

Targeting Oil in Water

Argus® Oil in Water Monitors

Reliable measurements: Replace manual sampling

In-line probe: No bypass loop, low maintenance

High pressure, high temperature applications:

Measurements throughout the process

Automated **self-cleaning**: Eliminate problems with scaling

Multipoint: Multiple measurement probes integrated into one system

Produced water management

- a major challenge for the Oil & Gas operator



ProAnalysis delivers unique technology for Oil in Water (OiW) monitoring. The new Argus® OiW monitors provide accurate and reliable OiW measurements, and are used for water discharge monitoring as well as produced water treatment process monitoring and management. The result is improved process performance, reduced operational costs and minimised discharges of hydrocarbons to the environment.

The challenge

Increasing water production is a major challenge for Oil & Gas operators worldwide. With global average water cuts of 75% and rapidly increasing, the performance of produced water treatment systems is often critical for oil production. Consequently, reliable measurements of Oil in Water are important, both for monitoring the water treatment process and for monitoring discharges to the environment.

Until recently, no online OiW monitors have fully satisfied the Oil & Gas industry's needs. Instruments are not designed for challenging offshore operations, and often fail to meet the industry's demanding requirements. As a result, the most frequently used method for OiW monitoring today is manual sampling and laboratory analysis – an inefficient, labour-intensive and expensive method.

The solution – Argus® from ProAnalysis

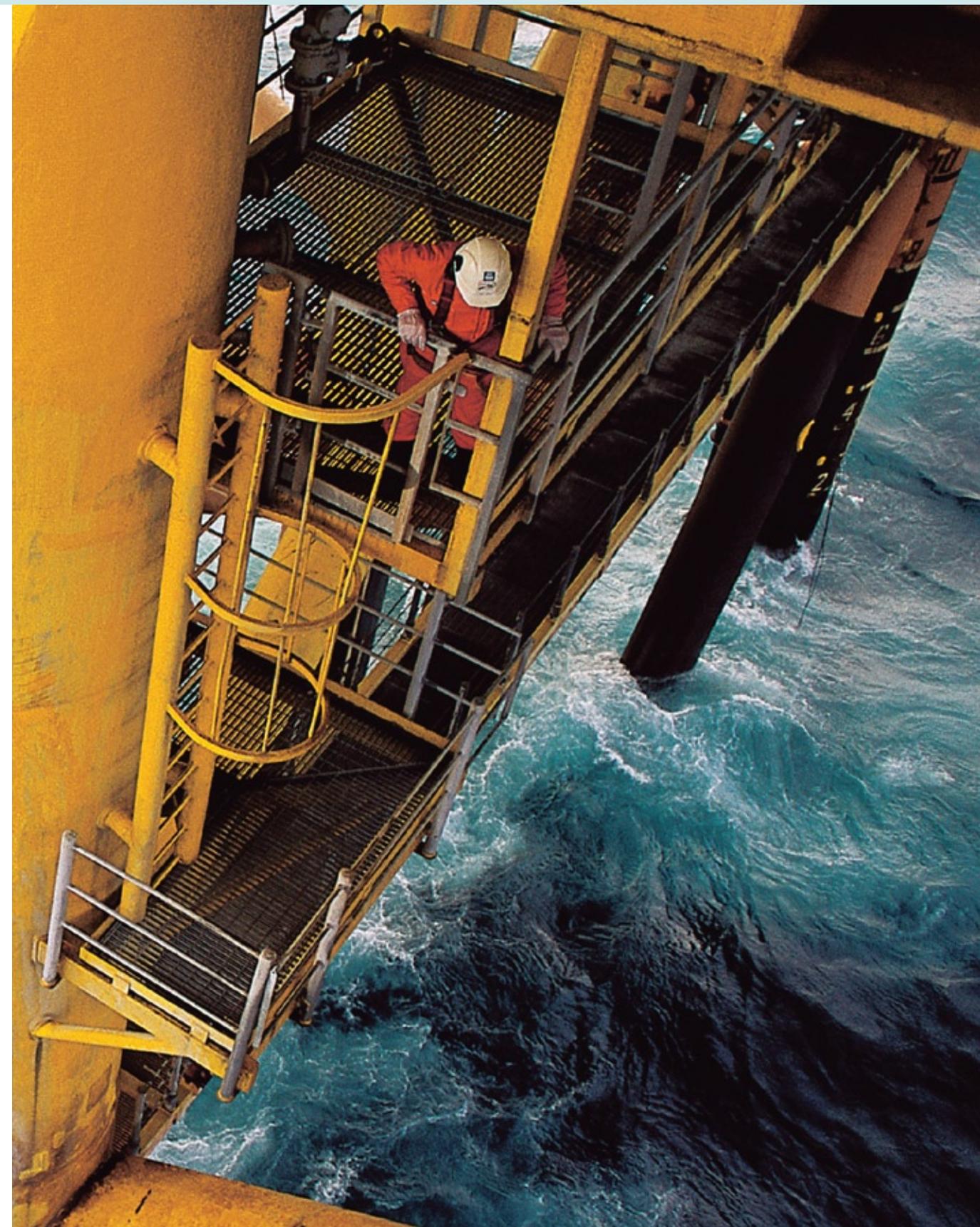
ProAnalysis has introduced a unique solution for online OiW monitoring - the Argus technology - meeting the challenges where traditional technologies fail. The Argus range of in-line online OiW monitors is designed for harsh offshore environments, providing continuous measurements of OiW concentrations used both for management of the produced water treatment process and for monitoring OiW discharges to the environment.

