



PRODUCED WATER SOCIETY
SEMINAR 2018

Training Workshop

An Introduction to Oilfield Water Treatment

Wally Georgie – Maxoil Process Consultancy



OPERATIONS ASSURANCE
SUBSEA PRODUCTION REALISATION
FLOW ASSURANCE
SEPARATION SYSTEMS
GAS TREATMENT & TRANSPORT
PRODUCED WATER MANAGEMENT
SAND & SOLIDS MANAGEMENT
CONTAMINANTS MANAGEMENT
CHEMICAL MANAGEMENT
PROCESS/PRODUCTION OPTIMISATION
PROCESS TROUBLESHOOTING
OPERATIONS PERFORMANCE STRATEGY [OPS]
SYSTEMS AWARENESS TECHNICAL TRAINING

maxoil

PROCESS SOLUTIONS

MAXIMISING PERFORMANCE THROUGH
OPERATIONAL **EX**CELLENCE

Introductions and Overview Conventional and Unconventional Produced Water Aspects

Wally Georgie

Maxoil Process Consultancy

- **Introduction to Produced Water**
- **Produced Water Management Overview**
- **Water Characteristics – Conventional vs Unconventional**
- **Treatment Challenges and Opportunities**
- **Technologies Overview**
- **Technology Selection and Configuration**
- **Technology Gaps and Development**
- **Where Can We Improve?**
- **Q&A**

What is Conventional and Unconventional Produced Water?

Conventional

- **In a new field/well the water volume handled is almost negligible**
- **Dealing with limited number of producing wells per field**
 - **Up to 30 wells/block per facility offshore**
 - **Up to 100 wells per facility/battery onshore**
- **Gradual build of formation water with time**
- **Later may include injected water after injection breakthrough**

What is Conventional and Unconventional Produced Water?

Conventional

- **Produced Water composition fairly consistent in any specific field through out the life of field**
- **Produced Water in a conventional field is mainly the formation water/aquifer and injected water, all from the same field/zone**
- **Composition may change due to the injected water breakthrough**
- **The produced water typically is treated through the facilities within the field before it is discharged, recycled or reinjected/dispose of**
- **The separated water must meet certain water quality prior to the discharge, recycle or reinjection**
- **The handling cost of dealing with water is relatively low since the treatment is done locally**

What is Conventional and Unconventional Produced Water?

Conventional

- **The Produced Water system can be operated at varies temperatures and pressures**
- **Typically hot above ambient, gassy, corrosive brines are produced**
- **Salinities can vary from fresh to highly salty brines (e.g. Total Dissolved Salts (TDS) contents of between 500 mg/l and 350,000 mg/l)**
- **Contains dissolved gases such as CO₂, H₂S and Hydrocarbon gases**
- **Contains dissolved organics and other contaminants**
- **Contains types of suspended solids and dissolved mineral scale species and suspended oil**
- **Requires common production chemical treatment strategy per field**
- **The chemical treatment cost is relatively low since the water composition is consistent per field**

What is Conventional and Unconventional Produced Water?

Unconventional

- **In a new field/well the water volume handled is significant from day 1 – can be over to 50%**
- **The nature of the water from day one is based on what is used for Fracing the well**
- **Dealing with large number of producing wells per field (possibly up to 1000 + wells/block)**
- **Handling Frac water which can be mixture of water from several formations/zones**
- **The water composition from different wells in any field can vary due to out sourcing the total Frac water volume**
- **There is no injection well production support in Unconventional production**

What is Conventional and Unconventional Produced Water?

Unconventional

- **Significant Produced Water composition variation between wells in the field**
- **Produced Water in unconventional field is mainly/initially Frac water which consists of different type of formation water/aquifer, ground water and treated sewage water**
- **Water composition handled through any gathering station (Battery) may change with each new Frac job**
- **The produced water typically is separated in the Battery and shipped to gathering point for disposal or recycled for next Frac job**
- **Total volume required for a Frac job is large hence will require water from more than one source**
- **The produced water must meet certain criteria before its reuse or disposal**
- **The handling cost of dealing with water is relatively high since the handling is done at different locations in most cases, not local to the processing facilities (Battery)**

What is Conventional and Unconventional Produced Water?

Unconventional

- Typically produced water system can be operated at varies temperatures and low pressure
- Can be hot, not so gassy, corrosive brines
- Salinities can vary from fresh to highly salty brines (e.g. Total Dissolved Salts (TDS) contents of between 500 mg/l and 350,000 mg/l)
- Contains dissolved gases such as CO₂, H₂S and Hydrocarbon gases
- Contains dissolved organics and other contaminants
- Contains types of suspended solids and dissolved mineral scale species and suspended oil
- Requires production chemical treatment strategy which can vary per field due to the nature of water being treated
- The chemical treatment cost is relatively higher than Conventional due to variations in the water composition
- Much higher risk for bacteria growth

