



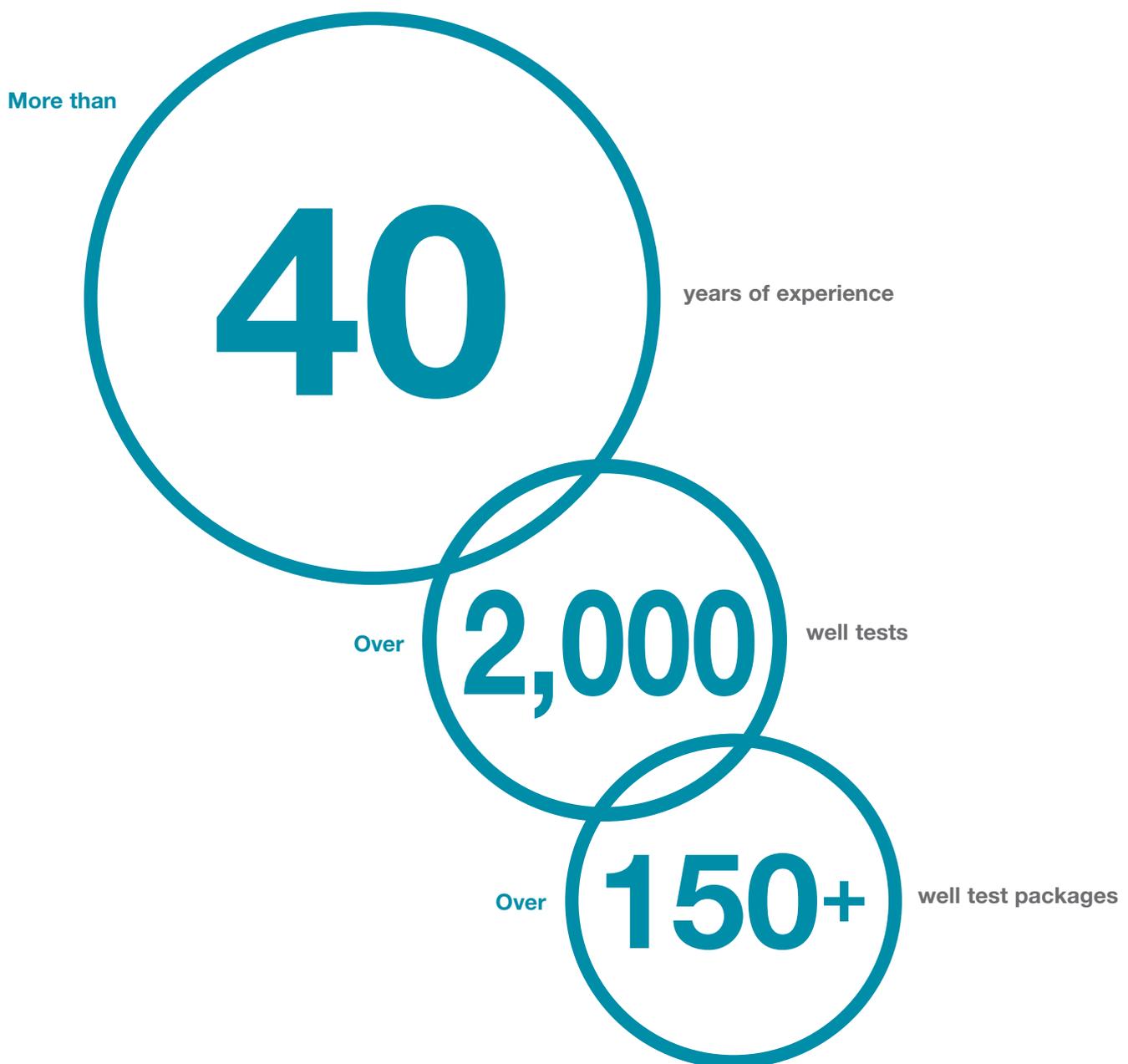
EXPRO

WELL FLOW MANAGEMENT™

Well Testing & Commissioning



From reservoir to disposal, Expro provides **safe, efficient** and **accurate** well testing services to meet the needs of our customers in **any well, anywhere** in the world.





