Expro Production Enhancement
Debottlenecking: Unlocking Production Through Cost Effective Solutions.

Chris Bennie
Product Specialist – Production Enhancement
What is Production Enhancement?

• The easy way to **1000's of bbls** of incremental/accelerated oil and gas production.

• To address late life field development problems Expro have developed the following Production Enhancement Technologies which are available on a lease, operate and maintain basis (LOM).
Production Enhancement Tools – Problems & their Solutions

- Low pressure / idle wells
- Water disposal problems
- High inlet water cuts
- Need for pilot water injection
- Bottlenecked production facilities
- Surface collection network problems
- Mercury production
- H₂S / CO₂ production

PRODUCTION ENHANCEMENT TOOL BAG

- Well Unloading Unit
- ExH₂O™
- Water Treatment & Injection Systems (PWT, SWIMS, PWIMS)
- Facilities upgrades
- ExHg, ExH₂S & ExCO₂

BASKET OF COMMON LATE FIELD LIFE PROBLEMS
ExH2O™ – Bulk Water Removal
**Q.** What is a **bottleneck**?

**A.** A bottleneck is a **restriction** on a production system which is **the limits further production**.

- When we talk about bottlenecks in terms of the ExH2O™ system, we are referring to **water production**.

- The **ExH2O™** system removes the majority of the water from a production network, which can reduce the back pressure on upstream well or ESPs and increase production.

- The **ExH2O™** substantially increases water handling capacity which allows previously shut-in, high water cut wells to be brought back online.
The flow-line bottleneck (hypothetical example)

Performance before the ExH2O® system

- 100 m³/hr (15,090 BFPD)
- 90 m³/hr of water (13,585 BWPD)
- 10 m³/hr of oil (1,509 BOPD)
- 30 barg

- 100 m³/hr (15,090 BFPD)
- 90 m³/hr of water (13,585 BWPD)
- 10 m³/hr of oil (1,509 BOPD)
- 10 barg

Surface Network

Sub-surface

Production Facility (inlet pressure 10 bar)
The flow-line bottleneck (hypothetical example)

Performance after the ExH2O™ system

By doing nothing more than removing the bulk water, production has increased by 300 BOPD due to the reduction of back pressure on ESPs!
Capacity bottleneck (hypothetical example)

Imagine you have the following field.

<table>
<thead>
<tr>
<th>Potential Production</th>
<th>Actual Production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oil BOPD</td>
</tr>
<tr>
<td></td>
<td>Oil BOPD</td>
</tr>
<tr>
<td>Well 1</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 2</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 3</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 4</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 5</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 6</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 7</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 8</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 9</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 10</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 11</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 12</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 13</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 14</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 15</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 16</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 17</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 18</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 19</td>
<td>1,000</td>
</tr>
<tr>
<td>Well 20</td>
<td>1,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>20,000</strong></td>
</tr>
</tbody>
</table>

| Well 1                | 1,000    | 2,000      | 67%       |
| Well 2                | 1,000    | 2,000      | 67%       |
| Well 3                | 1,000    | 2,000      | 67%       |
| Well 4                | 1,000    | 2,000      | 67%       |
| Well 5                | 1,000    | 3,000      | 75%       |
| Well 6                | 1,000    | 4,000      | 80%       |
| Well 7                | 1,000    | 5,000      | 83%       |
| Well 8                | 1,000    | 6,000      | 86%       |
| Well 9                | 1,000    | 7,000      | 88%       |
| Well 10               | 1,000    | 1,000      | 50%       |
| Well 11               | 1,000    | 7,000      | 88%       |
| Well 12               | 1,000    | 8,000      | 89%       |
| Well 13               | 1,000    | 9,000      | 90%       |
| Well 14               | 1,000    | 2,000      | 67%       |
| Well 15               | 1,000    | 7,000      | 88%       |
| Well 16               | 1,000    | 8,000      | 89%       |
| Well 17               | 1,000    | 9,000      | 90%       |
| Well 18               | 1,000    | 2,000      | 67%       |
| Well 19               | 1,000    | 8,000      | 89%       |
| Well 20               | 1,000    | 9,000      | 90%       |
| **Total**             | **9,000**| **20,000** |           |

