world's first commercial nuclear power station, Sellafield, England, opened with an initial capacity of 50 MW (megawatts, or one million watts).*

1957 – *The first commercial nuclear generator to become operational in the United States was the "Shippingport Reactor" in Shippingport, Pennsylvania.*

1979 – *The Three Mile Island (TMI) accident near Harrisburg, Pennsylvania, was the most significant accident in the history of the nuclear power industry. The event, partially attributed to human error, ultimately resulted in a partial core meltdown in Unit 2 and the release of small amounts of radiation.*

The radiation exposure to local residents around TMI was much less than most Americans receive each year from naturally occurring sources. No identifiable injuries due to the accident occurred, and a government report concluded that "There will either be no case of cancer or the number of cases will be so small that it will never be possible to detect them. The same conclusion applies to the other possible health effects."

1985 – *Grand Gulf Nuclear Station Unit 1, Mississippi's only nuclear generating facility, began commercial operation at Port Gibson on the Mississippi River. South Mississippi Electric owns 10 percent of the facility and receives 10 percent of its output.*

1986 – *The Chernobyl disaster in the former Soviet Union was by far the worst nuclear power plant accident in history, resulting in a severe release of radioactivity following several explosions and fire that destroyed one of the plant's reactors. The design used at the time by the Soviets did not include the massive containment walls that surround American reactors—the Chernobyl unit would never have been licensed in the U.S. because of its lack of safety features.*

2005 – *Congress authorized continued funding for research in the Energy Policy Act of 2005. The legislation set aside $2.9 billion for nuclear research and development and hydrogen projects.*

2007 – *Grand Gulf received one of the first early site permits (ESP) approved by the Nuclear Regulatory Commission. The ESP certifies that the Mississippi site is suitable for a second nuclear unit and resolves many safety and environmental issues related to permitting and licensing.*

For generations, nuclear science has been used to help improve a wide variety of American products and services, to the point where we rarely think about it.

However, much of our overall perception about the nuclear power industry is still shaped by the negative memories of Three Mile Island and the release of the movie "The China Syndrome," each of which happened nearly 30 years ago, as well as by the 1986 Chernobyl disaster.

The truth is that American nuclear power plants have long been among the most fortified facilities in the country and—as a result of security improvements after Three Mile Island and the events of September 11, 2001—are now even more robust. Nuclear plant design requirements incorporate extensive safety redundancy and physical protection to ensure that the reactor and spent fuel facility can withstand a wide spectrum of accidents, whether caused by human error, mechanical failure, natural disasters or acts of terrorism.

Safety

The U.S. Nuclear Regulatory Commission (NRC) regulates the commercial and institutional uses of nuclear energy, including domestic nuclear power plants. The NRC monitors plant performance according to three strategic areas: reactor safety, radiation safety and security.