What we offer

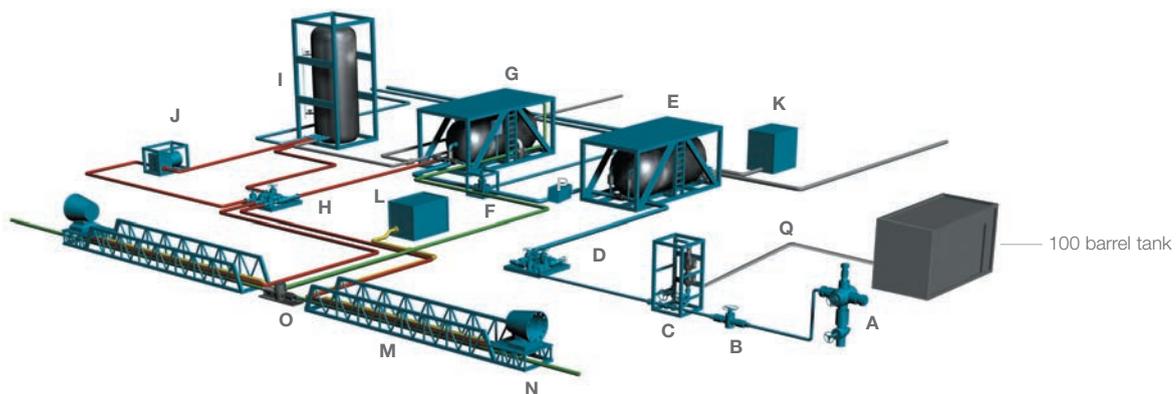
Expro has more than 40 years' experience of providing well testing services to the global oil and gas industry. As one of the largest well test companies in the world, we provide mobile process equipment that accurately measures the performance of our customers' wells. The data that we provide allows our customers to plan the optimal exploitation of their reservoirs.

High-value oil and gas wells, onshore and offshore, require a full range of testing solutions.

We offer the complete package, including:

- **Exploration and appraisal well testing**
- **Development well testing (clean-up) and flowback**
- **Production well testing**
- **Flarestack and pipeline services**

Expro works to develop newer, faster, more precise testing methods. We aim to perfect well testing operations and processes and make them as effective and efficient as possible. Our ability to offer the combination of superior service quality and technological innovation enhances the performance of our customers.



- | | | |
|--|---------------------------------------|---|
| A Surface Test Tree | G Separator | M Flare Booms |
| B Surface Safety Valve | H Diverter (5-way) | N Burner |
| C Solids Management Unit (desander) | I Surface Tank (metering tank) | O Diverter Manifold |
| D Choke Manifold | J Transfer Pump | P Multiphase Flowmeter |
| E Heat Exchange | K Steam Generator | Q Clean out line for desander to 100 barrel tank |
| F Relief Valve | L Compressor (air) | |



E&A well testing provides the initial exposure to reservoir production capability and potential. It is important that equipment is designed to handle a potentially, wide range of operating parameters.

Expro's temporary completion and production system equipment is designed to offer this, through a range of temporary completion and production systems. This allows our clients to measure pressure and flow rates, obtain fluid samples, assess the commercial viability and plan completion and production facilities.

Our well testing solutions can be used across a range of applications, including:

- **Onshore and offshore reservoirs**
 - Our equipment portfolio covers all eventualities from offshore skid mounted packages to purpose built trailer mounted well testing units
- **Deepwater**
 - Experience in global deep water environments
- **Heavy oil**
 - Well testing and extended well testing in designated heavy oil reservoirs at 10-11°API
- **High rate**
 - Our track record in high rate gas testing is extensive
- **Harsh environments**
 - Our operating experience includes desert, artic and both deepwater and shallow water offshore operations

Exploration and appraisal well testing

Surface well testing

The primary function of surface well test equipment is to provide a safe and efficient system to separate hydrocarbon phases, to measure and collect accurate well data and importantly, to collect representative fluid samples. The data monitored includes pressures, temperatures and flow rates recorded at multiple locations on the well test package.

The surface well test system is a combination of the following equipment and services:

Surface test tree

The flowhead isolates the well at surface from the reservoir and enables the downstream process equipment to be depressurised and made safe. It is typically equipped with a lift sub, swivel and temporary pipework connections for the flow and kill-wing valves. It comprises four gate valves installed in a forged solid block manifold. The flow wing valve is actuated and controlled by a hydraulic panel connected to the emergency shutdown system. The swivel is situated below the tree block and enables rotation of the string.

