# Fact Sheets

NTS
Nuclear Transport Solutions

orano

ORC

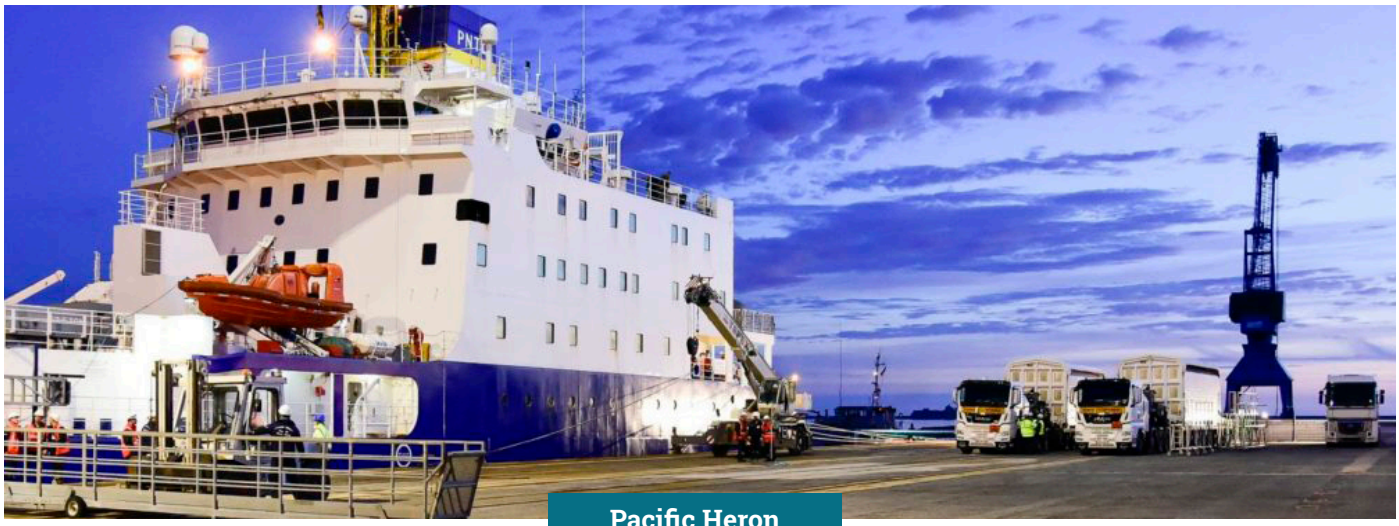
# 1 MOX Fuel Shipments from France to Japan

MOX (Mixed Oxides) fuel assemblies have been manufactured for 50 years in various specialized plants in Europe and have been loaded into 38 nuclear reactors to generate electricity. Today, only the Orano Melox plant in France masters this advanced technology..

MOX fuel assemblies contain thousands of small cylindrical pellets contained in four-meter long zirconium alloy tubes. Once sealed and welded, several of these tubes are joined together to form a fuel assembly.

The pellets contain a mixture of 92% uranium oxide and 8% plutonium oxide (average values).

Nuclear reactors operate with uranium fuel, MOX fuel or a mixture of both. 44 reactors worldwide have produced nuclear electricity with MOX fuel since 1972. To date, more than 8,650 fuel assemblies have been loaded in reactors in France, Germany, Belgium, the Netherlands, Switzerland, Japan and the United States.



Pacific Heron

Japan, which has limited natural resources, has a long-term program including 20% nuclear power partially using MOX to meet its needs for safe and stable electricity by 2030. MOX fuel effectively makes possible a new energy resource, derived from nuclear fuel that had previously 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 back to reactor sites in Japan by sea. To date, MOX fuel has been delivered to five of Japan's electric power companies for use in their reactors.

# 2 Advantages of MOX

**MOX fuel is an attractive energy source for several reasons:**

- The recycling of used nuclear fuel extracts substantial additional energy from uranium resources extending uranium reserves.
- The use of MOX fuel saves up to 25% of raw materials by recycling reusable nuclear materials.
- MOX fuel is energy efficient. One pellet of MOX fuel, approximately one centimeter long and weighing about six grams, generates the energy equivalent to one ton of coal or 600 kg of oil.
- Since nuclear power plants do not emit carbon dioxide or fine particles, the use of MOX contributes to environmental protection, air quality and the fight against global warming.
- The use of MOX fuel reduces the toxicity and volume of radioactive waste to be stored in specialized nuclear facilities.
- By reusing plutonium, MOX reduces the risk of proliferation of nuclear materials.

