FACT SHEET

MOX Fuel Shipments from Europe to Japan

Mixed Oxide (MOX) fuel assemblies are manufactured in dedicated facilities in Europe and loaded into nuclear reactors to generate electricity.

The assemblies contain hundreds of small cylindrical pellets, held within zirconium alloy tubes around four metres in length. Once sealed and welded, a series of these fuel rods is placed into a special framework to complete each assembly.

The pellets contain a mix of mainly uranium, with a small proportion of plutonium. The plutonium content ranges from 3–12 percent according to the fuel design.

Nuclear reactors can use uranium fuel, MOX fuel or a combination of the two. MOX fuel was first loaded in nuclear power stations on a commercial basis in the 1970s and has been used in over forty reactors. To date, more than 7,500 MOX fuel assemblies have been loaded in nuclear reactors in France, Germany, Belgium, Netherlands, Switzerland, Japan and the United States.

Pacific Heron

MOX fuel assembly in MELOX plant, France

Over the next decade, the number of nuclear reactors utilizing MOX fuel is forecast to increase. Japan, which has limited natural energy resources, utilizes MOX fuel as part of a long-term programme to provide secure and stable electricity supplies.

MOX fuel effectively makes possible a new energy resource, derived from nuclear fuel that has already been used in a reactor. Electric utilities in Japan sent their used nuclear fuel to Europe for chemical reprocessing from the late 1960s until 2001. Reprocessing used fuel separates out the reusable products (97%) from the waste (3%) and allows it to be recycled.

In 1999, with all the components of the nuclear fuel cycle infrastructure in place, MOX fuel began to be shipped to reactor sites in Japan. To date, MOX fuel has been delivered to five of Japan's electric power companies for use in their reactors.

QUICK FACTS

Worldwide energy demand is forecast to increase well into the future. MOX fuel provides nations operating nuclear power plants with an extended capacity to generate low carbon electricity. This is particularly important for Japan, where nuclear power plants maintain their position as an important part of the energy mix.

Two PNTL ships, the Pacific Heron and Pacific Egret, are fitted with special security equipment for transporting MOX fuel. For mutual protection, these vessels travel together, each escorting the other. They are fitted with fixed naval guns and have other additional physical protection systems, only some of which are visible.

MOX fuel after arrival in Japan

Shikoku Electric's Ikata Nuclear Power Station, Japan

MOX fuel is solid and stable and will maintain its structural integrity without dispersing into the environment if it is submerged in water. It is characterized by both long-term stability and low solubility.

The ships carry armed officers from the United Kingdom Civil Nuclear Constabulary (CNC), who provide on-board protection. CNC officers are specially trained to protect nuclear facilities and materials.

The overall physical protection system, established through cooperative agreements between the governments of the United Kingdom, France, Japan and the United States, ensures that appropriate measures are in place to counter any threat of theft or sabotage.

Benefits of MOX

MOX fuel is an attractive energy source for several reasons.

- Recycling used nuclear fuel extracts substantial additional energy from uranium resources. This helps extend uranium reserves.
- Utilizing MOX fuel means that useful energy-producing material does not go to waste.
- MOX fuel is energy efficient. One pellet of MOX fuel, approximately one centimetre in length and weighing about six grammes, generates the energy equivalent of one tonne of coal.
- Since nuclear power stations do not emit carbon dioxide and other harmful substances associated with fossil fuels, MOX contributes to promoting clean air.
- Utilizing MOX fuel reduces the amount of radioactive material that would otherwise need disposal, reducing demands on waste storage facilities.
- By using plutonium, concerns about the proliferation of nuclear materials can be reduced.

With its inherent stability, portability and high energy content, MOX fuel is an attractive source of electricity which plays its role in a low carbon energy mix along with renewables.

