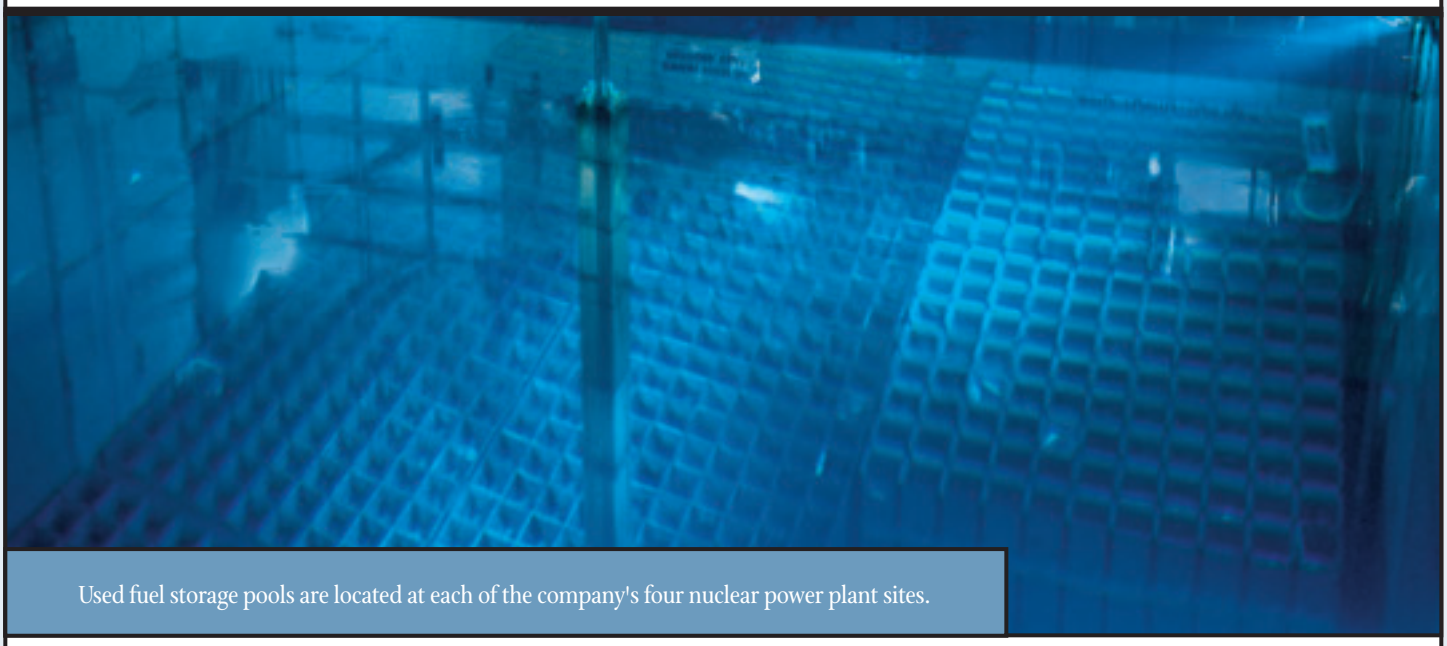
Safely Managing
Used Nuclear Fuel



Used fuel storage pools are located at each of the company's four nuclear power plant sites.

Safe, Clean and Reliable Energy

Florida Power & Light Company operates two nuclear power plants in Florida: St. Lucie Plant near Ft. Pierce and Turkey Point, south of Miami. In addition, FPL Energy, a subsidiary of FPL Group, operates Seabrook Station in Seabrook, New Hampshire and Duane Arnold Energy Center near Cedar Rapids, Iowa.

Nuclear power plants generate electricity by using uranium, a natural ore, as fuel. The uranium is processed into small ceramic pellets that are inserted and sealed into long, vertical, metal-alloy tubes (called "rods"). The rods are then "bundled" into fuel assemblies and precisely placed inside the reactor – a solid-steel, eight-inch-thick pressure vessel.

Within the reactor, a process called "fission" occurs. During fission, the uranium atoms are split, producing the heat needed to create steam and generate electricity. Unlike coal, oil or natural gas in other steam-generating power plants, the uranium fuel is not burned, so there are virtually no emissions, making nuclear power a clean, safe and reliable source of electricity.