- Looks great, however as you only have **20,000 BWPD** of produced water handing capability, production is limited to **9,000 BOPD** and multiple highwater cut wells need to be shut-in.
- By utilising an ExH2O™ system, an additional **11,000 BOPD** of production can be unlocked, by adding increase produced water handing capacity!
ExH20™

• ExH20™ Bulk water removal system is a **compact system** which utilises cyclone technology in a **two-step approach**

• ExH20™ is made up of the following units in series:
  
  - **Preseparation Hydrocyclone**: where partial separation of bulk fluids takes place
  - **Deoiling Hydrocyclone**: where oil-in-water separation takes places
  - Depending on well fluid characteristics and required produced water specification, additional equipment might be necessary

• **Simple** system with minimal facilities

• **Low cost alternative** to large residence time systems

• **Extends the operating envelope** of existing processing facilities

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ExH20™
Basics of Hydrocyclone Technology

- Inlet
  - Swirling, Flow Stabilisation
  - Increasing Velocity
  - Residence time to allow droplet migration to the core
  - Oil core coalescence
  - Core flow reversal

- Oily reject

- Clean water underflow

- Oil / water inlet
  - Flow reversal
  - Flow stabilisation
  - Increasing velocity
  - Core formation (coalescence)

- Liquid-Liquid Hydrocyclone
  - Additional residence time
  - Hydrocyclones are a low cost lightweight enhanced gravity separation device
  - Backpressure

- Water underflow
ExH20™
Basics of Hydrocyclone Technology

- Side wall ramp from inlet
- Reject orifice
- Back wall ramps
- Inlet
- Side wall
- Continuous taper
**ExH2O™**

*How does it work?*

Expro’s ExH2O™ is made up of the following units in series:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Separated Fraction</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>Basket strainer</td>
<td>Removal of solids from inlet stream</td>
<td></td>
</tr>
<tr>
<td>Stage 2</td>
<td>Pre-separation</td>
<td>Multiphase separation to remove bulk water from oil &amp; gas</td>
<td>80 to 90% of water removed from inlet fluids.</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Deoiling</td>
<td>Removal of oil from separated bulk water phase</td>
<td>~100 to 500 ppmv oil-in-water</td>
</tr>
<tr>
<td>Stage 4</td>
<td>Polishing (such as CFU, Oil adsorption filters, Oil adsorption media etc)</td>
<td>Oil in water from separated water fraction in Stage 2</td>
<td>&lt;20 ppm oil-in-water</td>
</tr>
</tbody>
</table>

And if required we can add a final polishing system to clean bulk water.
ExH2O™
Basics

**Preparation**
Crude + Free Gas
- Swirling, Flow Stabilisation
- Increasing Velocity
- Core flow reversal

**Wellstream Fluids**
- Oil core coalescence

**Deoiling**
Oily Reject + Evolved Gas
- Swirling, Flow Stabilisation
- Increasing Velocity
- Core flow reversal

Partially Clean P.W.

Produced Water.
• Preseparation hydrocyclones can only successfully process streams in the **water continuous phase** - typically > 60% water cut.

• Preseparation hydrocyclones are **very tolerant** to the presence of gas. They can accommodate up to **50% GVF** without the need for an upstream degasser.

• The steadier the inlet water cut, the greater the maximum separated water fraction.

• The units have a minimal residence time and therefore are not effective at processing streams with slugging flow regimes.
ExH2O™ - What does it look like?

1. Strainers
2. Preseparator
3. Deoiler
4. LCP
ExH2O™ - What does it look like?

Typical package dimensions

- Package dimensions will vary according to flowrate and design pressure.
- For a 33,000 BLPD package the dimensions were **6.3m L (20ft) x 2.5 mW (8ft) x 3.1H (10ft) x 12MT (Dry )/ 15.6MT (Wet)**

- For a 33,000 BLPD the equivalent production separator size would be **10 m L (32ft) x 3.5 mW (11.5 ft) x 3.5 H (11.5ft) x 20 MT (Dry )/ 60 MT (Wet)**
- The equivalent production separator takes up **2.5 more volume** and **weights 4 times** as much in operating conditions.
ExH2O™
Typical package installation
Expro Project – South East Asia