Solids exclusion

Expro recognises that solids management is crucial to a safe and efficient well operation. In addition to our existing 5k and 10k sand filter systems, Expro has developed 10K and 15K cyclonic desanders. Expro's solids exclusion equipment is designed to be deployed close to the wellhead and upstream of the first well control device, allowing solids to be removed at high pressure and thereby reducing erosion in the downstream equipment.

Choke systems

The choke manifold controls the well flow via a fixed or an adjustable choke. Expro's choke systems provide reliability and security, with easy maintenance and multiple safety features, operating efficiently and effectively. Our equipment provides unparalleled wear resistance, reducing costly damages. The use of this technology in the exploration and appraisal market is ideal to reduce downtime where continuous flow data is critical to the success of the operation. Based on the latest engineering design and technology, our choke systems have become industry leaders.

Heat exchangers

Expro offers various types of heat exchangers which typically comprise high pressure coils contained within a steam jacket. Expro multi-tube heat exchangers are significantly more efficient than the conventional direct heat exchangers used in well test operations. The combination of eliminating bends in the tubes and their large surface area promotes highly efficient heat transfer compared with conventional heaters. It also aids reliability since the flow profile makes this type of heat exchanger far less prone to erosion from solids production.

- Direct, indirect and multi-tube heaters within fleet
- Direct steam heat exchangers provide fast reaction to changing process conditions
- Heater controls systems ensure accurate regulation of process temperature
- Safety systems protect vessel and process coils against overpressure

Three-phase separator

Hydrocarbon flow is directed to Expro's three-phase separator where the oil, water and liquid phases are separated and metered. Expro's inventory includes various designs of both horizontal and vertical separators which meet the well flow parameters stated by the customer. The separators are designed to maximise the efficiency of the separation process.

Data acquisition

Expro's EdgeX is a Windows based data acquisition and management system. It provides a total data solution for a wide range of applications including well testing, extended production tests and platform process plant monitoring (see below).

Produced water system

The produced water leaves the separator vessel and is directed to the surge tank where it can be stored, accurately measured and degassed prior to being stored in the stock tank. To dispose of the water overboard in a responsible and environmentally-safe manner, Expro uses a produced water treatment package. This filter system is designed to provide a light, compact, reliable, and economic method of filtering water, lightly contaminated brines and fluid cushions.

Environmentally safe disposal

Oil fluids are directed to Expro's leading burner technology for environmentally-safe disposal. The gas flow is directed through to the flare, where the latest silencer technology can be employed to reduce noise to an acceptable level. The Sea Emerald burner features carefully positioned multiple burner tips, which create maximum flame turbulence and air ingestion, making the burn very clean and eliminating smoke.

Burner heads

Sea Emerald™ Burner

The Sea Emerald™ Burner's carefully positioned multiple burner tips create maximum flame turbulence and air ingestion, making the burn very clean, eliminating smoke:

- Highly efficient, environmentally friendly
- Third-party rated at over 99.993% efficient
- Modular design can be used in multiples to match anticipated flow rates
- Stable pilot assembly provides reliable ignition source
- Clean start-up, wide turndown ratio, simple operation



Data services

EdgeX

EdgeX is a Windows based acquisition and management system. It provides total data solution for a wide range of applications including well testing, extended production tests and platform process plant monitoring.

Its features include:

- Real-time data monitoring, processing and logging
- Graphical user interface (GUI) for live data and trending
- Visual and audible alarm monitoring
- Industry standard communications
- Data export and reporting

The extensive multitasking capabilities of EdgeX allow it to incorporate data from a multitude of sources using various communication protocols. This includes surface instrumentation, other Expro services (WWS, DST, Subsea) and 3rd party equipment. Essentially EdgeX is the total data solution which combined with 'data to desk' provides clients with data, whenever and wherever they need it.

This service provides the client with the full suite of tools necessary to view real-time data through a web browser anywhere in the world.

- Field data acquisition
- Secure single click data transfer
- Secure data server space
- Client web browser

The web browser allows the client access to all data logs and sequence of events obtained in the field. To view this information standard graphical user interfaces are available for trending and live monitoring.



Development well testing and flowback

Clean-up

The purpose of well testing on development wells is to clean up and commission the well prior to its connection to the permanent production facility.

The permanent completion is used with a temporary subsea/surface safety tree and production system. Included in the development well testing segment are DST/TCP operations, associated with completions activity such as a 'shoot and pull' run prior to well clean-up, fluid separation, solids management and disposal operations. Current methods for disposal in a well test or clean-up involve burners, water remediation, storage of produced fluids to a tank.