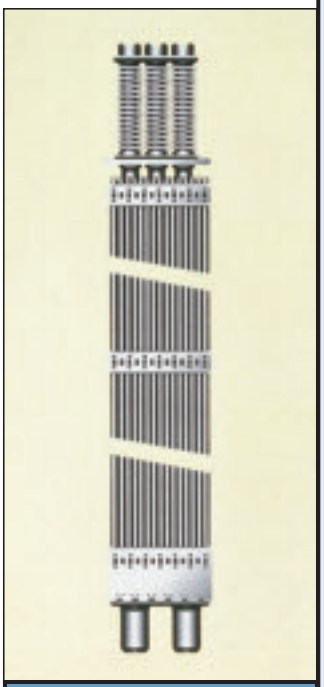
Safely Managing Used Fuel Storage

The fuel assemblies are typically used in the reactor for three operating cycles of about 18 months each. After that, the assemblies no longer contain enough energy to be used efficiently. At this point, the fuel is considered "used," but the remaining material inside the pellets still releases some heat and another form of energy called radiation.

The used fuel is then removed from the reactor and safely placed in stainless steel-lined concrete pools of water. The water cools the used fuel and acts as a shield to protect workers and the environment from radiation. This is called "wet storage" and is used at FPL's four nuclear power plant sites.

Planning for Additional Storage Space at Our Plants

The original plan for all U.S. nuclear power plants was that the federal government would reprocess the used uranium fuel



A typical fuel assembly measures about 12 feet long, 8 inches square and weighs 1,300 pounds.

so it could be "recycled" and used again. Based on that plan, U.S. plants designed the size and capacities of their storage pools.

In the mid-1970s, the federal government decided not to pursue reprocessing. Instead, used fuel would be taken from plant sites and placed in a permanent repository for disposal. This federally-operated repository was to have opened in 1998, but the licensing of the disposal site is behind schedule. As a result, nuclear power plants now have to store all their used fuel temporarily at the plant sites until the federal facility is operational.

The used fuel pools at FPL's Nuclear Fleet plants will begin to reach their storage capacity limits within the next several years (see chart below). Because the federal government has not fulfilled its obligation to dispose of used fuel, we will need to continue managing the storage of used fuel safely and reliably, as we have for more than 30 years. To accomplish this responsibility, the company will supplement the current wet storage of fuel with an additional approach using dry storage.

Storage Capacity Reached*	St. Lucie Unit 1	St. Lucie Unit 2	Turkey Point Unit 3	Turkey Point Unit 4	Seabrook Station
	2008	2010	2010	2012	2009

** Duane Arnold Energy Center implemented dry storage at its site in 2003.*

Dry Storage – A Safe Solution

Used fuel assemblies from St. Lucie, Turkey Point, Duane Arnold and Seabrook plants will be moved periodically into steel and concrete containers and stored on plant property until the federal repository can accept all the used fuel.

Dry storage is a proven technology that is safe, secure and environmentally sound. The design and operation of dry storage systems are licensed by the Nuclear Regulatory Commission (NRC), the independent federal agency responsible for overseeing and regulating U.S. nuclear power plants. Approximately one half of the nation's 64 nuclear power plant sites currently have some form of onsite dry storage. In fact, the Duane Arnold Energy Center, one of FPL Energy's nuclear power plants located in Iowa, has successfully used dry storage since 2003. FPL's Nuclear Fleet will utilize this industry knowledge and implement best practices in its dry storage process.

Dry storage canisters are stored in concrete modules that are about 21 feet long, 10 feet wide, and 19 feet tall, providing a barrier of steel and concrete around the used fuel that measures approximately two to four feet thick.

The modules are designed to:

- provide radiation shielding
- protect the canister from natural disasters (tornadoes, earthquakes, hurricanes, etc.), and
- provide natural airflow cooling of the used fuel inside.

How Dry Storage Works

After the used fuel has cooled for at least five years in the storage pools, the assemblies may be placed in dry storage. Dry storage canisters are loaded and transferred as follows:

- A sturdy stainless-steel canister is loaded into a metal transfer cask and placed in the cask area of the used fuel pool. Used fuel is then loaded into the canister. A lid is placed on the canister, and the transfer cask with all its contents is removed from the used fuel pool.

- After movement to a separate building, the canister lid is welded in place, and the water is drained from the canister. Then, the canister is dried, sealed and inspected.

- The transfer cask, with the sealed canister inside, is placed on a trailer and transported to the dry storage site, which will be located inside the plant's security area.

- The canister is loaded into a solid concrete dry storage "module" that provides support and protection. These modules will be located on a concrete foundation pad.

Frequently
Asked Questions

Used fuel assemblies are stored in cooling pools at the nuclear power plant site.

The fuel assemblies are placed in metal canisters, such as the one shown above.