- MOPU production from 15 off ESP wells - **15,200 bpd @ 70% WC**
- MOPU process facilities has only two phase separation
- All liquids pumped to FSO for Water/Oil separation and storage
- Oil/Water separation in storage tanks, skimmed and pumped back to MOPU
- Water re-injected by MOPU Water Re-injection system (booster/injection pumps)
The Problem

- MOPU export flowline to FSO ~ max capacity of **13,000 bpd**
- FSO maximum pumping capacity of water back to MOPU ~ **10,200 bpd**
- 3 new wells plus 2 side tracks totaling ~**6,000 bpd** extra production cannot be produced with existing facilities due to export flowline capacity restriction & water import flowline restriction causing water build up in FSO
- Major bottleneck limiting production
**ExH2O™**

*Case Study*

**The Solution**

- Two Stage Partial Processing System located upstream of MOPU process
- Capacity **33,000 bpd** total fluids
- Separate ~**20,000 bpd** water (75%) from Production Manifold and route directly to PWRI system.
- Treat separated water to <**500 ppm** (spec for re-injection)
- Forward <**10,000 bpd** (with reduction in BS&W from 70% to ~30%) to existing process facilities and FSO
ExH2O™
Case Study

• The Solution
**ExH2O™**
*Case Study*

**Results**
Prior to Commissioning

- MOPU Production = 15,200 bpd @ 70% BS&W
- Production to FSO = 14,450 bpd @ 69% BS&W
- Water Production to FSO = 10,000 bpd
- Water Production from FSO to MOPU = 10,200 bpd

Post Commissioning

- MOPU Production = 16,750 bpd @ 72% BS&W
- Production to FSO = 8,350 bpd @ 44% BS&W
- Water Production to FSO = 3,660 bpd
- Water Production from FSO to MOPU = 3,660 bpd
- Water Separated by Partial Processing = 8,400 bpd

**Current Benefits**

- Spare Capacity in Export Flowline to FSO: 4,650 bpd
- Spare Capacity in Water Flowline from FSO: 6,540 bpd
- Production now beginning to ramp up with the addition of new wells
ExH2O™

CASE STUDY – 1st year performance record

BEFORE bulk water removal package installation

- Increase in fluids handled: 50%
- Increase in P.W. handled: 52%
- Increase in crude production: 22%
- Increase in water cut: 2%

AFTER bulk water removal package installation

- Package pressure drop: < 30 psi
- Separated water fraction: > 80%
- OiW separated water fraction: < 100 ppmv

Other benefits:
- Decrease in production chemicals
- Decrease in power consumption
- Decrease in operating pressures
- Re-establish 3 phase separation for now debottlenecked processing train

Production fluids (BPD)

Time (months)

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Well Unloading / Multiphase Transfer Unit.
Well Unloading Unit / Multiphase Transfer Unit.

- To debottleneck production networks, Well Unloading Units can bring low pressure wells back in to production by:
  - Separating the Oil / Gas phases
  - Removing the gas (flared or compressed for gas lift or export)
  - Boosting the oil pressure for export
Well Unloading Unit / Multiphase Transfer Unit
Gas export mode

- Compressor used to **export gas**.
Well Unloading Unit / Multiphase Transfer Unit
Gas lift mode

- Compressor used to **provide a gas lift supply**.
• Suitable for applications where a **high pressure** gas source is available.
• **Minimum** footprint & weight solution.
• Solution can be integrated with existing well test separator.
Well Unloading Unit / Multiphase Transfer Unit
Gas flaring mode