Conventional Production and Process

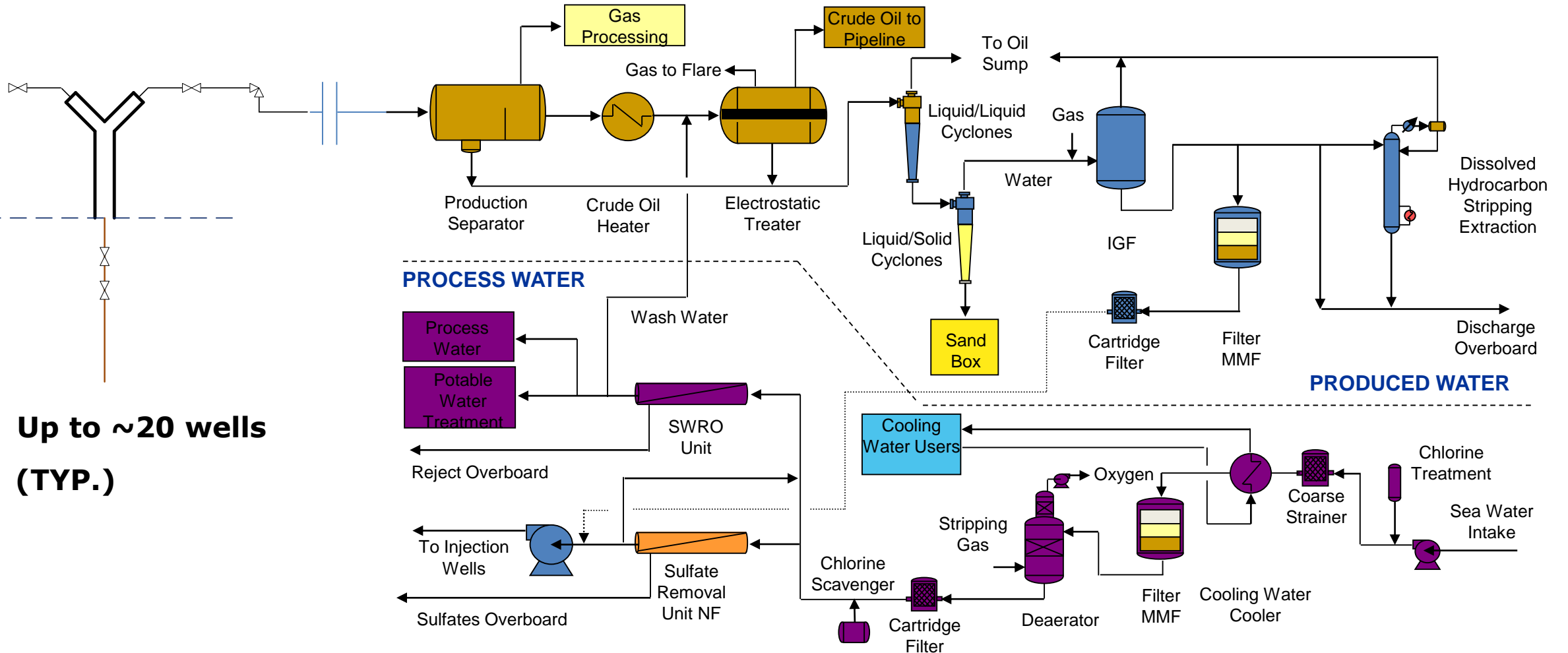
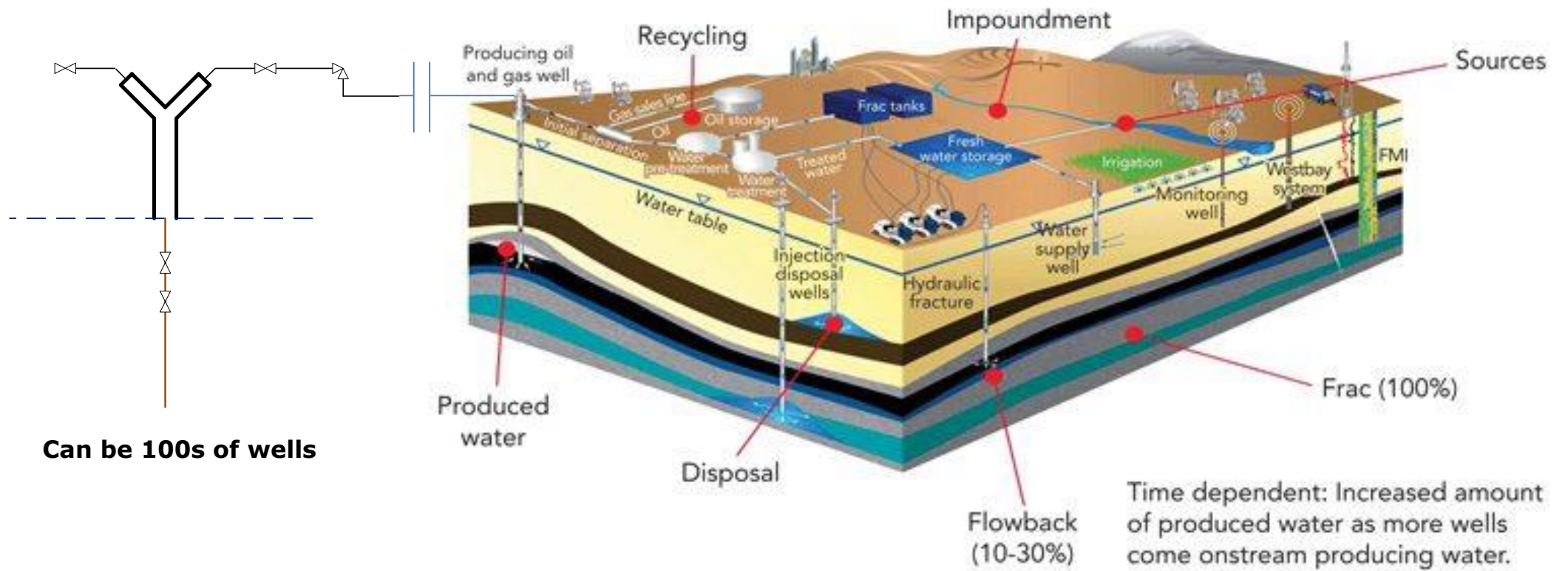


