

ENERGY  
ENVIRONMENT  
ECONOMY

## CASE ARCTIA OFFSHORE ICEBREAKERS: FIRST TURNKEY NOR RETROFIT ON ARCTIC VESSELS



Arctia Offshore contracted Wärtsilä to install emission reduction systems on board MSV Fennica and MSV Nordica multipurpose icebreakers in 2011.

—Our icebreakers can now operate sustainably in the Arctic Ocean. Thanks to Wärtsilä's technology for exhaust gas cleaning, our vessels are able to continue their sustainable heavy machinery operations in this sensitive environment, says the Arctia Offshore representative.

Arctia Offshore Oy, part of Arctia Shipping Oy, is a Finnish government owned company, whose main business areas are providing icebreaking services and special services with multipurpose vessels. In addition the company offers ship management and freight services. Arctia Shipping Oy was founded in 2010.

Arctia's multipurpose vessels MSV Fennica and Nordica are powerful icebreakers ideal for tasks that require manoeuvrability and precision, such as highly demanding operations in oil fields all over the world,

including those requiring dynamic positioning capability. Both vessels have two 16-cylinder Wärtsilä Vasa 32 + two 12-cylinder Wärtsilä Vasa 32 diesel electric main engines.

The vessels had been hired to operate in the Arctic Ocean's Chukchi and Beaufort Seas to assist in oil exploration missions.

— We are sailing in sensitive locations, so a regular Selective Catalytic Reduction (SCR) system is insufficient. In addition we needed a closed crankcase ventilation system to prevent volatile organic compound (VOC) emissions, explains the Arctia representative. ■ ■ ■

WÄRTSILÄ

| Challenges  | Solution  | Benefits   |
|---|---|--|
| <ul style="list-style-type: none"> <li>– The vessels needed to be able to operate sustainably in sensitive arctic locations</li> <li>– Emissions (NO<sub>x</sub>, PM, CO and VOC) had to be below the IMO Tier III regulations</li> <li>– Modifications on board the vessels was not allowed to impair the capabilities of the multipurpose icebreakers</li> <li>– Very tight schedule; contract made in September 2011 and vessels to be back in operation by summer 2012</li> </ul> | <ul style="list-style-type: none"> <li>– Installation of a two catalyst layer Wärtsilä NOR system with an integrated oxidation catalyst layer in the reactor for each engine</li> <li>– Removal of all obsolete exhaust pipes and other obsolete equipment having a significant weight impact in order to maintain vessel capability</li> </ul> | <ul style="list-style-type: none"> <li>– Emissions clearly below the required level in the IMO Tier III regulations</li> <li>– Systems that can withstand extreme arctic conditions</li> <li>– Prerequisites fulfilled to obtain exploration permits from the authorities</li> <li>– Ability to operate sustainably anywhere in the world</li> </ul> |

## ■ ■ ■ FIRST WÄRTSILÄ NOR RETROFIT TURNKEY PROJECT

After a thorough examination, Wärtsilä suggested a NOR system (Nitrogen Oxides Reducer) with two NOR catalyst layers that included an integrated oxidation catalyst layer in the reactor for each main engine. When operating in the Arctic Ocean, the vessels use ultra-low sulphur diesel (ULSD).

– This meant that we needed to wash the fuel oil tanks and the fuel oil system pipes in both vessels to get rid of sulphur residues. However, if the vessels operate outside the Arctic Ocean, they might use higher sulphur content fuel oils, in which case the catalytic elements can be removed from the reactor, says **Tuomas Helin**, Project Manager at Wärtsilä.

Both vessels came into dry-dock less than 2½ months after signing the EPC (Engineering, Procurement and Construction) contract in early September 2011. This two-stage project was the very first turnkey retrofit of Wärtsilä NOR.

## THE INSTALLATION STAGES WENT SMOOTHLY

The first stage included installation of the main large components of the system, i.e. new exhaust gas stacks, the NOR reactors, new exhaust gas boilers (EGB), compressed air equipment, urea dosing and pumping equipment, the crankcase ventilation separators, the 80 m<sup>2</sup> deck extension on the second bridge, new funnel casing, and the urea solution tanks, as well as the relocation of certain existing equipment. All the old

and obsolete exhaust pipes, as well as other remaining equipment having a significant weight impact, were discarded as were all unnecessary cables.

The urea tanks and filling lines were insulated and equipped with heating systems. The tanks have a total volume of 110 m<sup>3</sup>, corresponding to approximately two weeks of autonomous operation when using a 40 wt% technical grade urea-water solution, and with all four engines running at full load 24 hours a day. This, however, is not typical for the vessel during exploration and hence, the real life autonomy is considerably longer.

The second stage consisted of installing the catalyst elements within the reactor, as well as the pressurised air system and urea piping for the NOR, the fuel oil cooling systems (because of the use of ULSD) including all piping works, plus commissioning and performance testing the installed system. All modifications on board the vessels were carried out so that none of the excellent capabilities of the multipurpose icebreakers were compromised in any way.

The first stage was completed for both vessels in early 2012. The second stage for Fennica had to be ready by mid-March 2012, when the vessel set sail to the USA, and for Nordica it was completed at the end of April. Throughout the project both Wärtsilä's and Arctia Offshore's personnel showed strong professionalism and a commitment to making things happen.

– This was important because the tight schedule meant that a number of fast decisions had to be made. The schedule

could be maintained, because both parties had a mutual understanding and vision of the project's progress, says the Arctia representative.

## RELIABLE OPERATIONS IN ENVIRONMENTALLY SENSITIVE AREAS

The final emission tests and commissioning were performed when the vessels were sailing towards their final destination. The emission tests were performed by an accredited third party assigned by the customer.

– The tests showed that the emissions were clearly below the required level in the IMO Tier III regulations coming into force for new buildings in 2016, says the satisfied representative for Arctia.

Oil exploration operations in the Arctic Ocean are demanding for a vessel's machinery. Systems have to withstand the extreme conditions and long intervals between port calls. The very strict environmental regulations that exceed even the IMO Tier III NO<sub>x</sub> requirements must be complied with. These are an absolute prerequisite to obtaining exploration permits from the authorities.

– Thanks to the modification work performed, both our vessels, the MSV Fennica and Nordica, are now ready for demanding oil exploration work in the Arctic Ocean, and can operate sustainably for a long time into the future, states the Arctia representative.