- Gas direct to flare.
A typical WUU package has the following design specifications.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Spec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum inlet pressure</td>
<td>barg</td>
<td>1</td>
</tr>
<tr>
<td>Inlet design pressure</td>
<td>barg</td>
<td>API 3K inlet choke manifold.</td>
</tr>
<tr>
<td>Number of inlet slots</td>
<td>-</td>
<td>Four (4) x 2” API 3K</td>
</tr>
<tr>
<td>Inlet Temperature</td>
<td>°C</td>
<td>30 to 40</td>
</tr>
<tr>
<td>Oil &amp; Water</td>
<td>BFPD</td>
<td>500 to 12,500</td>
</tr>
<tr>
<td>Gas Flowrate</td>
<td>MMSCFD</td>
<td>2.5 to 5</td>
</tr>
<tr>
<td>Gas Discharge Pressure</td>
<td>barg</td>
<td>90</td>
</tr>
<tr>
<td>Gas Discharge Temperature</td>
<td>°C</td>
<td>50</td>
</tr>
<tr>
<td>Oil Discharge Pressure</td>
<td>barg</td>
<td>up to 90</td>
</tr>
<tr>
<td>Fuel</td>
<td>-</td>
<td>Process gas (for compressor) Diesel (for generators)</td>
</tr>
</tbody>
</table>

Expro can adapt the above specifications to suit the local conditions.
The following is a hypothetical example

- Imagine the following field:
  - 5 wells all producing into a single production flowline
  - The total production the customer is seeing at their stock tanks is 10,000 BOPD.
  - The operator does an inline well test on well number 3 and if they bean it out they can increase production from that well from 2000 BOPD to 4000 BOPD.
  - The operator spots an opportunity and puts the well 3 back into production with it beaned out expecting to see an increased production at the stock tanks
  - At his stock tanks the operator is now seeing only 9,800 BOPD, a loss of 200 BOPD – why is this???
Well Unloading

How is well unloading related to debottlenecking?

- Let's have a look at the field:

- The client relies on their meter just before the stock tanks to determine field production. Why has production gone down when well number 3 was increased in production?
- What can Expro do to help?
Well Unloading

How is well unloading related to debottlenecking?

- Lets go back a step and before we change any wells let's baseline the performance of the collection network and deploy meters to collect flow and pressure data from all wells.
- Continue to meter after we make the changes to well number 3 so that we compare the two datasets.
Well Unloading
How is well unloading related to debottlenecking?

• Lets compare the data:

<table>
<thead>
<tr>
<th>Field Baseline Performance</th>
<th>Well</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 Flowline</th>
<th>Total Production BPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Flow</td>
<td>BWPD</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>5000</td>
</tr>
<tr>
<td>Gas Flow</td>
<td>MMSCFD</td>
<td>2</td>
<td>1</td>
<td>10</td>
<td>0.5</td>
<td>4</td>
<td>17.5</td>
</tr>
<tr>
<td>FWHP</td>
<td>Barg</td>
<td>20</td>
<td>11</td>
<td>30</td>
<td>12</td>
<td>13</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Performance Once Well 3 is Beaned Out.</th>
<th>Well</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 Flowline</th>
<th>Total Production BPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Flow</td>
<td>BOPD</td>
<td>2000</td>
<td>1200</td>
<td>4000</td>
<td>800</td>
<td>1800</td>
<td>9800</td>
</tr>
<tr>
<td>Water Flow</td>
<td>BWPD</td>
<td>1000</td>
<td>600</td>
<td>2000</td>
<td>400</td>
<td>1000</td>
<td>5000</td>
</tr>
<tr>
<td>Gas Flow</td>
<td>MMSCFD</td>
<td>2</td>
<td>0.6</td>
<td>20</td>
<td>0.2</td>
<td>4</td>
<td>26.8</td>
</tr>
<tr>
<td>FWHP</td>
<td>Barg</td>
<td>20</td>
<td><strong>10.3</strong></td>
<td>30</td>
<td>10.5</td>
<td><strong>11</strong></td>
<td>10</td>
</tr>
</tbody>
</table>

• What did we find out:
  ➢ Well 3 has a **high GOR** which when opened increases the back pressure on wells 2, 4 & 5 and drops production!!
• Now that we have done the **surveillance portion**, how do we do the **enhancement portion**?

• **Lets consider the following two solutions:**
  1. Put in a **simple well unloading unit** at well number 3 to send the gas to flare. (i.e. no compression – oil to pipeline).

  OR...

  2. Run the low pressure wells to a **well unloading unit** (gas and oil boosted in pressure using a compressor and pump respectively).
SOLUTION 1: Simple well unloading unit at well number 3, gas is sent to flare.

