

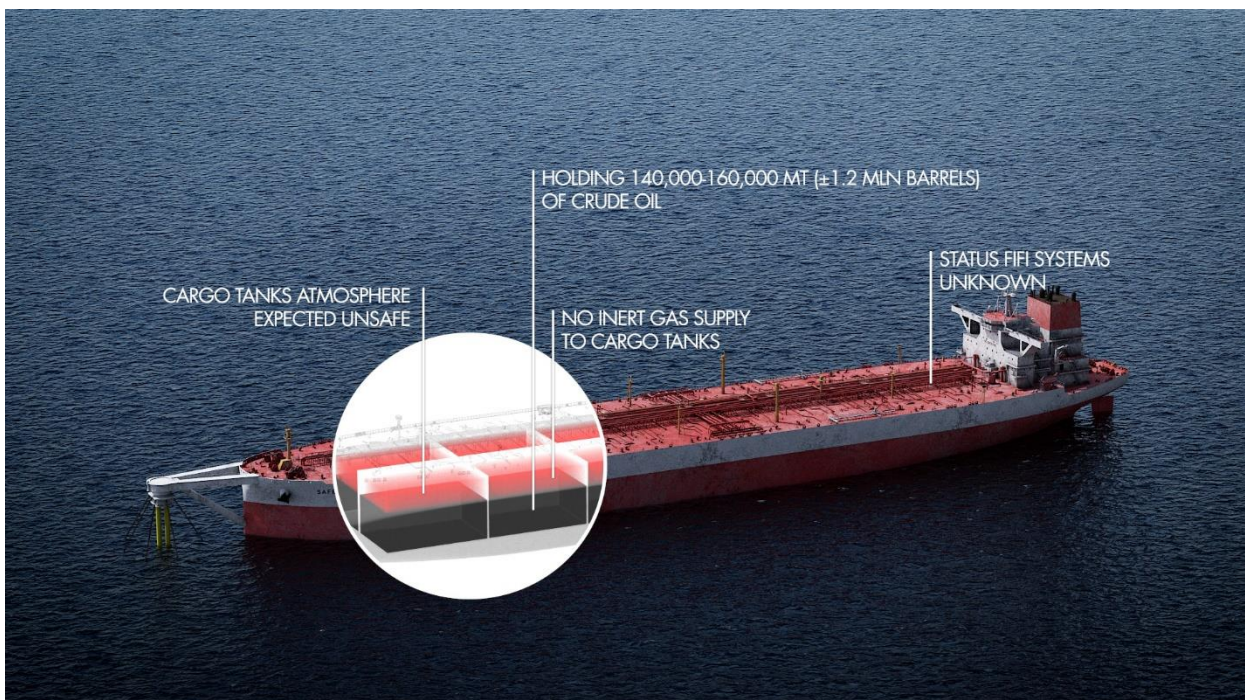
## FSO Safer Oil Transfer operation by Boskalis

### BACKGROUND

Constructed in 1976 as a supertanker and converted a decade later to be a floating storage and offloading facility (FSO) for oil, the FSO Safer is moored about 4.8 nautical miles off the coast of Hodeidah governorate in Yemen. The vessel holds an estimated 1.14 million barrels of light crude oil.



Production, offloading and maintenance operations on the Safer were suspended in 2015 because of the war. The structural integrity of the Safer has significantly deteriorated. All assessments indicate that the FSO is beyond repair and at imminent risk of spilling oil. In 2017, the systems required to maintain inert gas in the tanks ceased to function and therefore in addition to concerns about the structural integrity, the amount of fumes in the tanks results in a risk for fire or explosions.



### **Boskalis contract**

Boskalis, through its subsidiary SMIT Salvage, has been involved since 2021 in assisting the United Nations (UN) in developing a plan to remove the oil from the FSO Safer to avert a large-scale environmental and humanitarian disaster. This support has resulted in an agreement that Boskalis will take precautionary measures to prepare the Safer and to execute a safe ship-to-ship transfer of the crude oil into a double hull VLCC (Very Large Crude Carrier). The key phases of the project include the mobilization of the necessary equipment, the inspection of the Safer to make it safe, the actual ship-to-ship transfer of the oil into the VLCC and the cleaning of the tanks of the Safer.

