



VENTURIE AS



**THE VENTURIE
VOC SYSTEM**



**A SOLUTION TO VOC
EMISSIONS FROM STORAGE,
HANDLING AND TRANSPORT
OF CRUDE AND PRODUCT
OILS, ON OR OFF SHORE**

The Venturie VOC System for Reclaiming of Hydrocarbon Losses

Losses of Volatile Organic Compounds (VOC) are also money and energy lost. One of the major sources of VOC emissions is the oil industry. Worldwide, the annual evaporation from oil tankers represents the volume of about 20 VLCCs of oil. Recovering the VOC can be good business economy. It's all about selecting the cost effective solution.

Venturie AS has developed a process that cuts loading losses considerably, and completely eliminates transit losses. In addition, H_2S gas levels are kept low, improving crew safety. This process not only meets environmental regulations, but payback demands too.

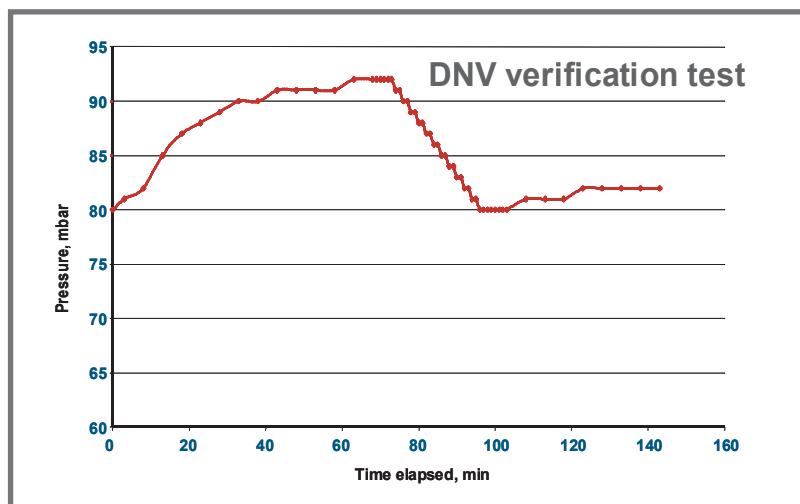
The Venturie process controls tank pressure during loading to reduce evaporation, and it reabsorbs evaporated VOC back into the cargo. This is done by relatively simple and lightweight equipment that easily integrates into the ship's structure and power supply.

Pressurized loading of a VLCC typically leaves it with extra light ends on board worth about 50,000 USD at 40 USD/barrel. This primarily reduces the local concentration of ground



near ozone. However, when the ship leaves, volatile components will evaporate.

To save the global environment and keep the saved hydrocarbons as valuable cargo, you would need the Venturie absorption unit to keep the VOC dissolved in the oil. The same applies for vented storage and loading facilities on shore, for crude and product oils. Reducing the loading evaporation is the easy part. We help you keep what you save.



This plot from the DNV verification test shows the tank pressure drop when operating the Venturie absorption unit after pressurized loading

Saving Emissions and Cargo

Loading, transit and unloading losses from crude oil transportation amount to some 0.2% of the cargo as a worldwide average¹, with loading losses as the dominant part. Pressurized loading cuts evaporation by 20-50%, depending on oil volatility. To cash in on this, you need the Venturie absorption unit. The Venturie VOC System has a payback time of less than one year, irrespective of ship size. Pressurized loading cuts H₂S emissions considerably.

Venturie also offers cost effective solutions for VOC recovery during lightering and FSO operations, and for FPSO production and offloading.

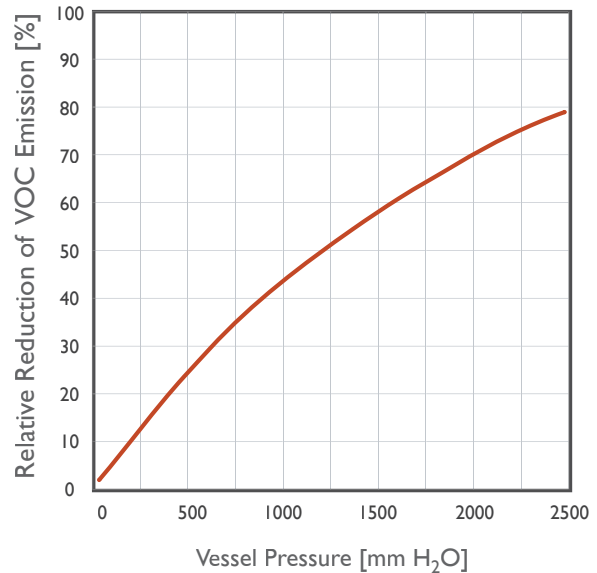
With the Venturie VOC System, there is simply more oil to deliver.