What has happen?
- Production has increased to **12,500 BOPD**!
- The gas removed at well 3 has lowered the flowline back pressures and the total flow has actually gone up by **2500 BOPD** - not just 2000 BOPD.
- This is because the reduction in back pressure on the low pressure wells has allowed the flow to increase from wells 2, 3 & 4.
- This may not be suitable for all clients if they are not allowed to flare or want to produce the gas.

### Field Performance Once Well 3 is Beaned Out & Gas Sent To Flare

<table>
<thead>
<tr>
<th>Well</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 Flowline</th>
<th>Total Production BPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Flow</td>
<td>BOPD</td>
<td>2000</td>
<td>2300</td>
<td>4000</td>
<td>2100</td>
<td>2100</td>
</tr>
<tr>
<td>Water Flow</td>
<td>BWPD</td>
<td>1000</td>
<td>1150</td>
<td>2000</td>
<td>1050</td>
<td>1000</td>
</tr>
<tr>
<td>Gas Flow</td>
<td>MMSCFD</td>
<td>2</td>
<td>1.15</td>
<td>0</td>
<td>0.525</td>
<td>4</td>
</tr>
<tr>
<td>FWHP</td>
<td>Barg</td>
<td>20</td>
<td>12</td>
<td>30</td>
<td>13</td>
<td>14</td>
</tr>
</tbody>
</table>
SOLUTION 2: Run the low pressure wells to a well unloading unit.

What has happen?
- Overall oil production has increased to **13,100 BOPD** and all gas is recovered!
- As wells 2, 4 & 5 are going through a WUU they are no longer at the mercy of flowline pressure and can be produced at lower pressures, hence increased production as the bottleneck is removed.

| Field Performance Once Well 3 is Beamed Out & Well Unloading Unit Added for Wells 2, 4, 5. |
|---------------------------------|-----|-----|-----|-----|-----|----------------|-----|
|                                | Well | 1   | 2   | 3   | 4   | 5 Flowline | Total Production |
| Oil Flow                       | BOPD | 2000| 2300| 4000| 2600| 2200       | **13100**        |
| Water Flow                     | BWPD | 1000| 1150| 2000| 1300| 1000       | **6450**         |
| Gas Flow                       | MMSCFD | 2  | 1.15| 20  | 0.65| 4          | 27.8             |
| FWHP                           | Barg | 20  | 8   | 30  | 10  | 8          | 10               |
Well Unloading Unit

Typical Scope - Production Manifold

- 3,000 psi MAWP
- Single well to the 4 way manifold shown above
- Integral SSV / SDV built into skid
- 2” adjustable chokes
Well Unloading Unit

Typical Package Scope - Vertical Separator

- 285 psi MAWP
- Vertical (reduced foot print)
- 10,000 BPD / 20 MMSCFD
- Integral Package ESD System
Well Unloading Unit
Typical Scope – Transfer pump

- 5 to 90 bar $\Delta P$, 33 to 85m$^3$/hr (5000 to 12,800 BPD) capacity
- Electric motor drive
- VFD Drive
- Pressure, flow controls and safety systems included.
Well Unloading Unit
Typical Scope - Gas Compression Unit - Gas lift

- Gas engine drive
- 3 stage gas compressor
- 2.4 MMSCFD
- 2 to 3 bar suction / 85 barg discharge
- Full Altronic controls - multiple shut down systems
Well Unloading Unit
Typical Scope - Gas Lift Manifold

- 4 or 6 Well Gas Lift Injection Manifold
- 2” Configuration with 1” Gas Meters
- 2” Adjustable Chokes
Gas Lift – Bringing wells back to life…

- For wells which are out of production due to insufficient well pressure but the company does not want to risk changing the completion to install gas lift mandrills, Expro have a solution.
- Using wireline, Expro can run in a perforating tool, to install a check valve which will provide connectivity between the annulus and the tubing.
- The check valve will allow lift gas to flow from the annulus into the tubing.
- One such perforating tool is shown here:
Mobile Water Injection Systems

When the bottleneck is the reservoir itself, for water drive reservoirs Expro can offer either or **SWIMS** or **PRISM** packages.