How much used fuel is stored in our country?

There are more than 100 nuclear power plants in our country, generating approximately 20 percent of the electricity produced in the United States. These plants don't create a lot of waste. If you took all the used fuel ever produced in more than 40 years of operation and laid it side-by-side and end-to-end, it would cover an area the size of one football field, to a depth of 15 feet.

Why is it important that FPL's Nuclear Fleet plants continue in their ability to store fuel?

Additional storage capacity is vital so that our plants can continue providing safe, clean and affordable power to our customers. On a national scale, U.S. energy needs continue to grow, and fossil fuel resources, such as oil and natural gas, are limited. We believe nuclear power must remain a viable energy source now and in the future. This is recognized in the Department of Energy's Global Nuclear Energy Partnership in which the administration plans to increase nuclear energy research and development funding.

What is on-site dry storage?

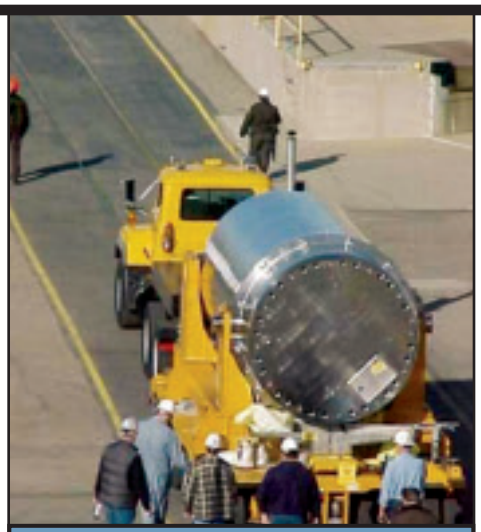
On-site dry storage systems involve sealing used nuclear fuel in airtight, steel-and-concrete canisters that provide both structural strength and radiation shielding. Storage canisters will hold 32 twelve-foot-long used fuel assemblies. The containers are naturally cooled and ventilated (they involve no mechanical devices for cooling or ventilation) and are built to withstand natural disasters such as hurricanes, tornadoes and earthquakes.

How do these containers provide protection from radiation?

The containers are designed to provide radiation shielding to protect plant workers and the public. Once the used fuel is loaded into the sturdy metal canister and then inserted into a larger concrete module, the amount of radiation will be very low. As part of routine operation, radiation levels at the plant sites are continuously monitored and must meet strict federal regulations established by the U.S. Nuclear Regulatory Commission to protect employee and public health and safety.

Could these dry storage containers withstand a crash similar to the 9/11 scenario or other terrorist attacks?

In 2002, the Electric Power Research Institute (EPRI) conducted a computer modeling study on whether U.S. nuclear power plant containment buildings, used fuel pools, dry storage facilities and fuel transport containers would withstand the impact of a 747-400 jumbo jet traveling at 350 miles per hour fully loaded with passengers and fuel. The report concluded that "…the structures that house reactor fuel are robust and protect the



The canisters are transported to the storage location within the plant's protected area.

The canisters are then loaded into concrete modules and placed on a storage pad.

fuel from impacts of large commercial aircraft."

Nuclear power plant sites have always been required to be able to protect against the threat of a terrorist attack. Since 9/11, there has been an intensive focus on modifying and improving security at all key industrial facilities including nuclear power plants. We are confident that our plants' designs and multiple barriers of protection, coupled with our highly trained professional security force and a comprehensive security system, make us fully capable of protecting the site, and public health and safety.

Isn't the federal government responsible for the disposal of used nuclear fuel?

Yes. Under the Nuclear Waste Policy Act of 1982, the U.S. Department of Energy (DOE) is the federal agency responsible for the disposal of nuclear fuel. The act required DOE to begin accepting used fuel from utilities by January 1998; however, progress on opening the disposal site is well behind schedule

Until DOE disposes of the plants' used fuel, FPL has a responsibility to continue managing its used fuel. Building interim dry storage space will extend the plants' fuel storage needs until the federal storage facility is operational.

Once DOE begins the disposal of used fuel, will dry storage at nuclear power plants no longer be needed?

Not right away. Yucca Mountain will accept the nuclear industry's fuel on the basis of "oldest fuel first," and will have some limitations based on how much fuel the site is able to accept during any given time period. Utilities will continue to have to store used fuel safely in wet or dry storage until all of their fuel has been transported to Yucca Mountain for permanent disposal.

Once a permanent disposal site is ready, how will used fuel be transported from the plants?

