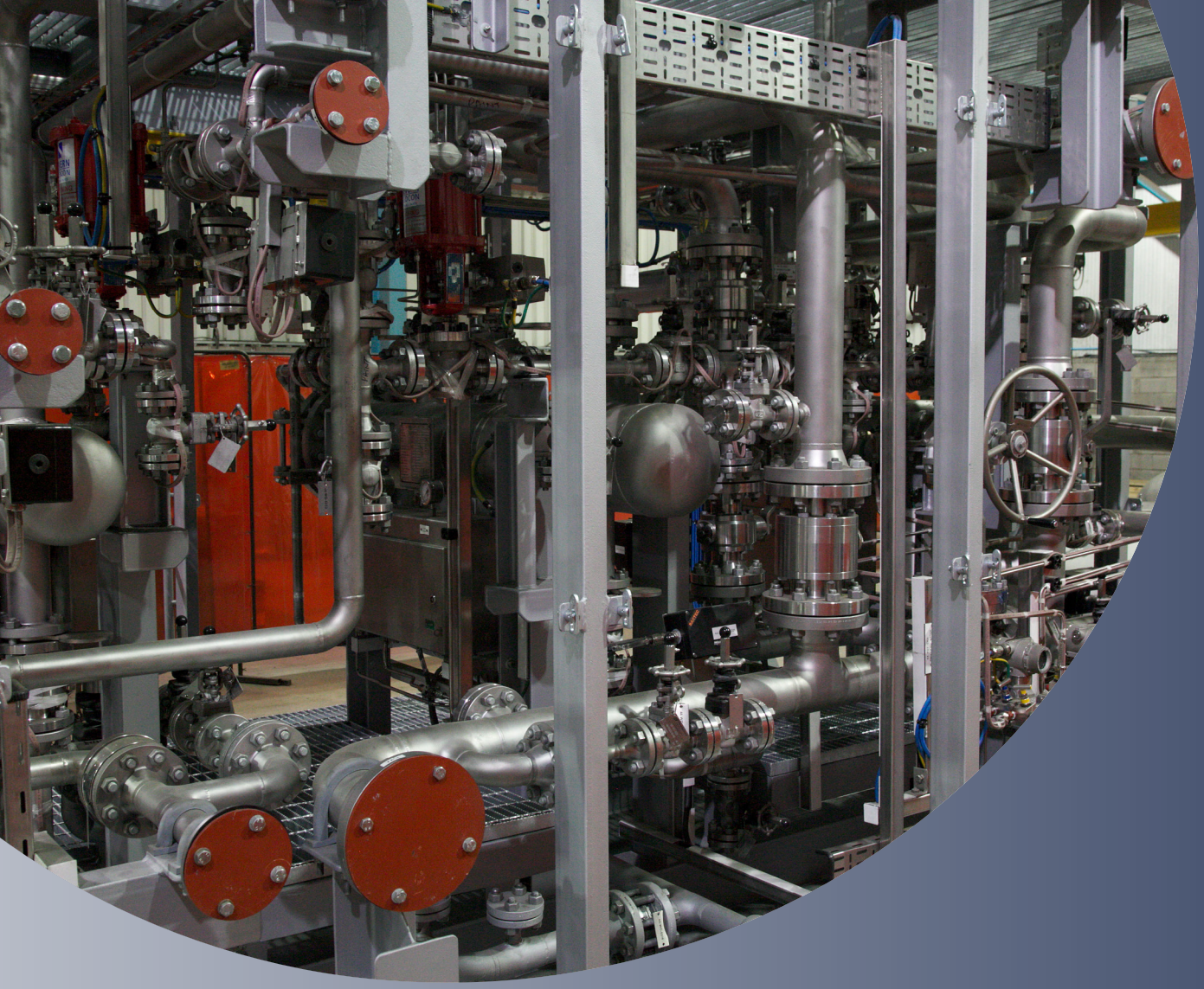


Upstream energy

Produced Water Treatment

WATER TECHNOLOGIES

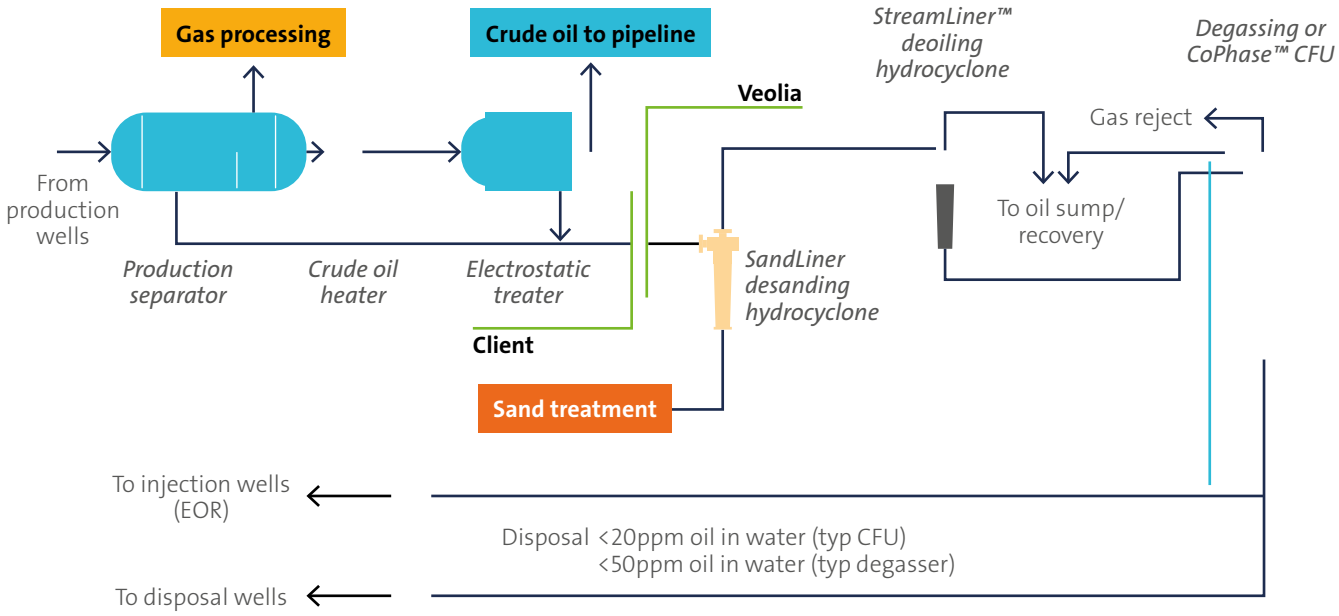
VEOLIA

Produced water treatment

Produced water is naturally occurring water that comes out of the reservoir as a byproduct of oil and gas production. It can contain a range of contaminants that need to be treated either for reinjection or for safe discharge to the sea.

Traditional produced water treatment is usually comprised of hydrocyclones followed by degassing or flotation processes. Increasingly stringent environmental discharge requirements plus the constant pressure to reduce equipment footprint have led Veolia Water Technologies to the development of an innovative range of produced water technologies that in combination are able to treat produced water to be safely discharged to the stringent environmental discharge requirements and achieve the high operational reliability demanded for offshore use.

Typical produced water process



Veolia Water Technologies, VWS Westgarth Ltd has developed an innovative range of produced water technologies that in combination are able to treat produced water to be safely discharged to the stringent environmental discharge requirements and achieve the high operational reliability demanded for offshore use. By combining a SandLiner™ range of hydrocyclones, with our STREAMLINER™ and Cophase™ CFU, common problems associated with interfacing plant from different suppliers are eliminated.

Sandliner™ desanding hydrocyclone

Our SandLiner™ desanding hydrocyclones, are designed to address the presence of solid particles such as sand, scale, and corrosion products in a produced water stream. These particles, if not removed, can cause damage and blockages, leading to reduced performance and increased downtime of the water treatment system. This results in higher operation and maintenance costs, as well as interruptions to oil production.