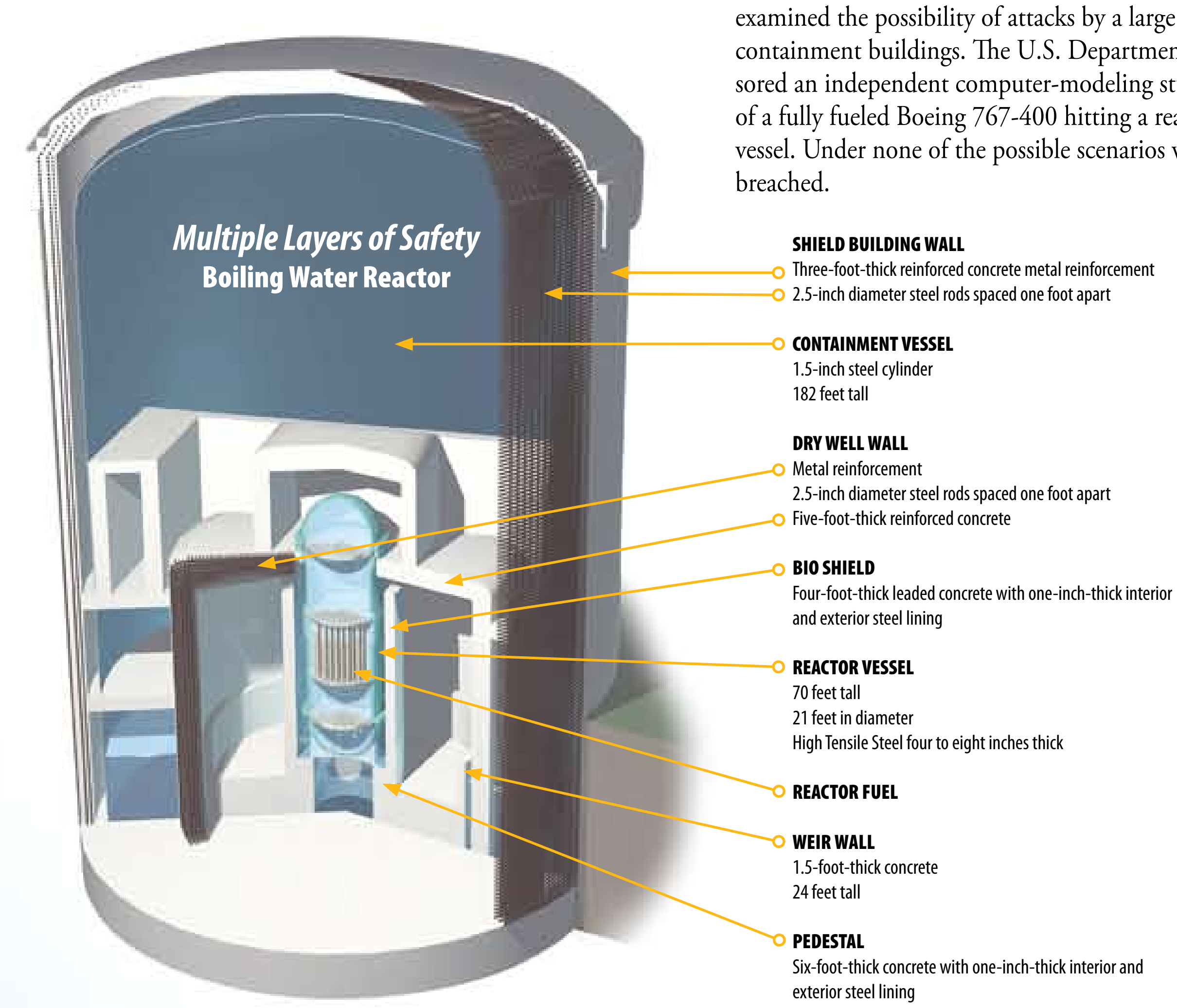
Independent NRC inspectors at each plant provide oversight of plant operation, maintenance, equipment replacement and training. In addition, the average U.S. nuclear plant receives between 3,000 and 8,000 hours of inspections every year.

Design Redundancy

The nuclear industry leaves nothing to chance. Everything is checked and double checked. Every system has multiple backup systems to cope with equipment failure and human error. The systems are designed to work automatically and immediately at the first sign of trouble.

Nuclear plants cannot explode because the fuel used has extremely low concentrations of fissionable uranium. The plants also have a series of physical barriers to prevent the release of any radioactive material. (see diagram below)

Since the 9/11 terrorist attacks in 2001, several studies have examined the possibility of attacks by a large aircraft on reactor containment buildings. The U.S. Department of Energy sponsored an independent computer-modeling study of the effects of a fully fueled Boeing 767-400 hitting a reactor containment vessel. Under none of the possible scenarios was containment breached.