In areas where strict regulations exist regarding the disposal of liquids by burning, well tests are performed without burning oil. Gas can be flared, and produced fluids stored in a barge or in workboat tanks for transport back to a land-based disposal facility.

Our clean-up packages include:

- Clean-up packages including surface production equipment and pre-production
- High rate gas flow rate measurement
- Water handling and treatment
- Solids handling systems

Flowback

A typical fracture flowback programme for a high-rate gas well onshore uses a multiple-stage fracture with three-to-five zones per well. Each zone is perforated, fractured and then cleaned up. Special severe service equipment is available to handle high flow rates and pressures, as well as abrasive frac materials recovered during the clean-up.

Flowback packages include:

- PowerChoke hydraulic choke and control systems
- Packages for plugging, perforating, frac flowback and clean-up
- Portable flare stack services

Key technologies

Solids management

Expro's solids removal systems comprise 5k and 10k sandfilter units and 10k and 15k cyclonic desanders, which provide a broad range of solids management options. Removing solids from the well stream at the earliest opportunity reduces damage to downstream equipment and can result in increased well production. This results in a range of benefits:

- Can extend separator life
- Virtually eliminates costs of build-up and blockage in processing equipment
- Has proven vital in post-frac cleanups and UBD operations
- Removes cuttings during UBD operations
- Minimises solids from return fluids during cleanout operations
- Removes solids from injection waters.

Severe service choke manifolds

Severe-service choke manifolds provide improved control, better service performance and in conjunction with solids management systems can prevent downstream erosion.

- Incorporates the latest adjustable choke technology
- Meets applicable industry standards
- Two flow paths, one adjustable and one fixed
- Allows fast choke changes without interrupting the flow
- Pressure and temperature rated to meet hostile environments
- Small footprint



In-line well testing

Production well testing involves measuring the contribution of oil/water/gas from individual wells. Expro's continuous production measurements are cost-effective, do not interfere with normal production and can improve reservoir understanding.

Wet gas meter

Expro's wet gas meters (WGM) are a cost-effective replacement of test separators. Wet gas flow meters provide continuous readings of the gas flow rate and the total liquid flow rate. To achieve good accuracy (+/-5%), the service includes calibration with non-radioactive tracers and wet gas pressure/volume/temperature (PVT) fluid sampling – a process accredited by DNV.

MPFM - Multiphase Flow Meters

Expro offers Multiphase Flow Meters (MPFM) as a complementary service to existing portable well test separators - without the requirement for phase separation. Measurement can be made at wellhead or line conditions, allowing process fluids to be returned to the production process, without pressure reduction.

Typical applications include exploration & appraisal, commissioning & clean up and routine production well testing operations.

Benefits of the portable well testing MPFM include:

- Small and compact foot print
- Instantaneous measurement of rate and fraction
- A wide operating range up to 98% GVF
- Non-intrusive measurement
- Real-time well site commissioning, data processing and diagnostics

Well site operation of the MPFM is supported with Expro's proven well site PVT sampling and analysis products and services.

Production testing

Extended well testing

For wells requiring long-term solutions, such as extended well testing or early production facilities, Expro has extensive global experience in delivering tailored reservoir and production requirements.

Used to generate and accelerate cash-flow from production before bringing a permanent production facility on line, these projects are often associated with remote environments or challenging operating conditions.

Extended well testing provides substantial reservoir information which can be used to:

- Establish reservoir behaviour
- Evaluate reservoir in real time
- Assess the commerciality and productivity of a field
- Determine the field development plan.

For wells requiring long-term solutions such as extended well testing or early production facilities, Expro has extensive global experience and success tailoring equipment to meet reservoir and production requirements for wells or fields.



Modular well test packages

Utilising module techniques, Expro is leading the technology development for surface well testing. This is primarily designed for offshore installations that require surface well testing equipment to be sea-fastened to the rig deck. However, the technology also offers many benefits for other applications.

The modular concept is a 'plug and play' methodology this allows you to swap main components for a package with only minor adaptations.

