FARLEY

Joseph M. Farley Nuclear Plant

SOUTHERN COMPANY

Energy to Serve Your World®

Joseph M. Farley Nuclear Plant

ALABAMA POWER
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About Plant Farley

The Joseph M. Farley Nuclear Plant is located on 1,850 acres along the Chattahoochee River in southeast Alabama near Dothan. The plant is owned by Alabama Power and operated by Southern Nuclear Operating Company. The plant is named for Joseph M. Farley, former president and chief executive officer and director of Southern Nuclear and Alabama Power Company. Plant Farley is one of three nuclear facilities in the Southern Company system.

Construction of the plant began in 1970. Unit 1 achieved commercial operation in December 1977, and Unit 2 began commercial operation in July 1981.

Plant Farley is powered by two Westinghouse Pressurized Water Reactors (PWRs), and each reactor unit is capable of generating 888 megawatts (MW) for a total capacity of 1,776 MW. The plant generates approximately 19 percent of Alabama Power's electricity.

Approximately 800 people – including engineers, mechanics, control room operators, lab technicians, instrument and control technicians, electricians, security officers and others – oversee the plant's operation 24 hours a day, seven days a week. Full-time, on-site inspectors from the U.S. Nuclear Regulatory Commission (NRC) monitor the plant to ensure it is maintained and is operated safely, efficiently and in accordance with established nuclear operating procedures.

Plant Farley uses approximately 400 of its 1,850 acres to accommodate two reactors, six cooling towers, a state-of-the-art control room, turbine building, low-voltage and high-voltage switchyards, training facilities and a visitors center open to tour groups year-round for scheduled tours.

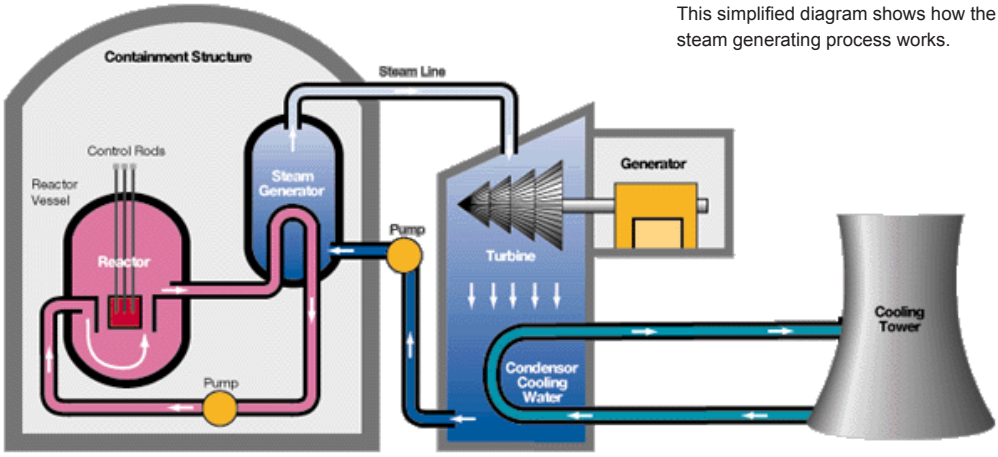
As people move to the southeastern United States and use greater amounts of electricity, additional power plants using nuclear energy, such as Plant Farley, are needed.

Nuclear power plants – with their huge output, low operating costs, minimal impact on the environment and inexpensive uranium fuel – continue to be an important and strategic energy resource for the United States.

How Nuclear Power Plants Operate

Most power plants generate electricity by heating water to produce steam. This steam fans the propeller-like blades of a turbine connected to the generator shaft. The electrical current from the generator is then fed to a network of wires (the electric grid) and delivered to consumers.

