



Produced Water Treatment  
McIlvaine Company Hot Topic Hour Webinar  
July 8, 2010  
Presented by Trygve Hegerland



# Topics

## Proprietary offering

- a) CTour
- b) TORR
- c) Sorbfloc
- d) Sorbsep



# **1** **Proprietary technologies**



# ProPure proprietary technologies

Technology	Produced water components removed				Mechanism	Key process component/ injected fluid	Additional specific process equipment required	Commercial status
	Dispersed hydrocarbon	Dissolved hydrocarbons (BTEX, PAH, phenols, ...)	Heavy metals	Particles (submicron)				
<b>CTour</b>	x	x			Extraction and coalescence with injected condensate	Mixer system/ condensate 0.3 - 0.8 %	* Condensate supply system * Downstream separation unit	Treats 70 % of the PW in the North Sea, Norwegian Sector
<b>TORR RPA</b>	x				Coalescence towards hydrocarbon wetted surface	Cartridge and coalescence material	* Upstream bag filter for particle removal	Triton, KOC Kuwait, several mobile units for batch treatment
<b>Sorbfloc</b>	x	x	x	x	Instant flocculant mixing for selective and robust flock generation	Mixer system/ Sorbfloc™ "green" flocculant 2- 5 ppm	* Flocculant injection system * Downstream separation unit	First pilot testing offshore completed
<b>SorbSep</b>	x	(x) <sup>1</sup>	(x) <sup>1</sup>	(x) <sup>1</sup>	Flotation	Twin vortices	* Flow conditioning; Distributed gas bubbles	First pilot testing offshore completed

<sup>1</sup> - In case of combination with Sorbfloc

**CTour** - Process named after French scientist *Cagniard de la Tour* who first discovered the phenomena of super critical fluids in 1822.

**TORR™** - Total Oil Remediation & Recovery    **RPA™** - Reusable Petroleum Absorbent

**Sorbfloc™** – Sorbwater Flocculant    **SorbSep™** – Sorbwater compact flotation separator

# CTour™

Compact high-performance mixer for injecting and mixing condensate to improve coalescence of dispersed oil droplets.

## Application:

Removal of dispersed and dissolved hydrocarbons from large volumes of produced water.

## Technical advantage:

- Proven to provide a “step-change” in produced water management; 1- 5 ppm oil-in-water achieved
- Effective in removing both dispersed and dissolved hydrocarbons
- Suitable for revamp / retrofit applications

## Key benefit:

- Avoid penalties for non-compliant produced water discharges



## Selected users:

- Statoil, BP, ConocoPhillips (polishes 70% of the produced water in the Norwegian Continental Shelf)

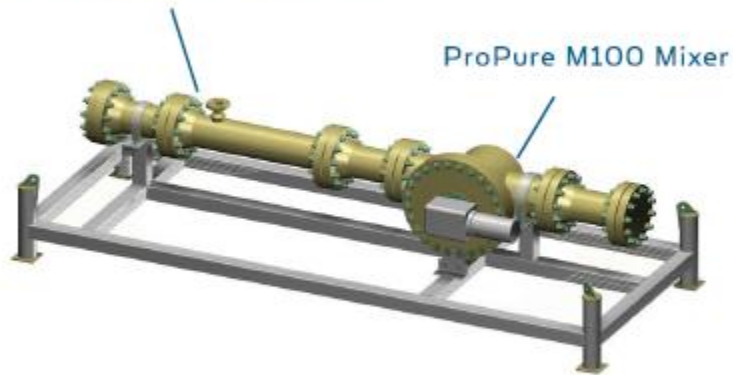
## Awards:

- Statoil’s Executive HSE price 2004 for the contribution to reaching the goal of “zero harmful discharges to the sea”.
- OTC 2006 Spotlight on Technology Award