A modular package includes the following features:

- Use of standardised bottom frames with interconnecting piping inside
- Re-arranged equipment packaging (choke & heater frame)
- Automation of valve sequences for meter factors
- HSE improvement (sampling cabinet, automation, manual handling improvements, walkways, handling methodology, lighting, pre-fabricated interface spools, steam degassing unit, improved pump control.)
- State of the art equipment design improvements
- Equipment that can be interchangeable
- Package pre-adapted for easy data acquisition system and electronic process shut-down system interface

Key benefits to the clients include a number of areas:

- Shorter installation time
- Reduced personnel on-board requirement
- Ability to split an installation up into smaller tasks to hit POB opportunities
- Reduced rig-crane requirements (about one third of a normal installation)
- A package that meets the latest stipulations related to HSE



15000 PSI

H₂S

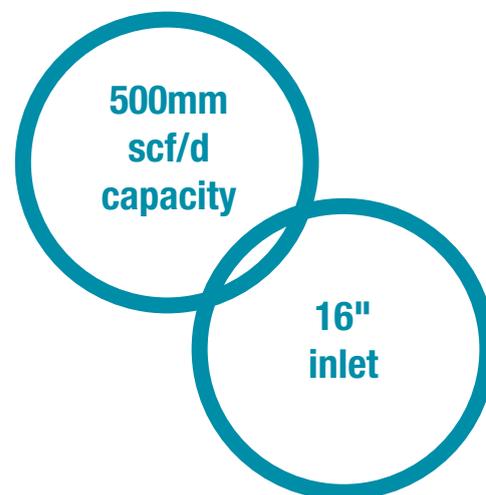
Flarestack systems

Flow management is a core business activity of Expro. Pipeline services are integral to this – we are specialists in safely handling high pressure hydrocarbons by separating, filtering, and/or flaring of the products.

With a 20-year track record in the US pipeline market and direct access to our global pool of specialist flow management knowledge, Expro provides safe and efficient pipeline separation, filtration, or flaring need.

Expro has one of the largest inventories of international certified equipment in the industry, including the highest capacity pipeline separation units (up to 500 MM scf/d with a 16" inlet). The fleet includes both high pressure and low pressure systems for separation, fluids handling, storage, analysis, water treatment, solids handling and disposal. Our state-of-the-art trailer mounted flare systems are designed to be easily mobilised to handle your flaring needs.

To compliment this proven equipment, Expro employees are some of the best in the industry with experience in flaring products from natural gas to liquid propylene to NGL. Expro flarestack service supervisors are qualified by NCCER, Veriforce, and OQSG for our tasks to comply with the DOT operator qualification rule.



Flarestack and pipeline services

Separation and filtration services

Expro's separation supervisors share these same qualifications and have experience in a variety of separation applications.

Expro provides the know-how, equipment, and personnel for the separation, fluids handling and flaring services necessary for:

- Pipeline flushing
- Pipeline decommissioning and commissioning
- Chemical or gel pipeline cleaning
- Pipeline pigging / smart pigging
- Hydrostatic testing operations
- Pipeline blow-downs
- Separation

Expro's expertise and credibility has been earned through its proven separation services, in the harshest of environments. Expro's equipment and personnel have been used for:

- Liquids removal from gas lines
- Gas removal from liquid lines
- Evacuation of a crude or products line for maintenance, repair, or hydro testing
- In line inspection
- Cleaning of pipelines
- Filtration

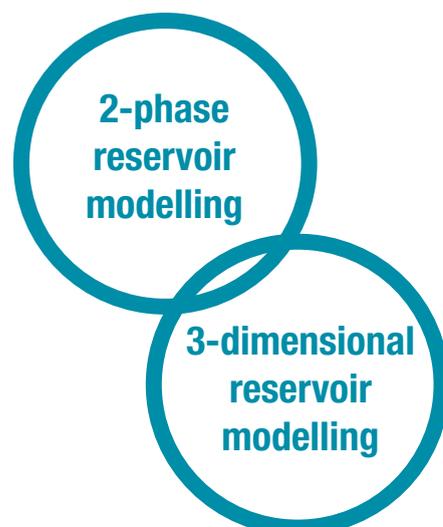
Expro's filtration separator is the leading choice for clean products before delivery to plants, and has been effectively used with charcoal filter elements to clean vapor before venting to eliminate odor. These units can be rigged up with a manifold system in order to allow flawless operations of the pipeline while changing filter elements.

The data analysis centres complement Expro's field activities by providing comprehensive job planning and selection capabilities. Quality, attention to detail and flexibility are hallmarks of the Expro DACs.

Expro's state-of-the-art reservoir information centres offer the following services:

- Well test simulation
- Well test design
- Pressure transient analysis
- Multi-layer reservoir analysis
- Completion efficiency evaluation
- 2-phase reservoir modelling
- 3-dimensional reservoir modelling
- History matching
- Reservoir performance forecasting
- Well/field performance optimisation

A key component in Expro's range of well testing services is the ability to provide the customer with a complete interpretation and analysis of the acquired data.