Fig. 1: HYDRAULIC FRACTURING OPERATIONS

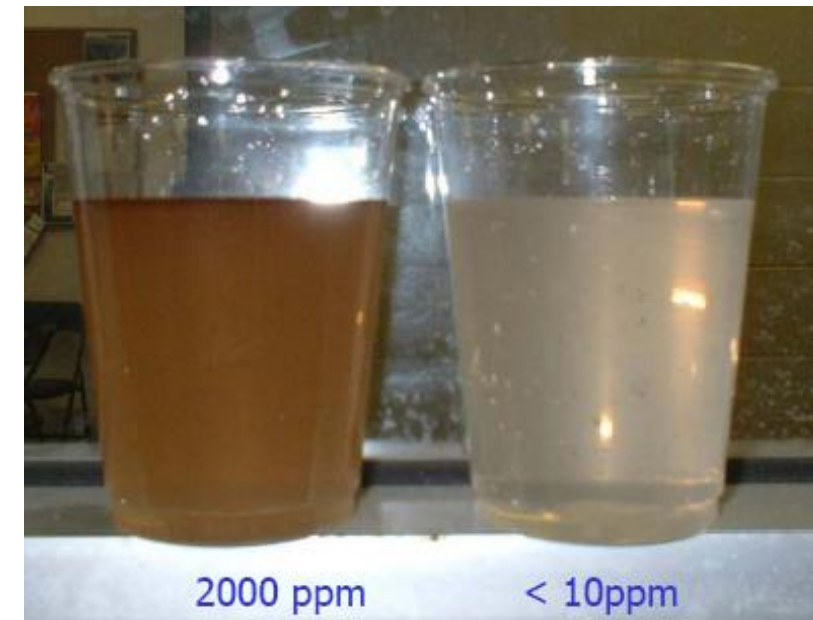


Source: Schlumberger Water Services

Produced Water Management Overview Conventional Versus Unconventional

What is necessary to achieve low cost water management?

- **Treatment Basics**
 - Separation of produced water from oil, gas and solids
 - Separated produced water is treated in dedicated facilities both offshore and onshore
 - Clean produced water is then either
 - Discharged to the outside Environment
 - Disposal injected into wells
 - Re-injected into the reservoir (PWRI)
 - Sent away for further treatment (unconventional)
- **Technology Selection and Configuration**
 - Right technology?
 - Recycles
- **Key Design Influences**
 - What is the inlet water quality?
 - Easy question. Difficult to measure, relatively easy to influence
 - Where in the system does water quality start to be affected?
 - Impact of water cut, temp, chemicals, solids, shear
 - What level of treatment is required?
 - Discharge or injection
 - Performance & reliability
 - How much and when?



Produced Water Management Overview Conventional Versus Unconventional



What is necessary to achieve low cost water management?

- **Chemical management**
 - **Chemical selection**
 - **Injection location and dose rates**
 - **Compatibility and effectiveness**
- **Solids management**
- **Monitoring – why?**
 - **To meet discharge requirements – avoid fines (\$)**
 - **Water quality control – Waterflood / WI**
 - **Water quality control – Disposal injection**
 - **Reduce fouling deposition in pipelines (MIC Failures)**
 - **System efficiency**
 - **Environmental control**
 - **Corrosion control – MIC / biofilm / schmoo (fouling)**
 - **Bacteria control**
 - **Toxicity control**
- **Common Problems**

Conventional

Challenges

- Production Chemicals (CI, SI, hydrate inhibitors etc.)
- Solids
- Tightening overboard disposal OIW specifications
- Technology development process duration

Opportunities

- New/Improved tertiary treatment technologies
- Improved online monitoring

Unconventional

Challenges

- Short well production life
- Large number of wells
- Changing composition and chemical content
- bacteria

Opportunities

- Water inconsistency will drive new innovation for improved technology
- Digital and data mining

Q&A