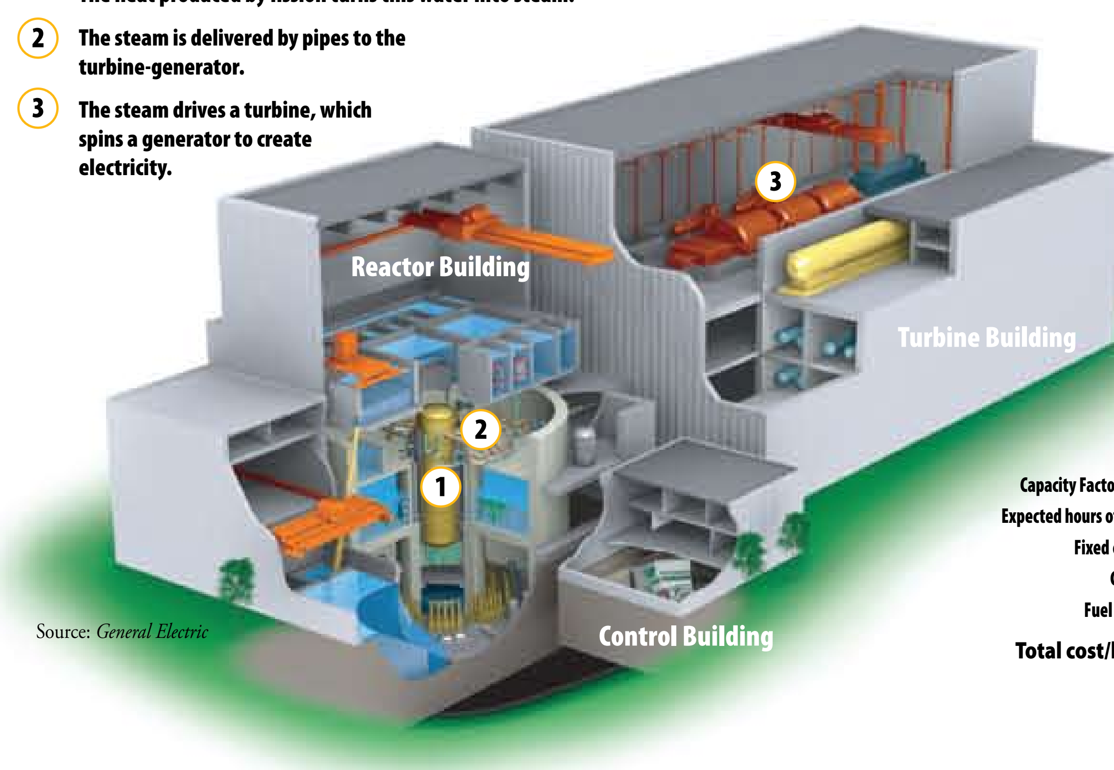
Source: *Nuclear Energy Institute*

How Nuclear Plants Generate Electricity

Nuclear plants—like plants that burn coal, oil, biomass, or natural gas—produce electricity by boiling water into steam. This steam then turns turbines to produce electricity. The difference is that nuclear plants do not burn anything. Instead, uranium fuel, in the form of solid ceramic pellets, is used.

Nuclear power plants obtain the heat needed to produce steam through fission, a physical process that splits the atoms of uranium in the reactor. Long, vertical tubes of fuel pellets are inserted into the reactor. Control rods with no fuel in them are inserted or withdrawn to varying degrees to slow or accelerate the reaction.

1. **Fuel tubes are surrounded by water in the reactor. The heat produced by fission turns this water into steam.**
2. **The steam is delivered by pipes to the turbine-generator.**
3. **The steam drives a turbine, which spins a generator to create electricity.**



Source: *General Electric*

Fuel a Small Part of Nuclear Production Cost

Nuclear energy has the lowest production costs of any large-scale source of electricity except for hydroelectric plants, which is why it is so effective in meeting base load generation needs.

When comparing just the overall production costs (fuel compared to operations and maintenance expenses), nuclear fuel accounts for approximately 26 percent of nuclear energy, compared to 80 percent for coal and 90 percent for intermediate and peaking plants using natural gas.

As new plants are built, with very high capital costs for construction, a low cost, stable fuel source will be vital. When comparing the overall expenses to operate plants using different fuels, nuclear plants have, by far, the lowest fuel costs.