Technology and innovation

Mobile well test unit

Expro unveiled three new arctic enclosed mobile well test units during a launch event in Anchorage, Alaska, in 2013.

These units provide an innovative solution for well flow management and are specifically designed for harsh arctic operating conditions.

The mobile well test units are fully portable production facilities and are capable of well test and clean-up operations. The units process and measure well effluent, as well as remove water and solids prior to flowing to a production facility.

The mobile units have been designed to meet increasing onshore activity in Alaska, both for Expro's established and new operators moving in to drill new wells, and rework existing fields.

Normally this equipment is transported to the well site in multiple pieces on several trucks and requires extensive rig up times. By combining all of the equipment into one mobile unit, logistical efficiency is significantly enhanced, resulting in the reduction of rig-up time and transportation costs. This also reduces the need for customer-provided well support.

Applications

- Mobile well test solutions globally
- Land and deep-water sites

Features

- Full geographical representation
- Complete well test packages
- Skilled operators

Benefits

- Complete package of well testing solutions
- Accurate and timely data delivery
- Data to desk
- Bespoke solutions
- ISO14001 accredited

I have been looking forward to the arrival of the mobile well test units as I'm extremely interested in utilizing the unit for an upcoming project, said **Tim Crumrine, senior staff completions engineer for Pioneer Alaska**. In my opinion, Expro is the only choice for Pioneer Alaska well testing.





Case Study

Kazakhstan - KPO well test solution

The oil and gas industry increasingly faces tougher legislation and targets to reduce emissions, and one of the key areas of focus is the traditional practice of flaring crude oil. In many parts of the world, governments impose significant fines on companies that continue to flare at high levels, and have encouraged operators to consider alternative methods to this practice.

Expro was invited to work with Karachaganak Petroleum Operating BV (KPO) to find a solution to the issue of flaring on the Karachaganak field in Kazakhstan where KPO's objective to reduce flaring. KPO required production data from the production tests performed where information gathered was crucial to the future development and field management. Central to the solution has been the deployment of Expro reduced emission package, which allows all produced hydrocarbon fluids to be sent directly to the process facilities and all gas being flared, reducing the impact on the atmosphere. All produced water was sweetened by removing the H₂S content to allow it to be transported to the ECO centre for processing.

Karachaganak field information

The Karachaganak field is one of the world's largest oil and gas and condensate fields located in northwestern Kazakhstan, near to the town of Aksai. The field extends over an area measuring 15 x 30 km.

Current production reservoirs are Permian and Carboniferous in age and comprise low permeability limestone and dolomites. The main reservoir interval is between 3600 mss (subsea) and 5150 mss mainly gas and condensate with approximately 200m of oil rim. To date more than 250 wells have been drilled in the field, including exploration, appraisal, production and observation wells by the previous field operators. The reservoir fluid can be classified as highly corrosive, exceeding the partial pressure limits for both CO₂ and hydrogen sulphide (H₂S) content.

The way ahead

While is aimed at the large producing wells, there are a significant number of existing smaller producing wells on the Karachaganak field, each having its own unique challenges to overcome. Expro is in the process of providing KPO with an effective well test solution to the issues arising from flareless testing. As part of that process the companies are also working together on a solution on producing new wells during the well clean up phases especially during post frac stimulation without the requirement for flaring. This will have its own challenges with limited pressures to operate with, but will help the environment with the complete removal of flaring.

Expro's mission is **well flow management**. We provide services and products that **measure, improve, control** and **process** flow from high-value oil and gas wells, from exploration and appraisal through to mature field production optimisation and enhancement.

With a specific focus on **offshore, deepwater** and other **technically challenging environments**, we provide a range of mission critical services across **three key areas**:

- **Well Test & Appraisal Services**
- **Subsea, Completion & Intervention Services**
- **Production Services**

Our vision is to be the **market leader** in well flow management, using the industry's best people, to deliver the highest standards of **safety, quality** and **personalised customer service**.

Expro's **40+ years** of experience and innovation empowers the company to offer **tailor-made solutions** for customers across the energy sector. With 4,500 employees in over 50 countries, Expro offers a **truly global service solution**.



For more information contact:
welltesting@exprogroup.com

Or visit www.exprogroup.com/contact