# CTour™ mechanism

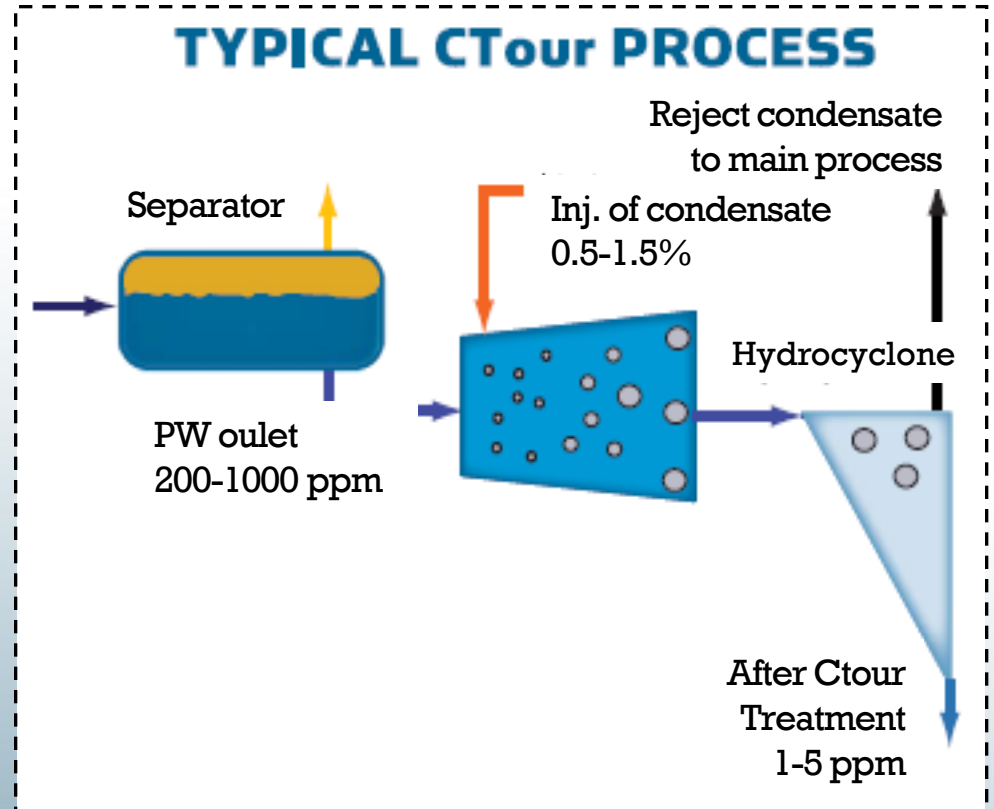
## CTour MIXER TRAIN

ProPure C100 Injection Mixer



**The unique CTour process will meet current and future requirements for water treatment.**

## TYPICAL CTour PROCESS



# TORR™

Compact high-performance modular cartridge system using coalescence towards hydrocarbon wetted surface.

## Application:

Removal of dispersed hydrocarbons from produced water without the use of chemicals.

## Technical advantage:

- Exceeds strictest environmental regulation
- Removes residual oil from produced water down to less than 5 ppm
- Modular standardized cartridge vessels including RPATM cartridges
- Robust toward upset in feed conditions
- Large PW turn-down; 1:100

## Selected users:

- KOC, Wood Group / HESS (Triton Platform), ENI, Schlumberger

## Key benefit:

- Avoid penalties for non-compliant produced water discharges



# Coalescing RPA™ cartridge





# Sorbloc™

“Green” biodegradable flocculant for efficient treatment of produced water.

## Application:

Removal of dispersed and dissolved hydrocarbons along with heavy metals and nano-particles from produced water.

## Technical advantage:

- Full spectrum removal of harmful components;
  - dispersed and dissolved hydrocarbon
  - heavy metals
  - submicron particles
- Instant flocculant mixing by proprietary ProPure equipment for “green” flocculant for selective and robust flock generation

## References:

- Technology transfer utilized from industrial partner Sorbwater for water treatment application areas; slop water, sewage water and grey water. Qualification tests in progress.

## Key benefit:

- Avoid penalties for non-compliant produced water discharges



# Sorbifloc™: Reaction and robustness



# SorbSep™

Compact cyclonic gas flotation unit with coalescing enhancer

## Application:

Primary produced water unit or secondary polishing unit.

## Technical advantage:

- Serial installation of two units can treat water from several hundred ppm of oil in water down to just a few ppm.
- Designed to be combined with SorbFloc™. The combination of both technologies makes zero discharge of oil can be obtained.
- Compact unit; the produced water treatment capacity of a 3 m<sup>3</sup> unit is 250 m<sup>3</sup>/h.
- Coalescing unit at vessel outlet – enhancing performance of 2<sup>nd</sup> stage unit