Veolia Water Technologies has developed the SandLiner™ desanding hydrocyclone to efficiently remove these troublesome solids, protecting against production loss and associated costs. The SandLiner™ complements other Veolia produced water treatment technologies, providing an integrated and optimized solution at every key process stage in the water treatment system.

The SandLiner™ is available in various models, all with the same external dimensions. Each model is designed to achieve an appropriate balance between pressure drop and separation performance, allowing for the required separation performance to be achieved within the available pressure drop in most applications. Multiple selected hydrocyclones can be mounted in one or more pressure vessels to meet the user's flow rate and turndown requirements. The typical required pressure drop in operation ranges from 1 to 5 bar, depending on application requirements.

The Veolia SandLiner™ is suitable for temperatures up to 140°C with standard seals, and can be used in any pressure class up to #2500 or API 10,000.

DESIGN PHILOSOPHY

Designed with a sharp focus on demanding and high performance oil & gas applications:

- Constructed from ceramic material to resist highly erosive conditions
- Minimise footprint and weight
- Reduce maintenance
- Extend operating life
- A number of liners models are available, all with the same external dimensions.

HOW IT WORKS

The Veolia SandLiner™ operates by introducing produced water through tangential inlets into the widest part of the conical internal cavity, creating a vortex. As the water passes through the vortex, centrifugal forces push the suspended solids to the wall of the hydrocyclone. The vortex flow pattern transports the separated solids along the wall to the outlet port, where they flow into a catchment chamber below the Sandliner. The desanded water flows in a reverse direction, up the center of the Sandliner and out through the axial port at the top. Normally, the sand in the catchment chamber would be intermittently discharged to a sand cleaning system while the hydrocyclones are online, although other discharge strategies are possible.

