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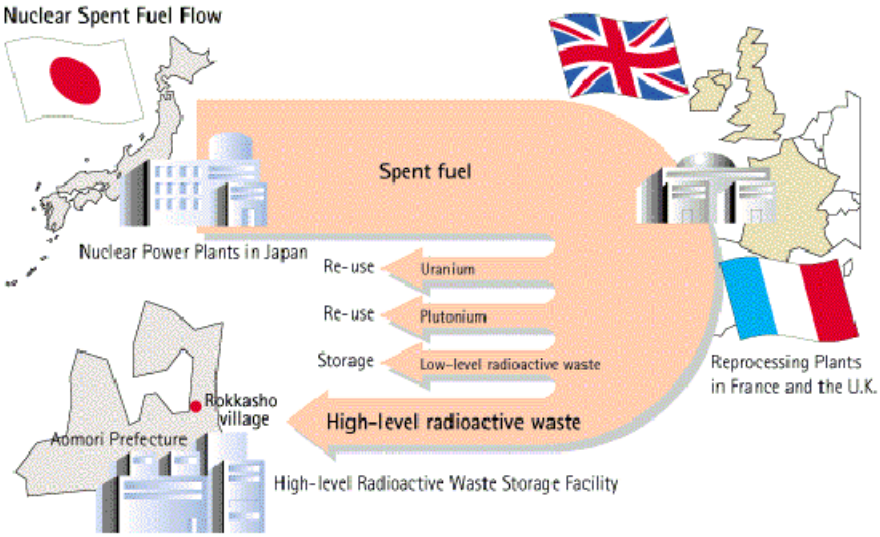
Transportation of Nuclear Materials



Japan is planning to start the MOX utilization program, which involves utilizing MOX fuel --a mixture of uranium and plutonium oxides-- in existing light-water reactors. MOX fuel is fabricated using plutonium that has been recovered through the chemical reprocessing of spent fuel. Due to a current lack of facilities in Japan, most of the reprocessing of spent fuel and fabrication into MOX fuel has been done in Europe, necessitating its transport back to Japan. In addition, the reprocessing process involves the vitrification of a small portion of high-level radioactive waste, which is part of spent nuclear fuel. Thus, MOX fuel as well as vitrified waste residues must both be transported from Europe back to Japan.

Transportation of MOX Fuel

MOX fuel shipments are conducted in accordance with the U.S.-Japan Agreement for Cooperation Concerning Peaceful Uses of Nuclear Energy (U.S.-Japan Agreement). Under the terms of the Agreement, Japan needs to consult with U.S. authorities for any shipment containing plutonium extracted from nuclear fuel originally supplied by the United States for use in Japan's power reactors. This transportation plan was established with the cooperation and assistance of the U.S. government.

MOX fuel shipments are carried out by vessels belonging to Pacific Nuclear Transport Ltd. (PNTL) , Over the past 20 years, PNTL has maintained an impeccable safety record, having transported over 8,000 tons of nuclear material

over 4.5 million miles without a single incident involving the release of radioactivity.
International experts rate PNTL vessels to be among the world's safest, far above conventional cargo vessels. They feature double hulls to withstand collision damage, enhanced buoyancy to maintain the ship afloat even in extreme circumstances, dual navigation and tracking systems, twin engines and propellers, and additional firefighting equipment, including a hold-flooding system. Moreover, all ships are certified to the highest safety category "INF3" code by the International Maritime Organization (IMO).

The specialized casks are built to standards set by the International Atomic Energy Agency (IAEA). The casks are massive, made from thick forged steel, and weigh around 100 tons, with five tons' of solid MOX fuel inside. Their security and reliability are carefully tested, including being dropped 9 meters onto an unyielding target, immersed in 15 meters of water for at least 8 hours, and fire tested, where the cask is fully engulfed in 800-degree-Celsius temperatures for 30 minutes. The casks are able to survive the pressure of several thousand meters of water.

In addition, the MOX fuel itself is inherently safe and resistant to the effect of outside elements. The pellets are a hard ceramic, stone-like material that is so durable that it would take thousands and thousands of years to dissolve. The fuel rods are corrosion resistant and are able to withstand the depths of several thousand meters of water.

A recent study by the Central Research Institute of Electric Utilities in Japan shows that even by discounting the sealing capacity of a cask on the seabed, the impact on those living near the incident would amount to one-millionth of natural background radiation. If such an accident happened in deep waters, the impact would be equivalent to ten-millionths of background radiation.

The physical protection measures for the MOX fuel shipments meet the recommendations of the IAEA and the requirements of the U.S.-Japan Agreement. There are typically two PNTL vessels, armed for self-defense that sail in a convoy, each escorting and protecting the other. Armed officers of the U.K. Atomic Energy Authority Constabulary (UKAEAC), who have been specially trained to protect nuclear facilities and materials, are responsible for protection aboard the ship. The U.K. government is also responsible for ensuring the physical protection of vessels and cargo during the voyage.

Transportation of Vitrified Waste

As described in the vitrified waste section, waste from reprocessing is entombed in glass. This waste must be transported back to Japan, the country of origin.

The canisters of vitrified waste are transported in a specific cask, licensed by French and Japanese Authorities. Each cask, designed to ensure the safety of the transport, weighs around 100 tonnes, is 6.6 m long and 2.4 m in diameter. It is similar to a spent fuel transport cask. Each cask can contain 20 or 28 canisters.

The ships have been specially designed and are only used for the transport of nuclear materials. Their length is in the range of one hundred meters. Four purpose-built ships (Pacific Sandpiper, Pacific Pintail, Pacific Teal, Pacific Swan) owned by Pacific Nuclear Transport Limited (PNTL) have been approved for the transport of vitrified residues.

The casks and ships used, as well as the organization of the transport meet the latest requirements of the applicable international and national regulations, including those related to safety (International Atomic Energy Agency recommendations, and International Maritime Organization).

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