Managing the water treatment process with reliable OiW measurements from Argus

- improves **performance** of produced water treatment systems.
- increases **throughput** where oil production is bottlenecked by the water treatment system.
- minimises OiW levels, achieving HS&E targets for **reductions in OiW**.
- reduces **operational costs** (use of chemicals, maintenance, etc.).
- provides multipoint and high temperature, high pressure OiW monitoring resulting in unique process management from measurements **throughout the process**.

Monitoring OiW discharges to sea online with Argus

- **replaces manual sampling** and laboratory analysis, eliminating / minimising the costs associated with such activities.
- prevents significant oil discharges by means of **immediate alarm** when OiW levels exceed the defined limit.
- is **easy to install**, no complex and expensive bypass loop is required.
- is **maintenance-free**, compared to the high level of manual maintenance associated with traditional (bypass) OiW monitors.
- facilitates **remote monitoring** of OiW (offshore or onshore), fully integrated with industry standard control systems.



The new Argus® technology

- designed for challenging process environments

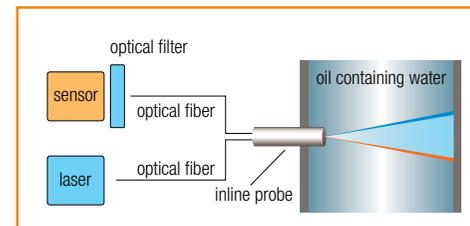


ProAnalysis' unique proprietary Argus technology has been developed in close cooperation with major Oil & Gas operators in the North Sea, as a response to the need for OiW monitor technology reliable over time under challenging process conditions. ProAnalysis introduced Argus to the Norwegian market in 2005, and is rapidly gaining acceptance as the leading supplier of OiW monitors in this market.

Stable and robust measurement principle

Argus is based on the measurement principle (laser-induced) fluorescence. A laser, uniquely developed for the sensor, emits ultraviolet light directly into the process line by fibre optics. The laser light interacts with crude oil, and fluorescence is emitted, collected, transmitted by fibre optics, spectrally and temporally filtered and finally quantified by a light sensor. The technology offers several significant advantages:

- Established and proven measurement principle.
- Stable and robust under harsh and changing process conditions (temperature, pressure, solids, gas, etc.).
- Accurate quantification of dispersed oil through the measurement of aromatic hydrocarbons (PAHs) – even at ppb levels.



In-line measurement - no bypass loop required

The main challenge associated with traditional OiW monitors is the need for bypass loops, which often are complex, expensive and require frequent maintenance. The Argus technology eliminates these problems as measurements are done through a permanent in-line probe installed directly in the pipeline. The solution offers several significant advantages:

- Low installation costs, eliminating the need for expensive bypass systems. Only a single flange is needed for the in-line probe.
- Eliminates high maintenance costs resulting from bypass lines being blocked by deposits (scale, etc.).
- Representative measurements under real process conditions. Sampling through bypass systems is problematic under varying process conditions.

Automated self-cleaning technology - maintenance-free OiW monitor

To handle challenges related to contamination (scale, etc.) from a demanding offshore process environment, Argus is equipped with an ultrasound-based technology for self-cleaning of the in-line probe. Cleaning of the optical process interface is mediated through an advanced high power excitation of the probe's sapphire window.

The proprietary ultrasound-based self-cleaning technology has proven highly efficient at installations facing severe challenges from e.g. scaling on process equipment, making Argus practically a maintenance-free OiW monitor at any application.



The Argus® Products



The Argus range of Oil in Water monitors comprises the Argus Environment OiW monitor for low pressure applications and Argus Process for high pressure applications.

Argus® Environment OiW monitor for low pressure applications

Argus Environment monitors Oil in Water concentrations at water discharges to the environment, online and real time. Oil & Gas operators are able to comply with HS&E regulations and reduce OiW levels without the need for manual water sampling and laboratory analysis.