FUEL TYPE	COAL (base load)	NUCLEAR (base load)	NATURAL GAS (peaking)	NATURAL GAS (intermediate)
Capacity Factor (% of annual use)	85%	90%	3%	25%
Expected hours of annual operation	7,446	7,884	263	2,190
Fixed cost /kilowatt hour	$0.07	$0.10	$0.43	$0.10
Cost of fuel/MMBtu	$3.00	$0.60	$8.00 - 13.20	$8.00 - 13.20
Fuel cost/kilowatt hour	$0.03	$0.01	$0.10 - 017	$0.09 - 0.15
Total cost/kilowatt hour	$0.10	$0.10	$0.53 - 0.60	$0.19 - 0.25

Note: SMEPA's wholesale power costs are approximately $0.075/kilowatt hour. Member consumers pay approximately $0.11/kilowatt hour.

The Next Generation of Nuclear Plants

Nuclear units with new, simplified designs and streamlined approval processes are again at the forefront of discussion about how to meet America's growing energy needs.

Most nuclear power plants in the United States today were built between 1965 and 1985. Commercial nuclear energy was new, and the federal regulatory process evolved along with the new industry. The Nuclear Regulatory Commission (NRC) issued a construction permit based on a preliminary design, and safety issues were not resolved until the plant was essentially complete. This caused delays for many nuclear projects.

Today's nuclear power plants are nearly all one-of-a-kind designs. The industry plans to build the next generation in "families" of standardized designs. Greater standardization will reduce construction and operating costs and lead to greater efficiencies in nuclear plant operations, including safety, maintenance and training.

Proposed new nuclear plants will have passive safety systems—emergency cooling systems located above the reactor. No power will be needed to pump the cooling water into the reactor in an emergency. Valves can be opened, and cooling water will be initiated by gravity.

The new advanced plants will also be much simpler to operate, which means the plants will be even safer and cheaper to operate and maintain. The new reactors will have 25-30% fewer pumps, valves, motors and cables.

New plants will also be built using modular construction techniques instead of the one-pipe-at-a-time method used 25 years ago for today's plants. Large sections will be built in an industrial fabrication plant, like a shipyard, faster and with better quality control, then shipped to a reactor site and set in place. Such a process is expected to trim construction time to about four years, rather than the six to 25 years today's plants required. Shorter time frames translate to less interest expense and lower costs to build.

Streamlining the Approval Process

The Nuclear Regulatory Commission's new licensing process now addresses licensing and safety issues before safety-related construction begins. The new process has three elements: approval of standard plant designs; early site permits; and combined construction permits and operating licenses, also known as combined licenses. Through its Nuclear Power 2010 initiative, the Department of Energy is co-funding with the industry the cost of testing the NRC's new licensing process for nuclear power plants. The objective is to ensure that the licensing process is effective and efficient.

In a competitive market, there are three steps to construction:

1. File an application for a combined NRC license, which will allow a company to build and operate a nuclear plant, provided the facility conforms to approved specifications.
2. Begin procurement of major long-lead components and commodities.
3. Proceed with construction.

Today, companies are moving forward with developing plant license applications and discussing financing with company boards of directors and with the financial community. After 30 years without a single application to build a new plant, the Nuclear Regulatory Commission received 12 over the past 12 months, and expects another five by year-end.

More than 30 new U.S. reactors are in varying stages of planning, and that number is expected to grow as the industry and the NRC gain experience with the new licensing process. As new plants are built, the process will also become more predictable, faster and, as a result, less costly.

Abundant Supplies of Uranium

Uranium is one of the world's most abundant metals and can provide fuel for the world's commercial nuclear plants for generations to come. In 2005, the major foreign supplier of uranium to the United States was Canada, followed by Russia and Australia. Other major suppliers were Namibia, Uzbekistan and Kazakhstan. The United States supplied approximately 20 percent of all uranium purchased by U.S. nuclear plant owners.

Uranium fuel pellets are a little more than ½ inch high and about 3/8 inch in diameter. Each pellet contains as much energy as 157 gallons of gasoline, 1780 pounds of coal, 149 gallons of oil, or 19,200 cubic feet of natural gas.