**Sea Water Injection Mobile System (SWIMS)**

- Expro’s SWIMS system is a highly mobile sea water injection system, designed to lift, filter, deoxygenate and chemically treat sea water for injection into candidate wells. The injected sea water will replace volume lost through depletion and help maintain reservoir pressure.

**Produced Water Reinjection Stimulation Method (PRISM)**

- PRISM is design to utilize produced water for reservoir water re-injection. The system will: remove oil (if required), deoxygenate (if required), filter and chemically treat the produced water for injection into candidate wells.
The benefits of SWIMS & PRISM

- Increase production and oil recovery rate at reservoir enabled by water flooding
- This is also used to increase pressure in the reservoir, to sweep or displace oil from the reservoir, and push it towards a producing well.

Other applications

- Injection water for pipeline flushing
- Injection seawater to run ILI tools for pipeline inspection
- Troubleshooting for pigs stuck in pipeline
- Pipeline or casing pressure test
PRISM – Process Schematic

Notes:
1. For clarity, control loops are not shown.
Typical scope of supply includes:

- Sea water lift pumps
- Filters
- Chemical Injection
- Residence vessel
- Water injection pumps
- Injection manifold
- Utilities.
The SWIMS / PWIMS package is a highly flexible package which can be adapted to suit the required process conditions. Typical package specifications are as given below.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Spec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea Water / Produced Water Capacity</td>
<td>BWPD</td>
<td>6,500 BWPD – normal case (6,000 – 9,000 BPD in case SWIMS flushing unit)</td>
</tr>
<tr>
<td>Injection Pressure</td>
<td>psig</td>
<td>Up to 3,000 psig (400 – 600 psig in case SWIMS flushing unit)</td>
</tr>
<tr>
<td>Water filtration spec</td>
<td>microns</td>
<td>50 - 100 microns</td>
</tr>
<tr>
<td>Flow metering</td>
<td>-</td>
<td>By turbine flow meter</td>
</tr>
<tr>
<td>Chemical injection required</td>
<td>-</td>
<td>Oxygen scavenger / Corrosion inhibitor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Biocide – Anti scale</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Expro supply 2 x Chemical Injection Pumps</td>
</tr>
<tr>
<td>Tie-in point</td>
<td>-</td>
<td>Wellhead R35 / pig launcher 2“600#</td>
</tr>
</tbody>
</table>
Example Expro SWIMS unit operating in Thailand

- EXPRO SWIMS
- Water Injection Rate 3.5 - 4.5 BPM (5,000 – 6,500 BWPD)
- Pressure Injection 1,500 – 3,000 Psig
Expro offers a range of **produced water treatment technologies** which can be offered on a fast track basis and utilized to meet either overboard disposal or injection specifications.

- Packages can meet typical oil-in-water disposal targets of **<20 mg/l**.
- Technologies include:
  - De-oiling Hydrocyclone
  - Desanding Hydrocyclone
  - Corrugated plate interceptor
  - Induced gas floatation units
  - Compact floatation units.
  - Deareation Units
  - Dual Media Filter Units
  - Nutshell Filter Units
  - Cartridge Filter Systems
Facilities Upgrades

• Facilities upgrades is a product offered by Expro to address problems with bottlenecked facilities or facilities which are underperforming.

• Expro utilise our clamp-on Expro Sonar Meter™ capabilities and PVT analysis capabilities to perform site audits / health checks.

• Using our in house engineering expertise we diagnose the problem.

• Depending on the nature of the problem Expro can offer upgrades utilizing existing equipment from inventory or as new build equipment.

• Expro has the in-house expertise to engineer, design, integrate, project manage as well as install these facilities upgrades.
• To address problems related to production bottlenecks related to mature or late life facilities, Expro can offer the following technologies on a lease, own and maintain (LOM) basis to enhance production:

  – Well Unloading Unit (WUU)
  – Bulk Water Removal (ExH2O™)
  – Sea Water Injection Mobile System (SWIMS)
  – Produced Water Injection Mobile System (PWIMS)
  – Produced Water Treatment (PWT)
  – Facilities Upgrades
Contact Details

Production Enhancement

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