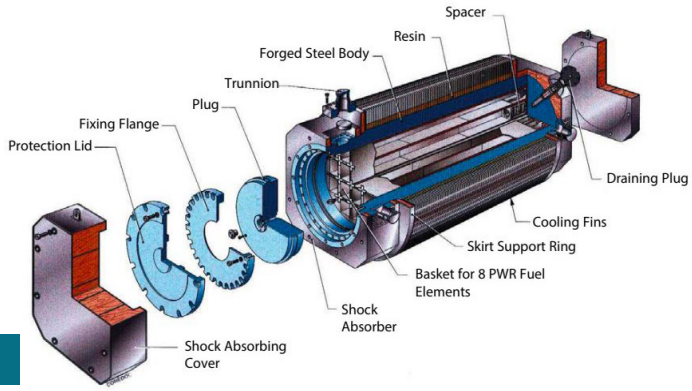
**With its inherent stability and high energy content, MOX fuel is a low-carbon source of electricity production that has a role in a low-carbon energy mix.**

# 3 Focus on the Packages

MOX fuel assemblies are transported in special packages designed by Orano to be securely stowed in the holds of the ships.

The required standards for the transport packages are set by the IAEA (International Atomic Energy Agency) which is a United Nations body. MOX fuel is transported in Type B packages that have undergone a series of tests to demonstrate resistance to severe impact, fire or immersion.

The packages used for MOX transport are massive structures composed of 250-mm thick forged steel shells weighing about 100 tons for a payload of less than 10 tons.



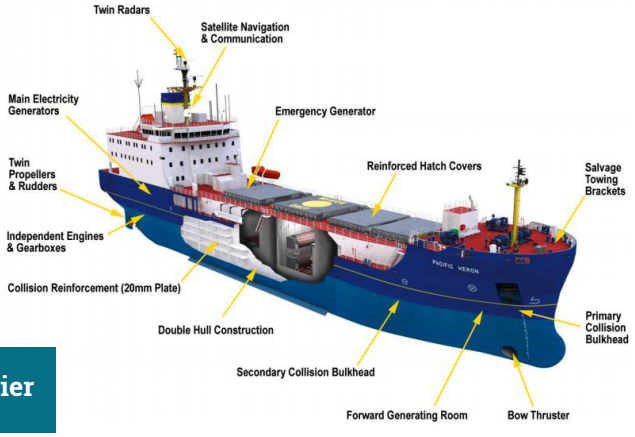

**TN 12/2 Transport Cask**

# 4 Focus on the Ships

MOX fuel is transported in dedicated, purpose-built vessels owned by PNTL (Pacific Nuclear Transport Limited). PNTL is operated by Nuclear Transport Solutions (UK) and is jointly owned by Orano (France) and a consortium of Japanese electric utilities.

PNTL, based in Barrow in the North West of England, operates a fleet of purpose-built second-generation vessels sailing under the British flag. They comply with national and international regulations including the INF Code of the International Maritime Organization (IMO), the United Nations body that regulates international shipping.

PNTL vessels travel non-stop to Japan and have highly trained and experienced crews, with operational equipment checked and tested before each departure from Barrow.




**Purpose-Built Nuclear Carrier**

**The PNTL ships have covered more than 5 million miles.**

**Their main technical characteristics are as follows:**

Double hull and anti-collision reinforcement;
Enhanced buoyancy;
Dual navigation, communication, cargo monitoring and cooling systems;
Satellite navigation and tracking;
Twin engines, rudders and propellers;
Bilge flooding system;
Multiple independent power generators

Shikoku Electric's Ikata Nuclear Power Station, Japan

# 5 Quick facts

## Growth

Worldwide energy demand is forecast to increase well into the future, especially with the electrification of products to decarbonize economies. MOX fuel provides nations with nuclear power plants an extended capacity to generate low carbon electricity over the long term. This is particularly important for Japan, where nuclear power plants are expected to contribute to the energy mix to meet the country's goal of achieving carbon neutrality by 2050.

## Packaging

The transport packages designed by Orano offer tested and proven reliability: resistance tests in conformity to IAEA standards. 6 similar shipments have already been carried out without any anomaly.

## Transport

Two PNTL vessels, the Pacific Heron and the Pacific Egret, are specially equipped to transport 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.

## Protection

Armed units of the British police (Civil Nuclear Constabulary) provide protection on board the ships during the voyage. CNC officers are specially trained in the protection of nuclear facilities and materials.

## Collaboration

The physical protection means have been established through cooperative agreements of the British, French, Japanese and American governments to ensure maximum security, particularly to counter threats of theft, sabotage or ship boardings.

**FOR FURTHER INFORMATION VISIT:**

www.pntl.co.uk | www.innuserv.com | www.orano.com


NTS Nuclear Transport Solutions

Nuclear Transport Solutions (NTS)
International Nuclear Services Ltd
and Direct Rail Services Ltd .
Herdus House, Westlakes Science
& Technology Park,
Moor Row,
Cumbria CA24 3HU

orano

Orano
125 avenue de Paris
92320 Châtillon
France

ORC

Overseas Reprocessing Committee
11F Hibiya-daibiru Building
2-2 Uchisaiwai-cho 1-chome
Chiyoda-ku
Tokyo 100, Japan