



Nuclear Submarines and Aircraft Carriers

Nuclear submarines and aircraft carriers are powered by onboard nuclear reactors.

- Heat from the nuclear reaction makes the steam needed to power the submarine.
- When a nuclear vessel is taken out of service, its radioactive parts are disposed of and monitored.

About Nuclear Submarines and Aircraft Carriers

In 1954, the U.S. Navy launched the first submarine that used radioactive material as a power source. Before then, submarines used diesel engines and had to go into port for fuel. Nuclear power provided submarines with about twenty years of power without having to stop for fuel. Food supplies became the only limit on a nuclear submarine's time at sea. Since then, similar technologies have been developed to power aircraft carriers.

Nuclear submarines and aircraft carriers are powered by onboard nuclear reactors. Atoms in the nuclear reactor split, releasing energy as heat. This heat is used to create high-pressured steam. The steam turns propulsion turbines that provide the power to turn the propeller. Additional turbines also make electricity for the ship. As the steam cools and condenses back into water, the water is routed back through pipes and the process starts again.

The nuclear reactor compartment is shielded to protect the crew from the radiation the reactor releases. Reactor engineers wear radiation monitors that are checked regularly. They follow strict safety procedures, work in shifts and carefully plan the work to limit their time in the reactor compartment.

Rules and Guidance

U.S. DEPARTMENT OF DEFENSE (DOD), U.S. NAVY

The Navy operates all nuclear submarines and aircraft carriers. The Navy is in charge of properly disposing of nuclear vessels that are no longer used. The nuclear fuel is removed from the reactor and sent to the Naval Reactors Facility in Idaho for processing. The nuclear reactor compartments are cut out, carefully sealed and taken to an approved disposal site. After the vessel's hazardous materials are properly removed and disposed of, the ships are stored at Puget Sound Naval Shipyard in Bremerton, Washington. They are eventually cut up and the various metals are recycled.

U.S. COAST GUARD

When submarine and aircraft carrier nuclear reactors are no longer being used, the compartments are shipped to the final disposal site on barges. During shipment, the Coast Guard or the U.S. Navy will provide an escort vessel to ensure the security of the barge. The Coast Guard may periodically inspect the barges.

U.S. DEPARTMENT OF ENERGY (DOE)

DOE disposes of some types of contaminated reactor parts from nuclear vessels at the Hanford facility in Washington State. These contaminated reactor parts are stored in specially designed waste storage cells.

U.S. DEPARTMENT OF TRANSPORTATION (DOT)

The Navy must comply with DOT regulations when shipping the reactor compartments. Radiation levels must not exceed DOT limits. These limits are in place to protect workers, the public and the environment while shipping and managing the reactor compartments and components.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA), SUPERFUND

EPA's Superfund is the federal government's hazardous waste cleanup program. Hanford, Washington, where contaminated nuclear vessel parts are housed, is a Superfund site. EPA, DOE, and the State of Washington developed an action plan addressing Superfund and Resource Conservation and Recovery Act (RCRA) issues at the Hanford site.

THE STATES

Oregon's Department of Energy works with the U.S. Navy to ensure the safe passage of barges carrying nuclear waste. Washington State's Department of Ecology, Nuclear Waste Program works to oversee all Hanford nuclear waste activities.

What you can do

Radiation safeguards for nuclear vessels are extremely thorough and strict. There is no reason civilians should ever encounter any exposure risk from nuclear submarines or the disposal sites that store the dismantled reactor compartments.

Respect Safety Zones: Safety zones are often established around contaminated sites. These zones limit public access to hazardous materials that may cause adverse health effects. The people working inside of the safety zone are trained professionals who are educated in safety procedures and potential hazards.

Where to learn more

You can learn more about nuclear submarines and aircraft carriers by visiting the resources available on the following webpage: <http://www3.epa.gov/radtown/submarines-aircraft-carriers.html#learn-more>.