The Department of Energy will be responsible for safely transporting the used fuel to the disposal facility. A schedule of shipments from each nuclear power plant in the country will be developed. Older plants that have been operating the longest will begin shipping fuel first, followed by newer plants.

As the time draws nearer to transporting the used fuel, we will share information with the community as plans are developed. Numerous provisions and protections will be provided in the plans to assure safe transportation to the permanent repository location. The nuclear energy industry has safely transported more than 3,000 shipments of used nuclear fuel over 1.7 million miles of U.S. highways and railroads since 1964. No nuclear fuel container has ever leaked or cracked in any way.

Secure Location For Dry Storage

Dry storage modules will be located on a concrete pad within the plant's highly protected security area that includes:

- robust physical barriers such as concrete barriers and crash-resistant gates;
- a comprehensive security program, including high-tech intrusion detection and alarm systems; and
- highly qualified security officers who meet rigorous NRC requirements.

When ready, dry storage containers will be placed into the horizontal storage module. Each plant site expects to add two to three containers per unit every 18 months. Activities, such as the loading and transfer of canisters, will be strictly controlled by a team of trained nuclear professionals using detailed procedures.

Access to the storage containers will be under strict nuclear security control, and monitoring of container conditions will be part of regularly scheduled operations performed by FPL personnel. We are committed to ensuring that dry storage is safe for employees, the public and the environment.

Long-Term Storage – Centralized Disposal Makes Sense

It just makes sense to safely and permanently dispose of used nuclear fuel and other radioactive materials from nuclear power plants in one remote location. Other nations, such as Sweden and Germany, already are planning underground repositories for their used fuel.

In the United States, scientists from the Department of Energy have been testing Yucca Mountain, Nevada, located in an unpopulated desert, as the country's first underground storage location. The repository will be far from the water table and deeply embedded in rock so that not even a natural disaster could disturb it. The site will be safely protected for thousands of years.

Most experts believe political, not technical, issues have delayed U.S. repository completion. At current estimates, we project the earliest Yucca Mountain would be ready to receive used nuclear fuel is in the 2015-2019 timeframe.

We are encouraged to see an increase in public support for being environmentally responsible in committing to a disposal solution now rather than leaving it for future generations. Until the disposal site opens and begins to accept used fuel, we are committed to safely managing the storage of used fuel at our four plant locations – just as we have for the last 30 years.

Dry storage of used fuel is safe, secure and environmentally sound.

Overview
of FPL's Nuclear Fleet

St. Lucie Plant

- The plant is located on Hutchinson Island, about eight miles southeast of Ft. Pierce.
- The site consists of two nuclear power units. Unit 1 began operation in 1976, and Unit 2 followed in 1983.
- The two units generate a total of about 1,700 million watts of electricity – enough power to supply the daily needs of more than 500,000 homes.
- The plant's information center contains exhibits on the storage of used fuel. Contact the Energy Encounter at 772-468-4111 or toll-free at 1-877-375-4386 for more information.

Turkey Point Plant

- The plant is located on Biscayne Bay, 24 miles south of Miami and just east of the Homestead area.
- The site includes two nuclear power units. Unit 3 began operation in 1972, and Unit 4 followed in 1973.
- The two units generate about 1,400 million watts of electricity – enough power to supply the daily needs of more than 450,000 homes.
- About 90 percent of the site remains in its natural habitat of wetlands and mangroves, which provide a home to the endangered American crocodile.

Seabrook Station

- The plant is located on a 900-acre site in the towns of Seabrook, Hampton and Hampton Falls in New Hampshire, about 40 miles north of Boston.
- The site consists of one nuclear power unit, which began operation in 1990.
- FPL Energy, a subsidiary of FPL Group, operates the plant and its share of the plant (88.2 percent) generates about 1,076 million watts of electricity – enough power to supply the daily needs of more than 900,000 homes. (Annual electric consumption is less in the Northeast.)
- The plant's information center contains exhibits on the storage of used fuel. Contact The Science & Nature Center at 603-773-7219 or toll-free at 1-800-338-7482 for more information.

Duane Arnold

- The plant is located on approximately 500 acres of land in Palo, Iowa, about nine miles northwest of Cedar Rapids.
- The site consists of one nuclear power unit, which began operation in 1975.
- FPL Energy operates the plant and its share of the plant (70 percent) generates about 415 million watts – enough power to supply the daily needs of approximately 420,000 homes.
- About 70 percent of the Duane Arnold property remains in its natural state – the remaining land not used for generating electricity is used by local farmers for crop production and animal grazing.

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