Converting Used Fuel to Reusable Fuel

For economic and national security reasons, the United States does not currently recycle used nuclear fuel. After it is used once in the reactor, companies remove the fuel for ultimate disposal in a repository. This "once-through" fuel use is called an "open" fuel cycle.

The federal government plans to develop advanced recycling technologies to take full advantage of the vast amount of energy that remains in used fuel. Through recycling, the separated uranium would become new fuel for commercial nuclear power plants. The recycling and reuse of nuclear fuel is called a "closed" fuel cycle.

Advanced recycling technologies would greatly reduce the volume, heat and toxicity of used nuclear fuel but not completely eliminate the byproducts. The recycling byproducts would require disposal in a permanent repository.

Yucca Mountain

Scientists have determined that the best way to dispose of nuclear waste is to place the material in a system of engineered vaults buried in stable rock formations deep below the Earth's surface. In that way it can be isolated from people and the environment for thousands of years. It can also be protected against theft or attacks.

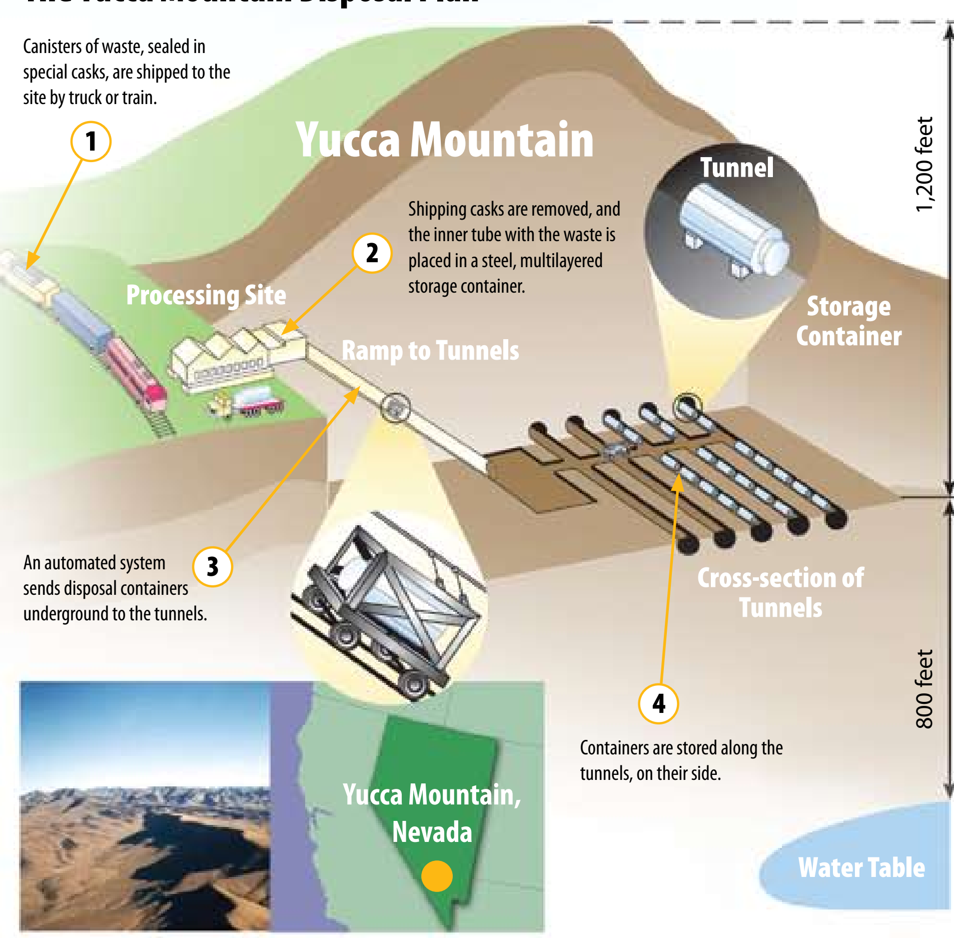
In 1987, Congress adopted an amendment to the Nuclear Waste Policy Act that directed the Department of Energy to study Yucca Mountain, Nevada—a remote desert location—as the site for a potential repository for geologic disposal of used nuclear fuel.