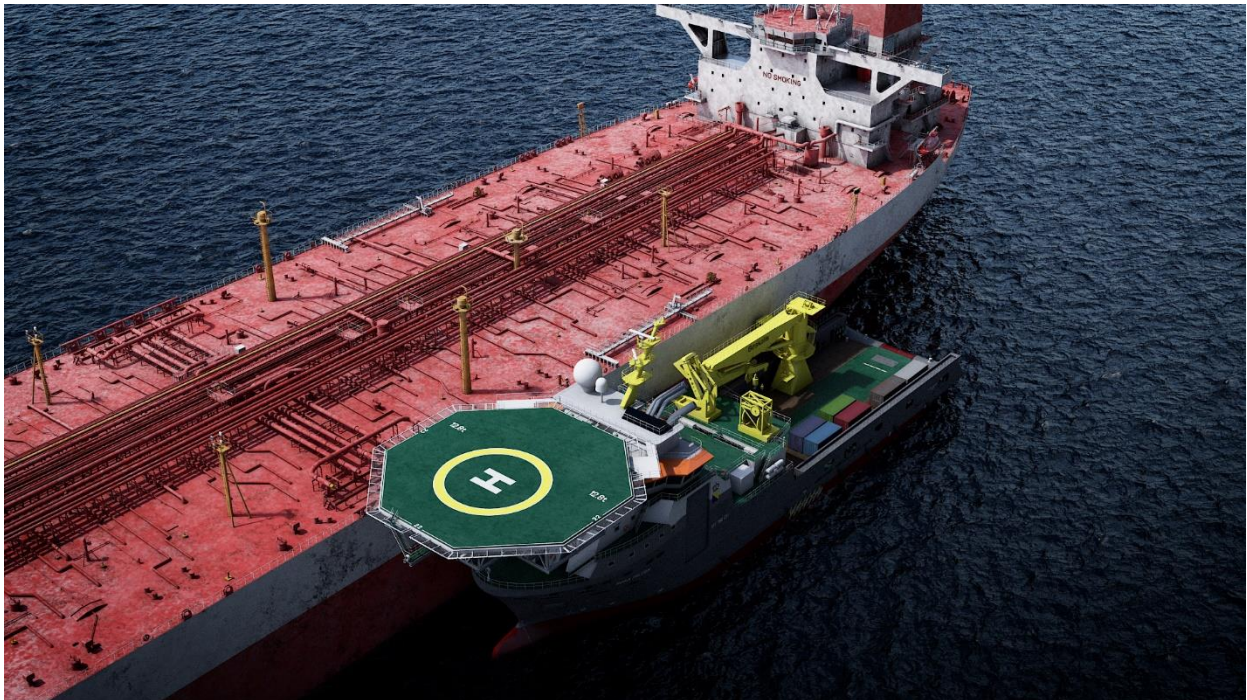
### **Mobilization Phase**

The Boskalis multi-purpose offshore vessel Ndeavor has been prepared in Rotterdam, the Netherlands to serve as the main asset from which the salvage crew will work. The Ndeavor measuring 99 meters (l) by 33 meters (w) has a large amount of deck space from which the operation will be executed and it can accommodate up to 98 persons on board. From Rotterdam, the Ndeavor will sail in approximately 20 days via the Suez Canal to Djibouti.

### **Djibouti final preparations**

In Djibouti, the final preparations will be made and the salvage crew will board the vessel. It is expected that in total approximately 65 persons will be on the Ndeavor throughout the operation. This includes the crew of the Ndeavor and 40 salvage experts and supporting staff. From Djibouti it will be approximately 1 day sailing to the Safer.