¹ Figures from Intertanko and The Energy Institute (Former Institute of Petroleum)

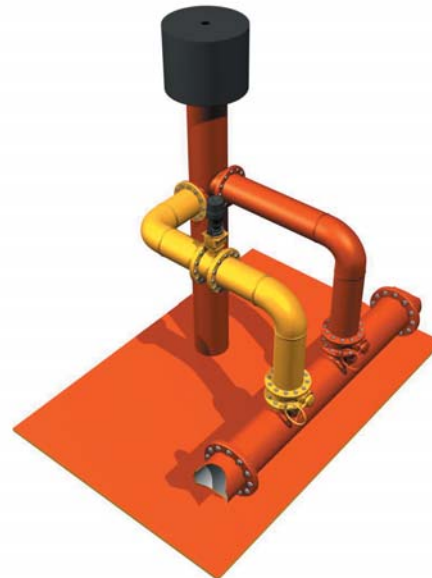
Pressure Control

The arrangement to keep tank pressure constant during loading is a valve controlled by a pressure transmitter. Installed parallel to the present riser valve arrangement, this complies with DNV and ABS requirements. There is no venting until the vessel pressure is close to the safety valve setpoint.

Effect of Increased Vessel Pressure on
VOC Emission During Loading



This curve shows how evaporation from a North Sea crude is reduced with increasing pressure. Safety valves normally lift at a pressure of 1,400 mm H₂O.



Pressure is controlled by a valve parallel to the standard pipe arrangement at the mast riser, complying with class safety demands. The controlled bypass is yellow in this illustration.

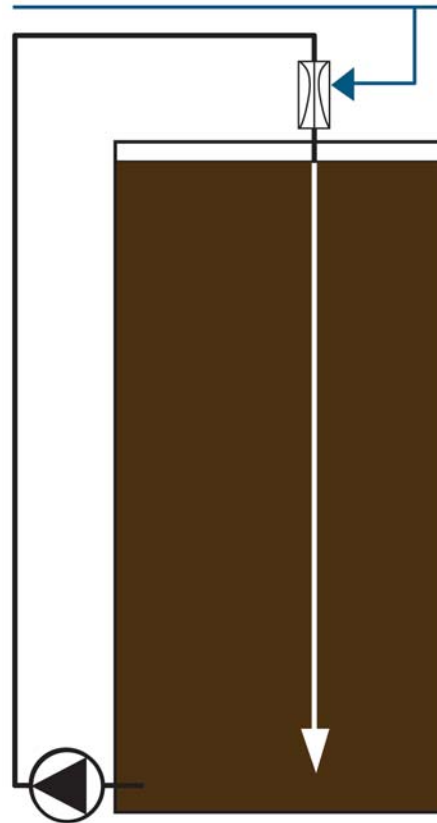
The VOC and H₂S Reabsorption Process

The venturi reabsorption unit of the Venturie VOC System consists of a pressure controlled pump, feeding oil to a unit with two venturis. Because of the venturi suction, VOC, H₂S and inert gases (IG) are drawn from the common IG line. The venturi unit is a gas compressor with no moving parts, designed to generate a bubble size optimal for rapid absorption. Released near the tank bottom, the soluble compounds are kept dissolved by the pressure head there. Inert gas will eventually surface. To keep a crude oil tanker emission free, the process operates up to 1-2 hours per day. The Venturie VOC System works on all tanker sizes, and offers a payback time of less than one year. We guarantee to keep ships free of all in-transit venting.

Applications

This well proven recovery concept can be adopted to cut or eliminate VOC emissions during lightering, loading and from FPSO operation. In addition, it is perfect for tanks onshore. It is the cost effective alternative among VOC recovery processes for crude and product oils.

The Venturie VOC System is approved by ABS and DNV, and is installed on Vela tankers.



Oil is pumped from a cargo tank through the venturi unit. Gas is sucked in from the main inert gas line and injected at the bottom of the tank.