In 1994, DOE started building a system of tunnels at the site. Scientists conducted extensive volcanic, seismic, geological, hydrological and geochemical studies in these tunnels to assess how a repository would perform over tens of thousands of years. DOE published the results of these scientific and technical analyses in a comprehensive evaluation of the site that demonstrated a Yucca Mountain repository is capable of protecting public health and safety.

Based on this comprehensive evaluation, in 2002 Congress and President George W. Bush approved Yucca Mountain as the site of the repository. In June 2008, DOE submitted a license application to the U.S. Nuclear Regulatory Commission to build the repository.

The Yucca Mountain repository is not expected to be operational until at least 2020. Until then, each plant is storing spent fuel in steel-lined concrete pools filled with water and in dry concrete casks. Used fuel has been stored safely at nuclear sites since the late 1950s. In that time, about 30,000 tons of used fuel has been generated overall—enough to cover a football field to a depth of about 14 feet.

The Yucca Mountain Disposal Plan



Source: *U.S. Department of Energy; Nuclear Energy Institute*

A View from Grand Gulf (Continued from page 1)

Public and political support for construction of new nuclear units has been steadily increasing, with some of the strongest support occurring in the communities where existing units are located. In Mississippi, where South Mississippi Electric owns 10% of Grand Gulf Nuclear Station in Port Gibson, support for another unit at that facility is strong. The governor and numerous other elected officials understand how important such a project can be for the region, although ultimately the state's public service commission will have to approve any plans.

Grand Gulf's Unit 1 currently employs more than 500 people with a payroll of more than $60 million. It pays more than $20 million in local and state taxes each year. A second unit at Grand Gulf would bring significant investment to the state, including as many as 2000-3000 construction jobs, hundreds of new permanent jobs and additional tax revenues.

To further gain public support and the backing of financial investors, the industry is addressing the issues of safety and security, predictability in the licensing and construction process, and the disposition of nuclear waste.

Proposed new reactor designs are even more advanced than older models, primarily due to the use of passive safety features which use natural circulation and ambient cooling instead of mechanical systems. U.S. nuclear facilities, already some of the most secure facilities in the world, were further fortified after the events of September 11, 2001.

The U.S. Nuclear Regulatory Commission, the agency responsible for approving and issuing operating licenses, has streamlined the process for license approval. The process today is designed to eliminate regulatory uncertainty, and many utilities have joined consortiums to test the new process. To help "jump start" the development of new projects, the U.S. government has authorized the Department of Energy to approve loan guarantees and potential production tax credits for the first few new domestic nuclear units constructed under the plan.

The industry is also evaluating methods to reprocess spent nuclear fuel in order to be more efficient. When discharged now, spent fuel still contains nearly 90% of its original uranium content, most of which can be recovered through reprocessing. Each of the nation's 104 nuclear units stores its spent fuel in on-site pools or dry steel and concrete casks, awaiting approval and construction of a planned national repository. Reprocessing would not only reduce the volume of spent fuel but would also significantly reduce the radioactivity level of the end product.

While new nuclear generation is not the only answer to all of our energy problems, safe, efficient, cost-effective nuclear units are increasingly being viewed as a larger part of the solution. Those of us in the nuclear industry have worked hard to address the issues and risks associated with our facilities. I have no doubt that we have positioned nuclear power at a place where it can play an expanded and prominent role in our energy future.

Brad Edwards is the nuclear specialist for South Mississippi Electric assigned to the Grand Gulf Nuclear Station. He graduated from Mississippi State University with a bachelor of science degree in mechanical engineering. During his 24 years at Grand Gulf, Edwards held several positions including General Manager of Plant Operations. He received his Senior Reactor Operator certification and completed the Senior Nuclear Plant Managers program at the Institute of Nuclear Power Operations.

Sources of Information for this edition: *Nuclear Energy Institute, Entergy Nuclear, Grand Gulf Nuclear Station, Wall Street Journal, New York Times Magazine*