### **Arrival alongside Safer**

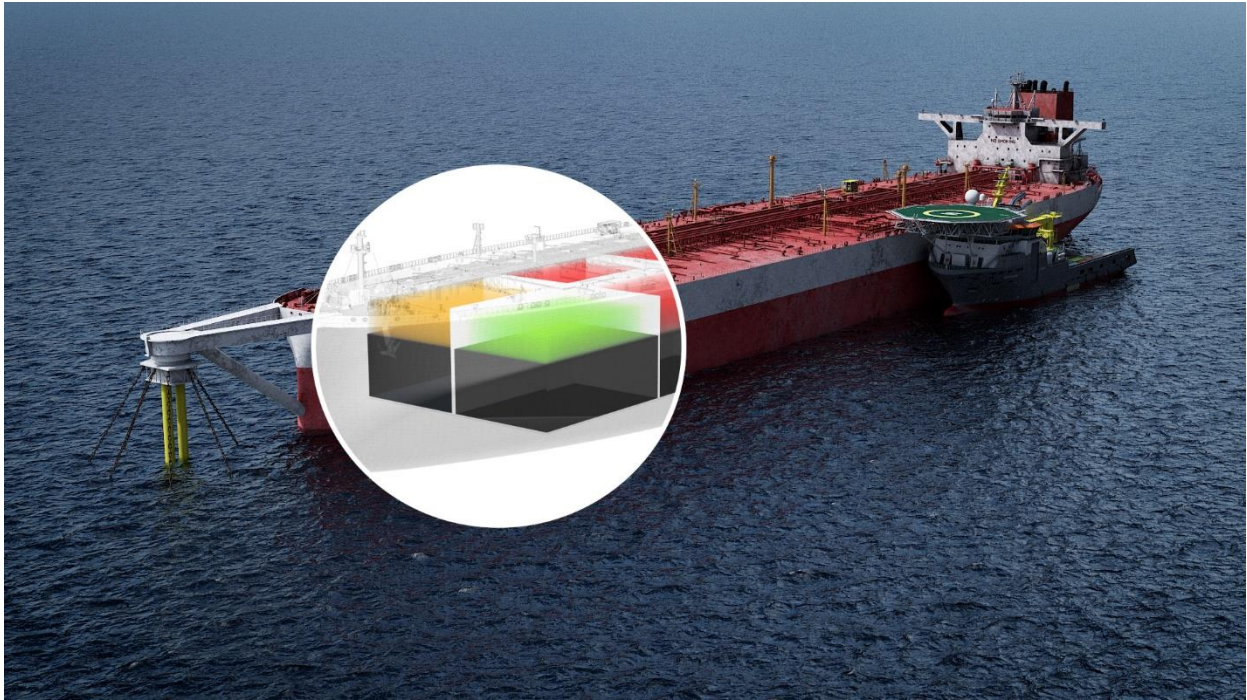


Upon arrival alongside the Safer, a large number of precautionary measures will be taken:

- Visual inspections whilst wearing gas suits and masks will be conducted and the levels of toxic gases will be measured and monitored.
- An inspection on board of the Safer, including the pump and engine rooms as part of the overall condition assessment.
- An inspection of the state of the mooring arrangements.
- Underwater inspections will be executed where necessary.
- The condition of the cargo will be assessed to finetune the transfer operation.
- The cargo and inert gas lines, valves and manifolds will be inspected and subject to the outcome, the salvage plan can be refined.

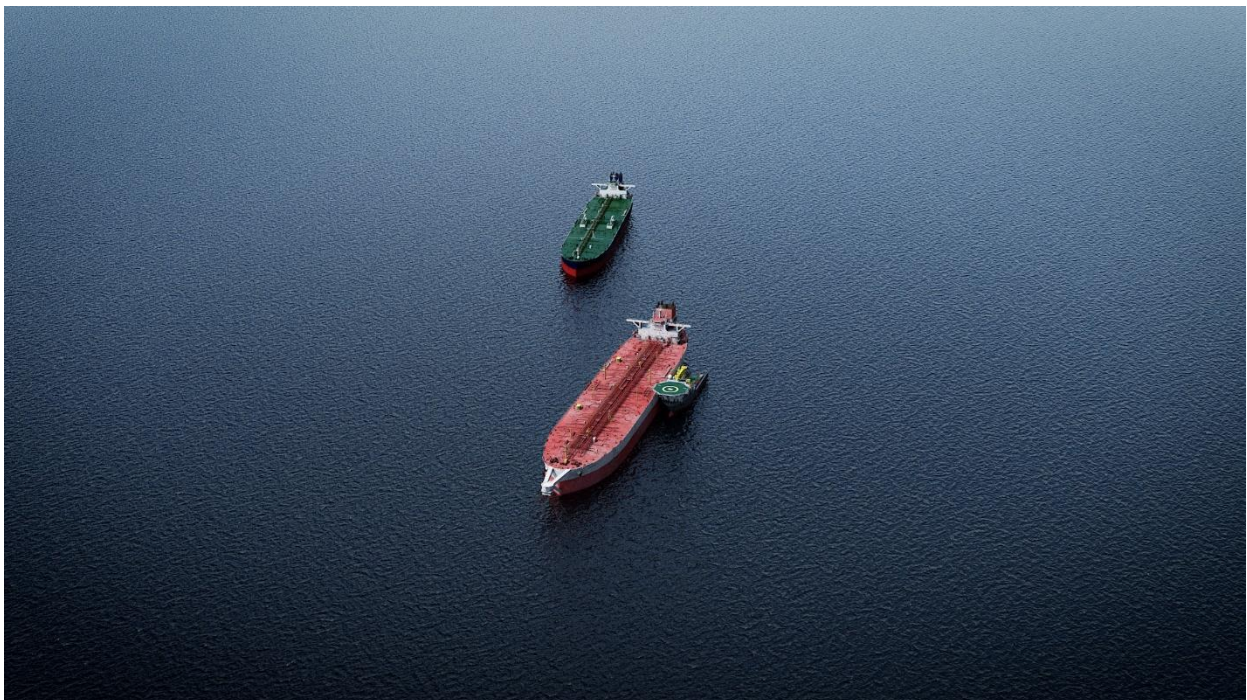
### **Stabilize tanks**

The atmosphere in the oil cargo holds is expected to be unsafe due to the accumulation of flammable cargo vapors and the lack of inert gas. This needs to be resolved by pumping inert gas into the holds using a portable inert gas generator. Each of the cargo tanks needs to be checked and declared safe before the actual oil removal process can commence. This entire operation is expected to take approximately 16 days.