While fossil power plants generate steam by burning oil, gas or coal, nuclear power plants generate steam with the use of tons of ceramic pellets made from uranium or other fissionable elements. The cylindrical pellets, each about the size of the end of your little finger, are arranged in long vertical tubes within the reactor. Many tubes are bundled together to form a fuel assembly. Control rods can be inserted in the fuel assemblies. These rods regulate a process that results in atoms invisibly flying apart, or fissioning. As the atomic pieces split and travel through the fuel pellets, they generate heat. Operation of the reactor is controlled by varying a number of parameters including the number of control rods and the degree to which they are inserted or withdrawn.



This simplified diagram shows how the steam generating process works.

The Water Cycles

Pressurized water reactors such as the two at Plant Farley use three separate water systems. To begin, water is pumped under high pressure through the reactor core where the nuclear chain reaction heats the water to a temperature of about 577 degrees Fahrenheit. Because the water in the reactor is kept under pressure, it does not boil into steam. This hot water travels from the reactor to the three steam generators – also located inside the protective containment structure – before it is pumped back into the reactor.

In the steam generator, cooler water in a separate system surrounds the tubes filled with hot water from the reactor core, which heats the cooler water until it boils into steam. This water does not mix with the reactor water. The hot steam passes to the turbine where it hits the turbine blades, making the turbine spin much like a windmill when wind hits its blades. The turbine spins an electric generator, producing electricity. The used steam then enters condensers where it is cooled back into liquid to continue the cycle.

The water that circulates through the condenser is cooled by large fans, much like a car's radiator is cooled by a fan. The circulating water system never comes in contact with the water in the reactor cycle.

Public Safety

Safety is the top priority of the U.S. nuclear energy industry. We take very seriously our obligation to protect the health and safety of our employees, the public and the environment.

Securing Our Facilities

Prior to Sept. 11, 2001, nuclear power plants were the most secure facilities of any industrial sites in the nation. Since Sept. 11, the nuclear power industry has taken a number of significant steps to reinforce and enhance our security measures, including increased personnel, training, technology and barriers –spending an additional $1.2 billion on security throughout all commercial nuclear power facilities in the United States.

Nuclear power plants are an important component of the nation's critical infrastructure and have been designed with multiple layers of protection, including structural strength, highly trained operators and proven emergency plans.

The Nuclear Regulatory Commission (NRC) holds nuclear power plants to the highest security standards of any American industry. And of the 17 infrastructure categories currently under evaluation by the U.S. Department of Homeland Security, the agency has said nuclear plants are by far the best protected. Furthermore, the nuclear reactor sector is referenced by Homeland Security as its security standard.

Emergency Planning

Comprehensive plans have been developed in accordance with federal requirements by the NRC and other oversight agencies to respond to an emergency at any of the Southern Nuclear-operated facilities.

Southern Nuclear has overall responsibility for the emergency plan, which involves Southern Nuclear, Alabama Power and the various county, state and federal agencies.

The emergency plan specifies the procedures, personnel and equipment used to classify an emergency. This plan defines and assigns responsibilities and outlines an effective course of action for safeguarding personnel, property and the general public.

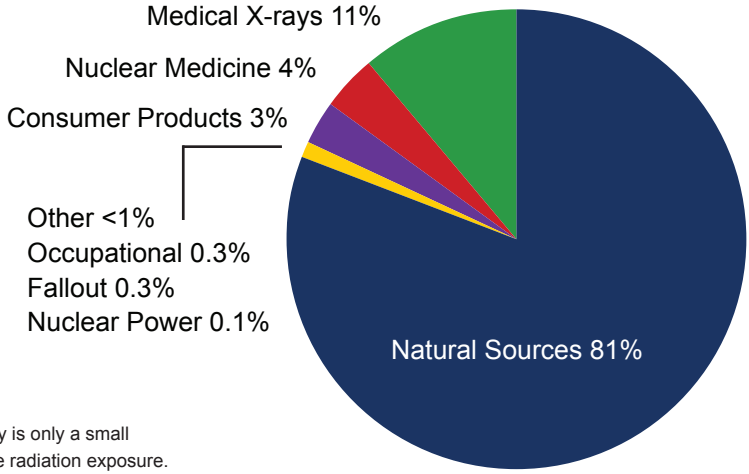
These plans are updated regularly and maintained at all times. Drills and exercises are conducted frequently to test these plans and to train and test personnel on procedure adherence.

