BACKGROUNDER
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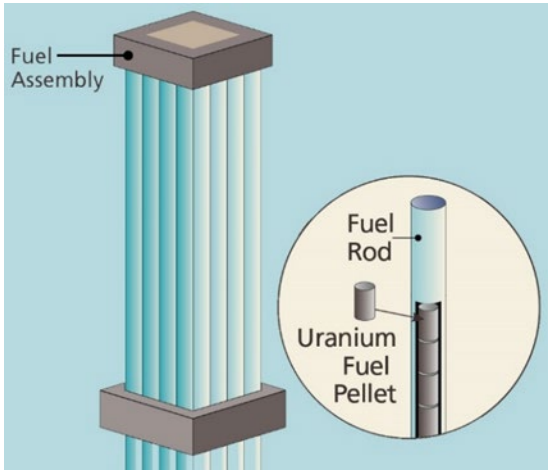
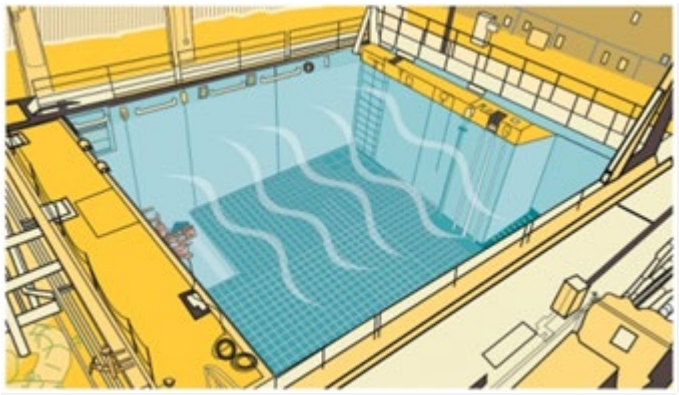
Storage of Spent Nuclear Fuel

Spent nuclear fuel refers to the bundles of uranium pellets encased in metal rods that have been used to power a nuclear reactor. Over time, nuclear fuel becomes less able to keep a nuclear reaction going. Every so often, about one-third of the fuel in a reactor must be replaced. The nuclear reaction is stopped before the spent fuel is removed. But spent fuel still produces a lot of radiation and heat that must be managed to protect workers, the environment and the public.



How is spent nuclear fuel managed?

Pool Storage Every reactor site has at least one pool into which spent fuel is placed for storage when it is removed from the reactor. Spent fuel pools:


Spent fuel is placed in pools for storage

- Are inside the plant's protected area.
- Contain an enormous amount of water to cool the fuel and provide radiation shielding.
- Have no drains that would allow the water to drain out.
- Can be filled using a variety of water sources, if needed.
- Have large safety margins, including about 20 feet of water above the top of the fuel, giving plant operators time to correct any problem that may arise.
- Are robust, with very thick, steel-reinforced concrete walls and stainless steel liners.
- May be located below ground level, shielded by other structures, or surrounded by walls that would protect the pool from a plane crash or other impact.

Dry cask storage The NRC also allows nuclear power plants to store their spent fuel on-site in NRC-approved dry storage casks. These casks:

- Are inside the plant's protected area.

- Are designed to resist floods, earthquakes, tornadoes, projectiles and temperature extremes.
- Have very thick metal or steel-reinforced concrete outer shells and a sealed inner metal cylinder.
- Draw fresh air in at the bottom without fans or pumps and allow heated air to rise through vents at the top. A typical cask emits roughly the same heat as a home-heating system.

On-site spent fuel storage in pools and casks may continue after a reactor is decommissioned, or even after a centralized facility for storage or disposal is available.

What makes spent fuel storage safe?

NRC regulations The NRC sets strict requirements for safe spent fuel storage. Developed through a public process, they provide a sound technical basis for protecting public health and safety and the environment. Reactor licensees and equipment vendors provide detailed descriptions of pool storage racks and dry casks, including extensive tests and analyses to show the equipment and its operation meet NRC requirements. The NRC carefully reviews these submittals. To obtain NRC approval, the designs must:

- Prevent the release of radiation.
- Be structurally robust.
- Prevent a nuclear fission reaction.
- Safely manage heat.
- Use materials that can withstand the effects of radiation, heat and corrosion.

Dry casks have thick shielding to protect workers and the public from radiation

Inspections, monitoring, testing NRC inspectors ensure that spent fuel is stored safely by:

- Regularly inspecting reactor and equipment vendors.
- Inspecting the design, construction and use of spent fuel equipment.
- Observing “dry runs” of handling procedures before dry storage system loading.

Power reactors must limit radiation doses to workers and the public, including at spent fuel pools and cask storage facilities. The facilities are under constant monitoring and surveillance.

The NRC also performs periodic testing and analyses that have shown:

- Spent fuel and cask components perform as predicted even after years of dry storage.
- Potential health risks from loading and storing spent fuel in dry casks are very small.
- No known radiation releases have affected the public since casks were first loaded in 1986.

How do NRC regulations evolve to address new information?

Fukushima response The NRC studied the effects of the March 11, 2011, earthquake and tsunami at Japan's Fukushima plant. The staff looked at how the spent fuel pool at a U.S. reactor similar to Fukushima might respond to an earthquake far more powerful than the one that struck Japan. In addition, the NRC ordered licensees to:

- Install additional instruments to monitor water levels in the pool.
- Develop ways to easily maintain or restore spent fuel pool cooling in an emergency.

Post 9/11 security requirements While there have been no known or suspected attempts to sabotage spent fuel storage facilities, the NRC upgraded protection requirements after Sept. 11, 2001. Licensees must meet those requirements, which include the ability to detect and stop an intrusion.

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