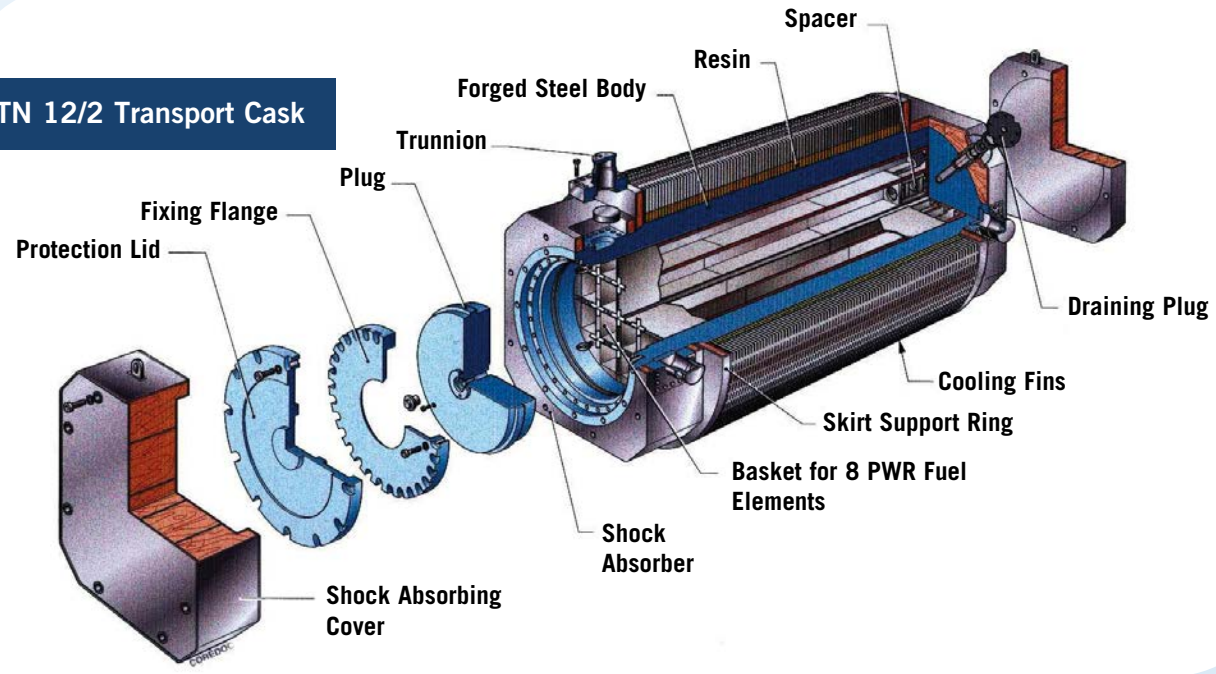
Focus on the Packages

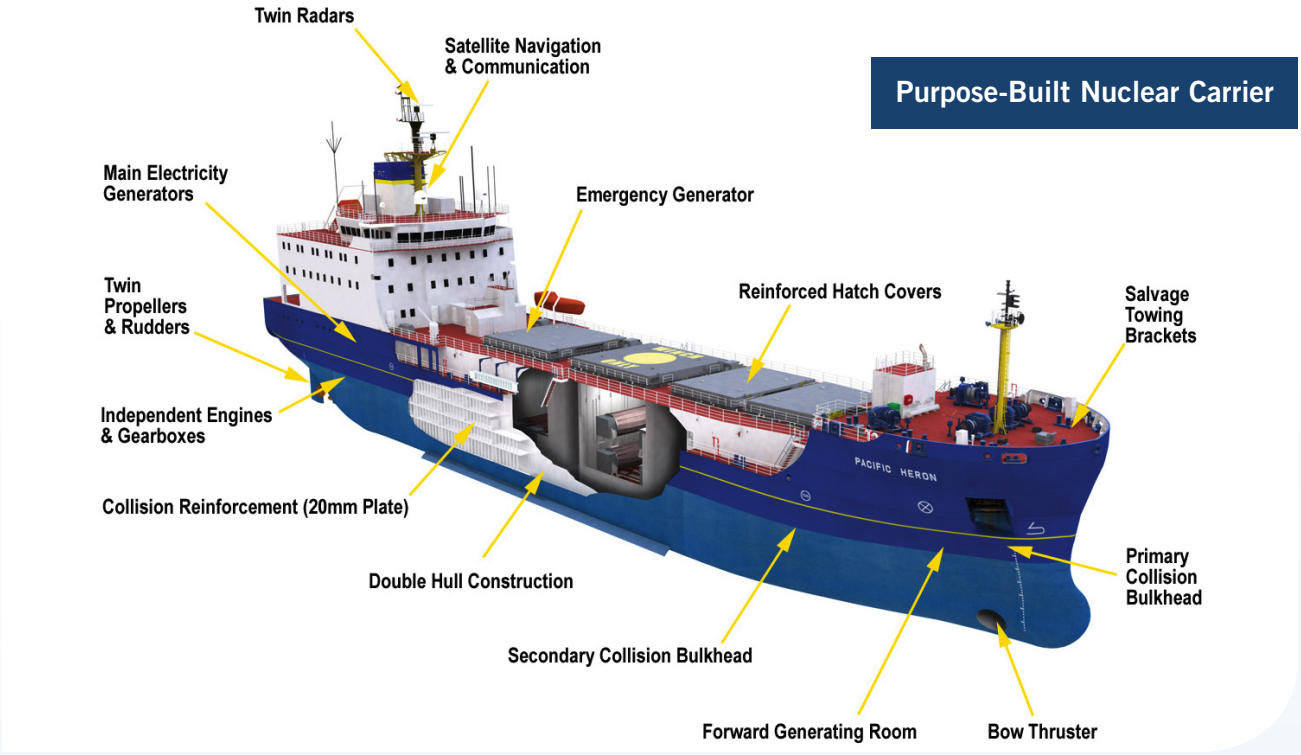
MOX fuel assemblies are transported inside special packages that are fixed to the holds of the ships.

The standards for packages of nuclear material are set by the International Atomic Energy Agency (IAEA), which is a United Nations body. The MOX fuel is moved in “Type B” packages, which are able to withstand a series of challenging tests that demonstrate resistance to severe impact, fire and immersion.

The Type B casks used for shipments of MOX fuel are robust structures made from 250mm thick forged steel and weigh around 100 tonnes.

TN 12/2 Transport Cask





Focus on the Ships

MOX fuel is transported in dedicated purpose-built ships owned by Pacific Nuclear Transport Limited (PNTL). PNTL is operated by Nuclear Transport Solutions (UK) and jointly owned with Orano (France) and Japanese nuclear companies.

PNTL is now using its second generation of purpose-built ships. They are flagged in the United Kingdom and based in Barrow, around 40 miles from the Sellafield nuclear site in the north west of England. The ships meet national and international regulations, including the requirements of the INF code of the International Maritime Organization (IMO), the United Nations agency that regulates shipping.

The PNTL ships travel to Japan non-stop and have fully trained and qualified crews. Operational equipment is checked and tested prior to each departure from Barrow.

The PNTL ships have covered more than 5 million miles.

Some of the design features include:

- Double hulls and hull reinforcing
- Enhanced buoyancy
- Dual navigation, communications, cargo monitoring and cooling systems
- Satellite navigation and tracking
- Twin engines and propellers
- Hold flooding capability
- Redundancy of electrical power generation

FOR FURTHER INFORMATION VISIT:

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