Should an emergency occur, one of the first steps would be to notify off-site authorities such as the Alabama Emergency Management Agency, the NRC and local officials. Communication would be maintained with these agencies to keep them fully aware of the emergency status, including on-site and off-site radiological information.

Radiation

The combined effect of the structural, mechanical and human safety systems built into our nuclear plants means that a person living within a few miles of a plant receives less radiation from its presence than from watching television.

Radiation to the human body is measured in millirem; the average "background" radiation from our natural environment (sunlight, food, rocks, soil) adds up to around 260 to 300 millirem a year, depending on where we live. Other man-made sources of low-level radiation add to this total.



The nuclear power industry is only a small contributor to your average radiation exposure.

A typical chest X-ray is about 10 millirem of radiation; a jet airplane flight from New York to California and back again adds five millirem. Living within a five-mile radius of a nuclear power plant will give less than one millirem of radiation exposure per year to an individual.

Federal regulatory agencies carefully set and enforce dose limits to protect plant employees, the public and the environment.

Defense in Depth

Nuclear power plants are designed with many redundant safety systems, sometimes called "defense in depth." Fuel pellets, which are between three and five percent fissionable U-235, are sealed in zircaloy tubes. The fuel assemblies are then contained in a reactor vessel, which has eight-inch-thick steel walls

and weighs 359 tons. This, in turn is housed within a containment building – a leakproof, carbon steel liner surrounded by 3.75 feet of reinforced concrete. There are several redundant cooling systems to minimize the possibility of overheating the reactor core. A nuclear reactor operating at full power can be shut down in only a few seconds by rapidly inserting the control rods to stop the fission process.

New Nuclear Plant Development

Southern Company currently is exploring opportunities to develop new nuclear plants to serve our customers' needs for the future. Southern Company's actions to again explore the nuclear energy option are part of our long-range generation-planning process that seeks to identify the most cost-effective, reliable and environmentally responsible fuel sources to meet growing electricity demand in our service territory. Nuclear power is a proven technology that is re-emerging as an attractive generating source.

Increased demand for energy is driving the need for new baseload capacity. The population of the southeastern United States continues to expand rapidly. It is expected that 40 percent of the U.S. population will live in the Southeast by 2030.

This artist rendering depicts two new potential units at Plant Vogtle in Burke County, Ga.

According to the economic forecast, the state of Alabama alone is expected to grow 1.3 million people by 2030, and the electrical demand on the Alabama Power system is projected to grow 22 percent during the next 15 years. Over the last 13 years, average residential consumption rose approximately 19 percent.

As energy needs grow in the Southeast, Southern Company intends to be on the forefront of exploring nuclear energy as an option for meeting rising electricity demand.

Nuclear power is a safe, reliable, cost-effective power source that has minimal impact on the environment. It is a prudent business decision to preserve nuclear power as an option to meet our customers' needs.

The Nuclear Advantage

Nuclear energy is a safe, reliable, cost-effective form of energy. Southern Company has operated nuclear plants safely and reliably for more than 30 years, and all three of our plants have operated at high levels of reliability. The average three-year capacity factor of our nuclear power plants is more than 90 percent. Capacity factor is the percent of time the unit is available to provide power to the electrical grid. Nuclear power has a low production cost compared with other fuel sources. Uranium is used as nuclear fuel, and it has less price volatility than other fuel sources such as coal and natural gas.

Nuclear power adds diversity to our fuel mix. Twenty percent of the nation's electricity is supplied by nuclear power, and behind coal, it is the second leading source of electricity. The use of nuclear power increases our energy independence by decreasing our dependence on foreign oil.

Nuclear power produces no greenhouse gases, making it a sound, environmentally responsible fuel source. Nuclear power accounts for three-quarters of all emission-free electric generating capacity in this country.