BENEFITS

- Hydrocyclone manufactured from ceramic material to resist high temperatures and erosion
- Designed & developed specifically for oil & gas applications
- Range of 5 hydrocyclones with common external dimensions, giving a range of capacities and efficiencies to suit most process requirements
- Simple design for mounting in pressure vessels
- Can be operated with a continuous or potted underflow
- Suitable for pressures up to API 10,000

Examples of SandLiner™ performance at 3 bar pressure drop, considering a typical range of water viscosities:

- D50: typically 8 - 18µm
- D95: typically 16 - 56µm
- Flow: typically 11 - 22m^3/h per SandLiner™

Streamliner™ deoiling hydrocyclone

The main purpose of a deoiling hydrocyclone is to separate free oil from produced water prior to further treatment, discharge, or injection.

Usually situated after the primary separators, de-oiling hydrocyclones are normally regarded as the first stage in the Produced water treatment process. Long established as a process step, proven in service and having an environmentally compact footprint, they are one of the most commonly employed processes in a produced water treatment system. Energy to drive the process comes from the pressure in the separators.

DESIGN PHILOSOPHY

Incorporating unique features for improved reliability, performance and efficiency together with simplified operation and maintenance, while offering an unbeatable combination of performance, and economy for your water treatment.

BENEFITS

- Geometry optimised for capacity and efficiency
- Annular axial inlets reduce turbulence
- Multiple inlet ports improve wear resistance
- Swirl inducer can be inspected without liner disassembly
- Retractable swirl inducer allows for internal liner inspection and easier jet cleaning
- Liners can be retrofitted into existing installations

HOW IT WORKS

Produced water enters the larger diameter conical end of the hydrocyclone liner through inlets that are tangential to the wall of the liner so that it is made to rotate.

The conical shape of the hydrocyclone liner causes an increase in rotation speed as the fluid flows towards the outlet of the liner, resulting in the development of high centrifugal forces which separate the lighter oil from the heavier water and solids. The separated oil collects at the centreline of the streamliner where a reversed flow transports the oil to an outlet at the opposite end of the streamliner to the cleaned water outlet (which is adjacent to the inlets).

Cophase™ Compact Flotation Unit

The Cophase™ CFU operates by optimally combining the well established principles of gas flotation, oil droplet coalescence and centrifugal separation into a single process unit.

Traditional produced water treatment is usually comprised of hydrocyclones followed by degassing or flotation processes. Increasingly stringent environmental discharge requirements plus the constant pressure to reduce equipment footprint have led to the development of the Compact Flotation Unit (CFU). Veolia has taken this process forward to the next level with the Cophase™ CFU.

DESIGN PHILOSOPHY

- Minimised skimming flow
- Remove the need for a pressurised gas supply
- Improve oil removal efficiency
- Minimise footprint and weight
- Reduce maintenance
- Extend operating life
- Eliminate power requirements
- On and offshore compatibility

BENEFITS

- Highly tolerant of typical FPSO motion
- Self regulating oil skimmer reduces water and eliminates in the reject stream
- Skimmed flow minimised to <1% of total flow
- One minute retention time reduces vessel size and weight
- No motor, pump or other equipment required to recycle water or gas
- Turndown performance is consistent
- 100% of the inlet flow passes through the LoHead™ eductors ensuring excellent gas/liquid contact and superior separation performance
- No rotating parts to maintain
- Designed for high flow rate
- No need for pressurised water or gas; in most cases no gas consumption at all

HOW IT WORKS

The efficiency of oil/water separation at low concentrations depends on maximising the contact between the oil droplets and gas bubbles. The smaller and more densely packed the gas bubbles, the greater surface area of the bubbles that the oil droplets have available to adhere to and agglomerate. The Cophase™ CFU LoHead™ eductor design is unique in that 100% of the inlet flow is fed through the gas eductors, thus maximising bubble generation and contact between the oil droplets and gas bubbles. By enhancing the opportunity for contact between the oil droplets and the gas bubbles, greater oil removal efficiency for a given vessel volume is achieved. The LoHead™ eductor design also generates a vortex within the separation volume, which applies centripetal force upon the heavier water and solids, forcing them to the wall of the vessel and concentrating the oil and gas bubbles in the centre. The vortex, combined with the internal geometry of the vessel has been designed to suppress backmixing in the vessel, causing the water to passes through the separation volume in what is termed “rotating plug flow”, which leads to a higher oil removal efficiency than is achieved in the older designs of flotation units currently available. The Cophase CFU also incorporates a unique floating skimmer that follows movements of the liquid surface so that it only skims from the very top layer of the fluid where the oil accumulates and thereby minmises the total skimming flow.

Resourcing the world

Veolia Water Technologies
Orbital House, 3 Redwood Crescent, East Kilbride G74 5PR • UK
off. +44 1355 588000
vtc.sales@veolia.com • www.vwswestgarth.com