### **VLCC tanker along side**

Once the cargo tanks are declared safe, the VLCC that the UN has procured by will be instructed to come alongside the Safer. Once safely moored, a number of additional environmental precautions will be taken including the installation of oil booms prior to the ship-to-ship transfer of the oil.



### Ship-to-ship transfer

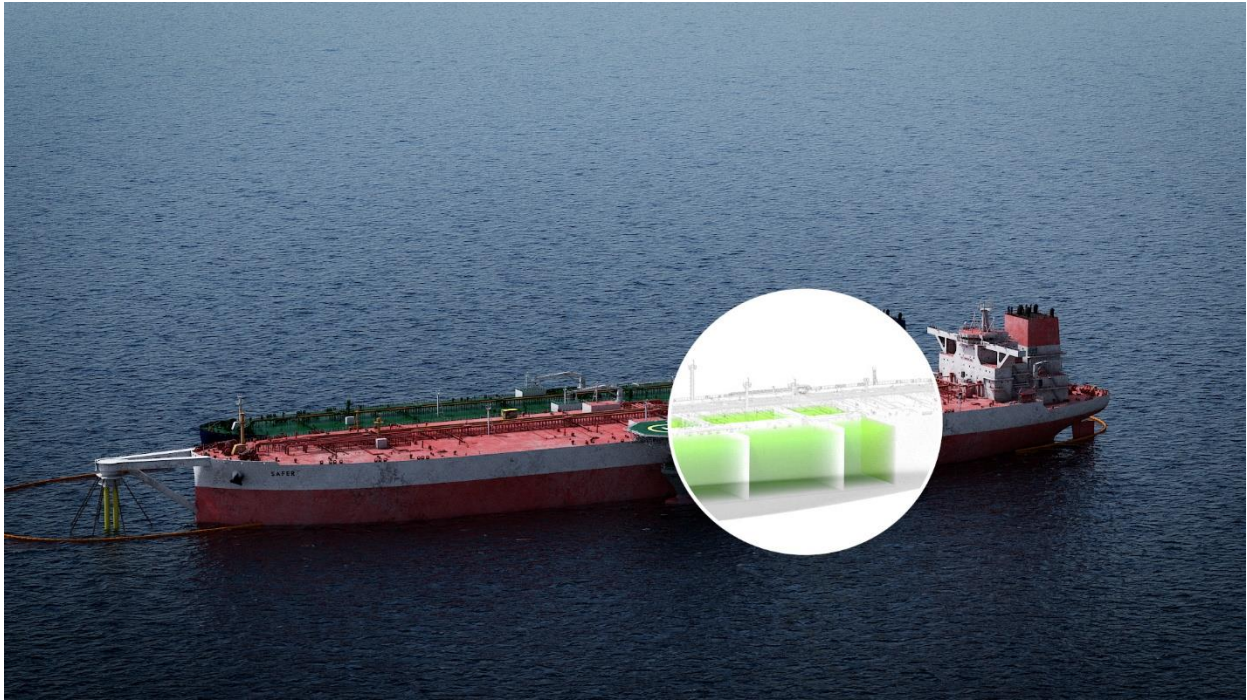
The actual ship-to-ship transfer of the oil is expected to take 19 days.

- Numerous hydraulic pumps will be lowered into each tank and all pumpable oil will be pumped into the VLCC.
- During the transfer operation inert gas will be supplied to keep the tank atmosphere at safe levels throughout the operation.



**Tank cleaning**

Once all the pumpable oil has been removed from the Safer, there will still be a small layer of thick oil in the bottom of the tanks and the walls will still be covered with a residual film. A mobile spray tank cleaning machine will be used in the tanks to clean the inside. The remaining dirty water is then also transferred to the VLCC tanker. The cleaning operation is expected to take 17 days.

**Outcome**

The outcome of this part of the operation is a clean and safe Safer which can be dismantled at a dedicated location. With the removal of the oil, a possible large scale environmental and humanitarian disaster is averted and the oil is stored in a modern and safe VLCC.