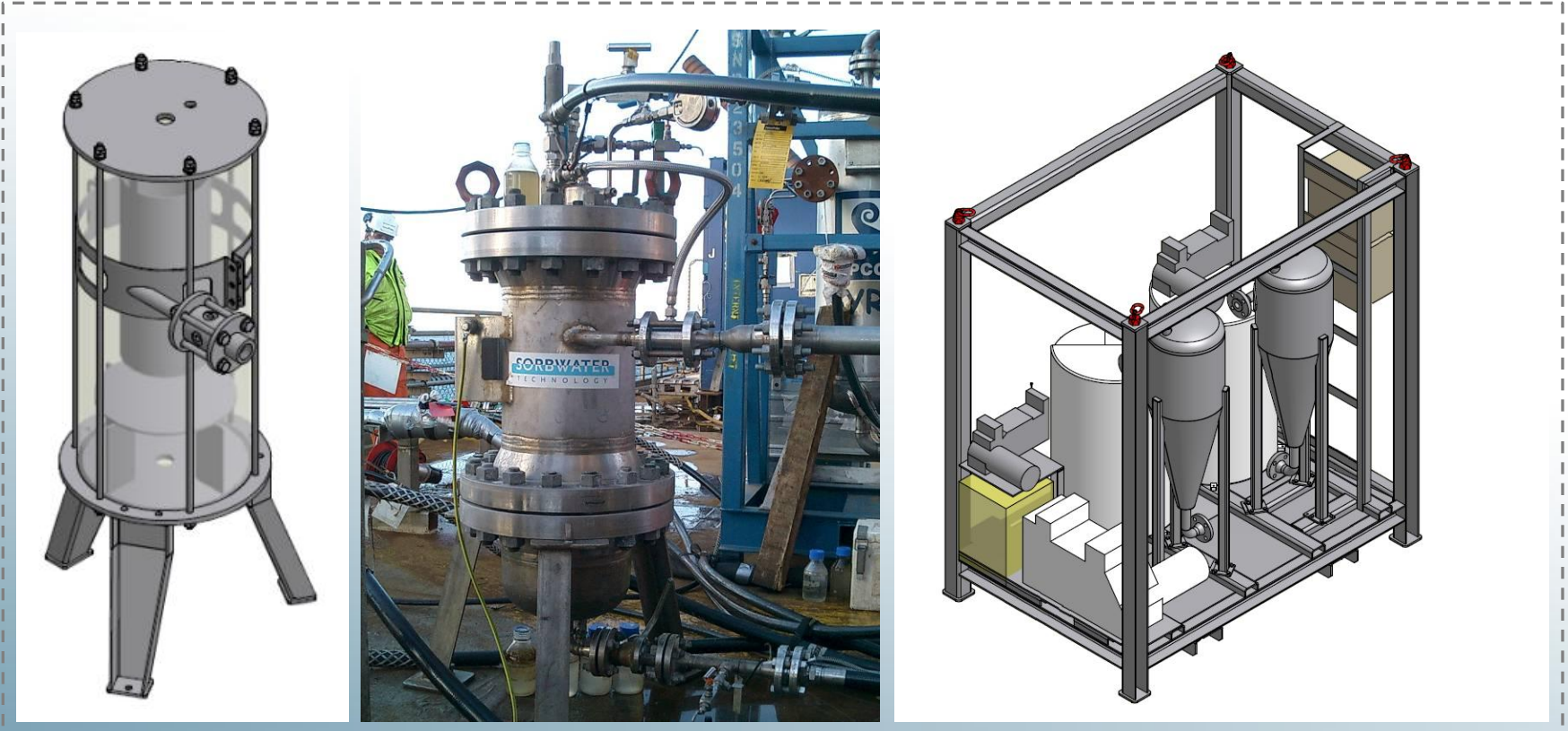
## References:

- Benchmark tested for produced water offshore Mach 2009, exceeding performance of BAT-listed compact flotation units.

## Key benefit:

- Avoid penalties for non-compliant produced water discharges

# Sorbsep™: Compact and efficient



# ProSep's complete offering

ProSep's high-technology proprietary offerings are complemented by a complete line of conventional solutions. These systems are designed as individual treating units or as fully integrated process trains.

## **WATER**

Primary separation: CPI, skimmers, hydrocyclones

Secondary separation: flotation systems

Tertiary/polishing: nutshell , GFU...

## **GAS**

CO<sub>2</sub> and H<sub>2</sub>S separation membranes, conditioning, gas dehydration (TEG), nitrogen generators, scrubbers, demistors...

## **OIL**

Primary separation, electrostatic and mechanical coalescers, FWKO, heater-treaters, single and multi-stage desalting systems...

# QUESTIONS?

ProSep is committed to supplying state-of-the-art process equipment to oil and gas producers.

Our separation and treatment technologies are installed on production facilities around the world, delivering economical and environmental benefits to our customers.

[www.prosepinc.com](http://www.prosepinc.com)

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