Nuclear power will continue to play an important role in meeting the growing energy needs of Southern Company customers, as the southeastern U.S. continues to expand rapidly.

Protecting Our Environment

Farley's Commitment to the Environment

Almost half of Plant Farley's 1,850 acres are wooded, with the remainder consisting of meadows, wetlands, ponds and a 100-acre lake. Since 1992, Plant Farley has been recognized as a certified wildlife habitat by the Wildlife Habitat Council. The council is a non-profit international organization dedicated to protecting and enhancing wildlife habitat.

Shortly after the plant was built, a detailed land management plan was developed. The plan outlines strategies for enhancing the habitat for waterfowl, songbirds, deer and plant life.

Plant Farley also manages an extremely successful bluebird nesting program. More than 75 bluebird boxes have been installed on the site, and plant workers monitor the boxes and count the number of nests, eggs and baby bluebirds. The nesting program has expanded into the local community, and plant employees have partnered with local school-aged children to monitor the boxes and record the results.

Climate Change

Earth's temperature is a balance between heat entering the atmosphere from the sun and infrared radiation leaving the earth's atmosphere into space. When

some of this infrared radiation re-enters into space, it is absorbed by certain gases and particles concentrated in the lower atmosphere. This process is called the greenhouse effect. Greenhouse gases occur both naturally and from human activity. They include water vapor, carbon dioxide and other trace gases, as well as man-made fluorocarbons.

There is evidence that greenhouse gases have increased because of human activities and other natural processes. Some scientists think this increase is the cause of more global warming. Although there is an increase in the concentration of greenhouse gases, there is still some debate over future changes. Despite these ongoing debates, Southern Company is committed to finding solutions that are technologically, environmentally and economically sensible, to reduce the production of greenhouse gas. Southern Company's consideration of new nuclear generation demonstrates that commitment. Permanent reductions require fundamental advances in the technologies we use to generate and use electricity. Our resources are devoted to a rational, long-term program focusing on technology development to address greenhouse gas emissions without forcing large, near-term emission reductions at a higher cost.

Storage of Used Fuel

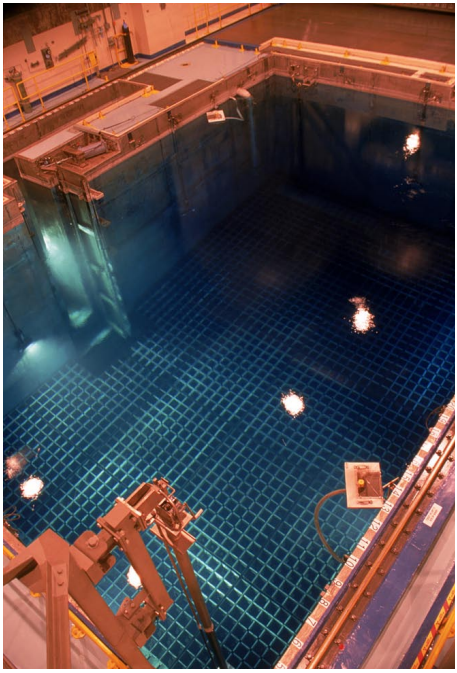
Under the Nuclear Waste Policy Act of 1982, the U.S. Department of Energy (DOE) is the federal agency responsible for the disposal of high-level waste such as used nuclear fuel. After more than 20 years of exhaustive scientific and engineering research, the president and Congress in 2002 approved Yucca Mountain, Nev. as the site of a national repository for used nuclear fuel. Opponents of the Yucca Mountain project have attempted to delay or halt its development through a series of legal actions.

Disposing of used fuel at this remote desert site supports sound national energy, environmental and security policies. The world's leading scientists, the president, Congress and now the courts have agreed on this fundamental principle. DOE's work to implement this consensus will benefit current and future generations. As we wait for construction of the repository, nuclear plants are safely storing used nuclear fuel.