Key benefits of Argus Environment

- Replaces manual sampling and laboratory analysis, eliminating / minimising the costs associated with such activities.
- Prevents significant oil discharges by means of immediate alarm when OiW levels exceed the defined limit.
- Is easy to install, no complex and expensive bypass loop is required.
- Is maintenance-free, compared to the high level of manual maintenance associated with traditional (bypass) OiW monitors.
- Facilitates remote monitoring of OiW (offshore or onshore), fully integrated with industry standard control systems.

Argus® Process OiW monitor for high pressure applications

Argus Process monitors Oil in Water concentrations at high pressure and/or temperature locations in the water treatment process, paving the way for new applications for online OiW monitors. Oil & Gas operators are able to manage the process with real time OiW data from single or multiple measurement points throughout the process, providing unique process control.

Key benefits of Argus Process

- Improves performance of produced water treatment systems.
- Increases throughput where oil production is bottlenecked by the water treatment system.
- Minimises OiW levels, achieving mandated HS&E targets for reductions in OiW.
- Reduces operational costs (use of chemicals, maintenance, etc.).

High Pressure High Temperature (HPHT) OiW monitoring

With its in-line probe, the unique Argus technology design facilitates measurements at higher pressures and temperatures, enabling measurements throughout the water treatment process. Argus OiW monitors can be used downstream separators, hydrocyclones, degassers and other process equipment, monitoring different stages of the process and providing the operator with unique process control.

Multipoint OiW monitors

With the Argus design, several in-line probes can be connected to the same measurement and control unit in a multipoint OiW monitoring system, resulting in significant cost reductions. The control unit can be located in a hazardous area (handling maximum 2 measurement points) or a safe area (handling maximum 12 measurement points), with a distance from the control unit to each measurement point of 100-200 meters.

The first multipoint OiW monitoring system was delivered in 2007.

Case study: Snorre B



At StatoilHydro's Snorre B platform, an Argus in-line online Oil in Water monitor has been in operation since early 2006, contributing to a 40% reduction in OiW concentrations in 2007.

The oil producing Snorre B platform, located in the Tampen area of the Norwegian North Sea, had an average water production of 26.600 m3 per day in 2006. In February 2006, following offshore testing of different OiW monitors, an Argus Environment in-line online OiW monitor from ProAnalysis was installed at outlet to sea downstream the degassing drum (process temperature 65°C and pressure 1 bar g).

Process management

Snorre B has actively used the Argus for monitoring and management of the produced water treatment process. Typical situations where the operator has benefited from use of the online OiW monitor include:

- Identification of the most effective and optimum dosage of production chemicals (flocculants) in the water treatment process, dealing with sudden increase in OiW concentrations.
- Optimising the use (dosage) of production chemicals (emulsion breaker) in order to improve separation (water and oil quality) and to minimise deterioration of water quality (environmental impact) while new oil-rich production wells are put on stream.

Accumulated data and experience since start-up clearly document the online OiW monitor as an efficient tool in produced water management at Snorre B. The daily use of Argus has contributed to a 40% reduction in oil in water concentrations (6.3 vs. 10.5 mg/l) over the last 12 months (December 2007).

Discharge monitoring

As for most other production facilities, discharging produced water to sea, manual sampling and laboratory analysis have been resource-demanding activities at Snorre B. Manual samples are collected 4 times every 24 hours, mixed and analysed by a laboratory technician in the platform laboratory. The result of this process is one single (averaged) OiW concentration value per day.

Following the introduction of Argus at Snorre B, a programme has been initiated to qualify the OiW monitor for reporting of OiW concentrations to the Norwegian Pollution Control Authority, replacing manual sampling for this purpose. The need for manual sampling with laboratory analysis will be reduced to the minimum accepted level of 5 times per month, resulting in significant cost reductions.





ProAnalysis AS

ProAnalysis AS delivers technology and associated services for Oil in Water monitoring for process and environmental control, combining technological insight with an understanding of user needs.

Our vision is to be a leading international supplier of technology and decision support for Produced Water Management.

ProAnalysis is located in Bergen, on the west coast of Norway. Our offices are in the High-Technology Centre, in close proximity to the University of Bergen.

Key contact persons

Gunnar Alfheim

MANAGING DIRECTOR

Telephone: (+47) 55 21 00 70

E-mail: alfheim@proanalysis.no

Gert Folmer

INTERNATIONAL SALES MANAGER

Telephone: (+31) 65 11 92 474

E-mail: folmer@proanalysis.no

Jarle Skeidsvoll

TECHNOLOGY MANAGER

Telephone: (+47) 55 21 00 62

E-mail: skeidsvoll@proanalysis.no

Sigurd Bekkevold

SALES MANAGER

Telephone: (+47) 55 21 00 63

E-mail: bekkevold@proanalysis.no

Contact information

ProAnalysis AS

Thormøhlensgate 49

N-5006 Bergen

Norway

Telephone: (+47) 55 21 00 60

Fax: (+47) 55 21 00 61

E-mail: contact@proanalysis.no

Web: www.proanalysis.no