

# Transport ship M/S Sigrid



In 2012, SKB launched a new ship to transport radioactive waste. M/S Sigrid arrived in Sweden in December 2013 to replace the Sigyn after many years of faithful service.

M/S Sigrid transports radioactive waste and spent nuclear fuel from the Swedish nuclear power plants to SKB's facilities in Forsmark and Oskarshamn. The low and intermediate-level operational waste will be transported to the final repository for short-lived radioactive waste (SFR) in Forsmark. The spent nuclear fuel will be transported to the interim storage facility for spent nuclear fuel, Clab, in Oskarshamn.

When SKB's new facilities have been built, the ship will

also transport encapsulated fuel from the planned encapsulation plant in Oskarshamn to a future final repository for spent nuclear fuel in Forsmark. Decommissioning waste from old dismantled nuclear power plants will also be taken to the extended SFR.

M/S Sigrid was built between 2011 and 2013 in Galati, Romania, by the Damen Shipyards Group. The International Maritime Organisation (IMO) has given her the highest classification, level INF 3, for ships that transport radioactive waste. The ship represents an advance over M/S Sigyn in terms of compliance with new requirements and regulations.

Environmental considerations have been given high priority in designing the Sigrid. The engine configuration, with four slightly smaller main engines, allows her to utilize

catalytic cleaning even at low speeds, thereby reducing NOx emissions. The ship operates on low-sulphur marine diesel, and SKB plans the shipments to minimize fuel consumption. In order to reduce the risk of spills in the event of an accident, none of the Sigrid's diesel or oil tanks are located up against the outer hull. She is also equipped with ballast water treatment, which reduces the risk of alien marine species being inadvertently transported to non-native habitats via the ballast water.

SKB has chosen to mechanically remove marine growth from the hull annually instead of treating it with anti-fouling paint, which can cause problems for the environment.

Safety has naturally also been a top priority. The ship is equipped with extra communication equipment, and has many internal and external safety-enhancing features. The Sigrid has a double hull with extra reinforcements and water-tight bulkheads. Critical systems are redundant and separated to promote high operational availability and flexibility. If an important system fails during a journey, for example due to a mechanical error or an accident, a reserve system will take over.

The Sigrid's cargo is unique. The spent nuclear fuel must be both radiation-shielded and cooled during transport. The requirements on the transport casks are very stringent and are regulated by the UN International Atomic Energy Agency, IAEA. In transit, the primary safety feature is the design of the casks. The more radioactive the waste, the tougher the requirements on the cask.

The cargo is driven on board via a stern ramp according to the roll on, roll off principle. It is also possible to open the loading hatch and lift the cargo on board. There is heavy-duty lashing gear in the hold to secure the different types of transport casks. The walls and floor in the hold are radiation-shielded, and there are instruments on board to monitor radiation.

M/S Sigrid arrived in her new home port, Simpevarp, outside Oskarshamn in December 2013. She has now assumed the duties of the Sigyn and has been put into scheduled service.

The Sigrid is owned by SKB, but Furetank Rederi AB is in charge of operation and crewing.



The Sigrid was launched at the shipyard in Galati, Romania, in autumn 2012.

Photo: Eva Newellus



SKB's project manager during shipbuilding, Jenny Holmström, on one of her many visits to Romania.

Photo: Lasse Modin

#### Facts

<b>Length overall</b>	99.5 metres
<b>Primary cargo</b>	Radioactive waste and spent nuclear fuel
<b>Cargo capacity</b>	12 transport casks or 40 freight containers
<b>Draught</b>	4.5 metres
<b>Deadweight tonnage</b>	1,600 tonnes

Footnote: "Sigrid" is a composite name representing "seger" ("triumph") and "frid" ("peace"), and like Sigyn originates from Old Norse..