A solid material, used nuclear fuel is safely stored at nuclear power plant sites, either in steel-lined, concrete pools filled with water or in steel or steel-reinforced concrete containers with steel inner canisters. The first on-site storage method is referred to as the spent fuel pool. The second is called dry storage.

Spent Fuel Pool

When most of the U-235 has been used in the fission process, the fuel assemblies are removed and replaced with new fuel assemblies. At most plants, used fuel is stored in large, steel-lined concrete pools filled with water. These pools are known as spent fuel pools. Both water and concrete are excellent radiation shields. In these spent fuel pools, the water acts as an absorber and prevents radiation from escaping from the pool. The water also keeps the fuel cool while the fuel decays, or becomes less radioactive over time. The water itself never leaves the inside of the plant's concrete auxiliary building.



Spent fuel pools are used as one of the safety measures in Southern Company's nuclear plants.

Dry Storage

The government's delay in providing a permanent repository for used nuclear fuel means that nuclear plants must store more used fuel than expected and store it for longer than originally intended. Since 1986, dozens of U.S. nuclear plants have supplemented their storage capacity by building above-ground dry storage facilities. Other countries have also safely and successfully stored used fuel above ground since the mid-1970s.

Two of Southern Nuclear's plants use dry storage – plants Farley and Hatch. It is likely that dry storage will be needed at Plant Vogtle by 2014.

Dry storage containers are cylindrical containers constructed of steel or steel-reinforced concrete and lead, which serve as proven, effective radiation shields. These containers effectively shield the radiation as used fuel continues its cooling process. Once loaded with used fuel assemblies, the containers are stored either horizontally in a concrete vault or stored upright on a thick concrete pad.

Dry storage at Plant Hatch

Each dry storage container design must be approved by the NRC. The agency requires that dry storage containers constantly be monitored and relicensed every 20 years. The containers are designed and tested to prevent the release of radiation under the most extreme conditions – earthquakes, tornados, hurricanes, floods and sabotage – and they are naturally cooled and ventilated.

Nuclear plants were designed to store at least a decade's worth of used fuel. And, with dry storage, used fuel can be safely stored for much longer. The NRC has determined that used fuel can safely be stored at plant sites for at least 30 years beyond the licensed operating life of the plant. While used nuclear fuel can be safely stored on-site, Southern Company and the industry maintain that a permanent underground repository is the best, long-term solution.

These storage areas are well protected by a combination of sturdy plant construction, state-of-the-art surveillance and detection equipment, and armed, well-trained paramilitary security forces.

Owners and Operators

Southern Nuclear Operating Company, headquartered in Birmingham, Ala., operates Southern Company's six nuclear units at three locations: the Joseph M. Farley Nuclear Plant near Dothan, Ala., the Edwin I. Hatch Nuclear Plant near Baxley, Ga. and the

Alvin W. Vogtle Electric Generating Plant near Waynesboro, Ga. Plant Farley was built and is owned by Alabama Power, and the plant generates approximately 19 percent of Alabama Power's electricity. Plant Vogtle and Plant Hatch were built by and are co-owned by Georgia Power Company, Oglethorpe Power Corporation, the Municipal Electric Authority of Georgia, and Dalton Utilities.

Southern Nuclear, Alabama Power and Georgia Power each are wholly owned subsidiaries of Southern Company. With 4.3 million customers and more than 42,000 megawatts of generating capacity, Atlanta-based Southern Company is the premier energy company serving the Southeast, one of America's fastest-growing regions. A leading U.S. producer of electricity, Southern Company owns electric utilities in four states and a growing competitive generation company, as well as fiber optics and wireless communications.
Southern Company brands are known for excellent customer service, high reliability and retail electric prices that are significantly below the national average. Southern Company has received the highest ranking in customer satisfaction among U.S. electric service providers for seven consecutive years by the American Customer Satisfaction Index (ACSI). You can access our website by logging on to www.southerncompany.com.

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