



Statoil

RESEARCH PROGRAMME: WATER HANDLING

ERC-RPM

Engineering Research Center in Reservoir and Production Management

Workshop, 7th of June 2017

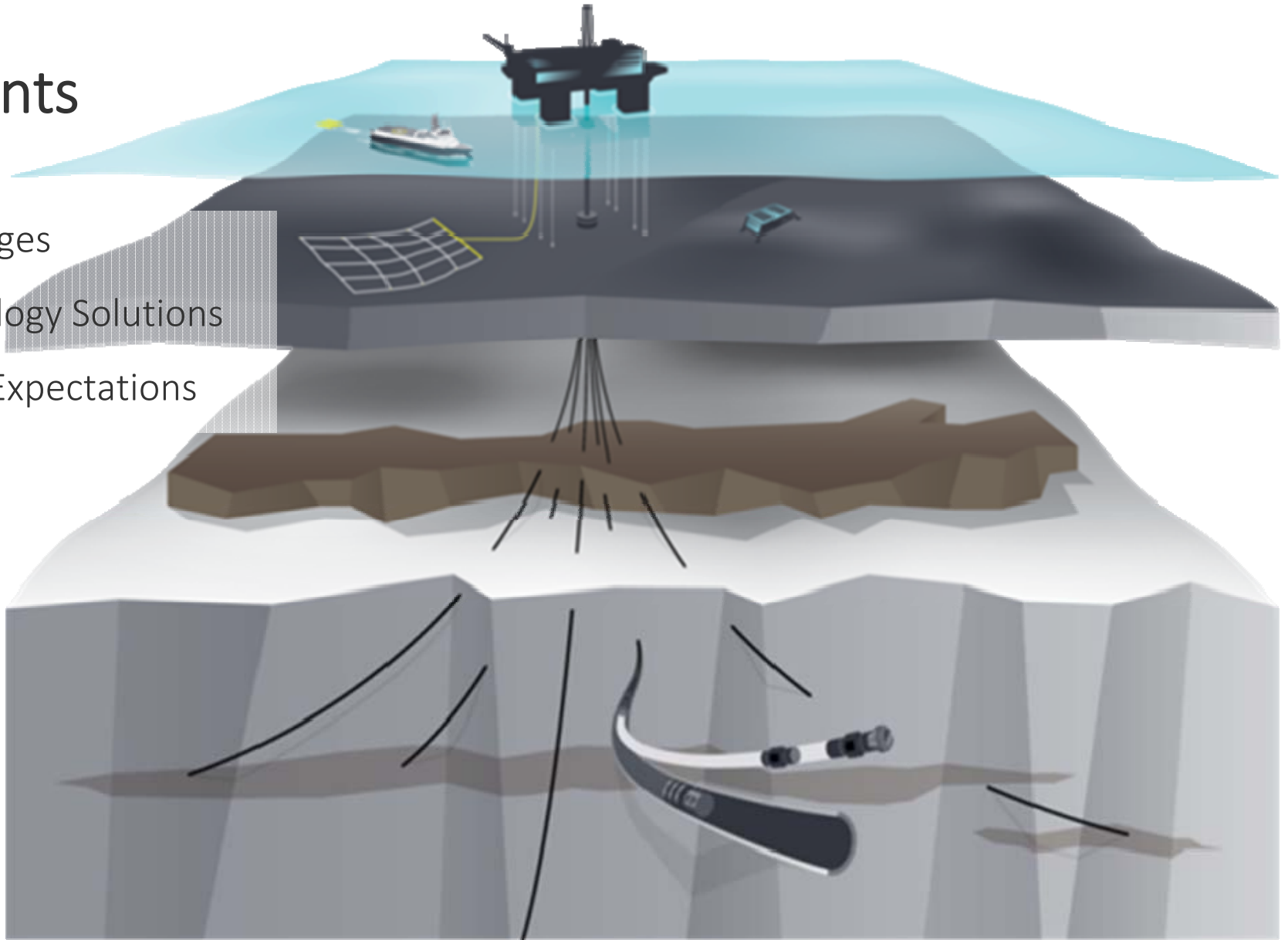
Classification: Open

7 juli 2017

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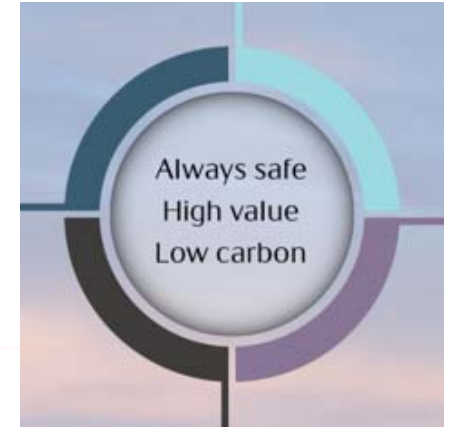
- Challenges
- Technology Solutions
- Statoil Expectations



Challenges

Call of Proposal – Water Handling

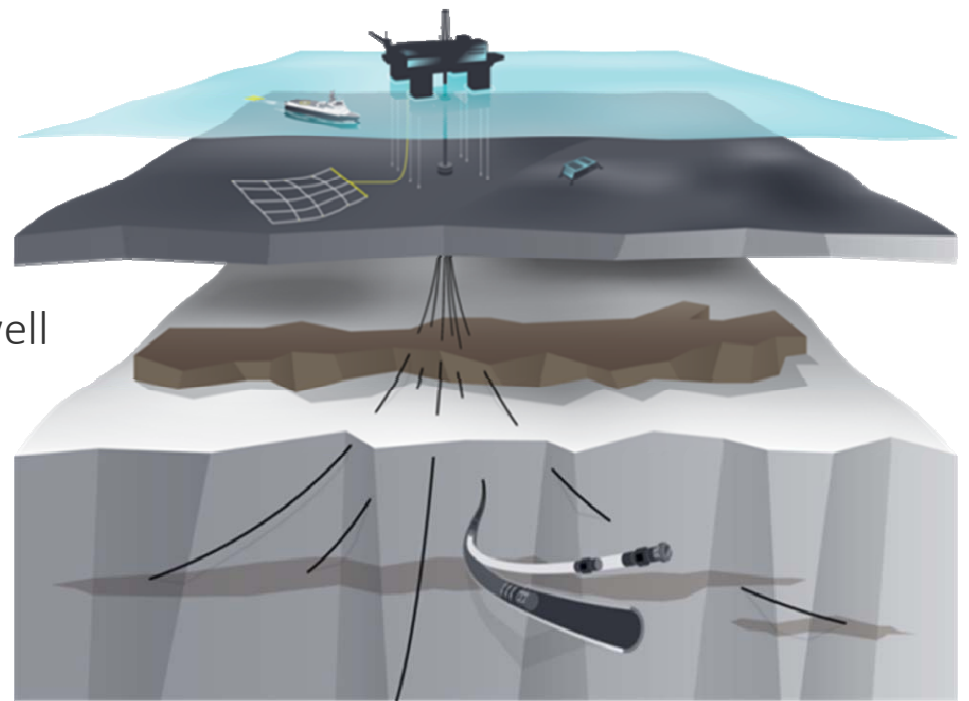
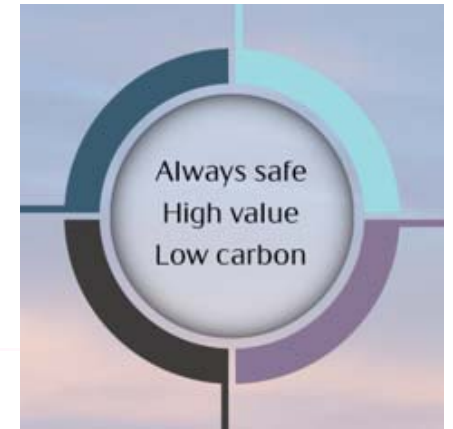
- Typical main drawbacks due to water production:
 - High cost of processing facility(CAPEX and OPEX)
 - Change in water handling capacity need during a field lifetime (CAPEX)
 - Energy consumed during water handling increase carbon footprint
 - Volume of water to be transported through risers to topside process facility
 - Potential risers also for produced water reinjection
 - Increased number of deep-water risers and/or increased dimension
 - Flow assurance
 - Lost oil production: processing capacity limitations or OPEX/energy use too high
- Reservoir injectivity: Complexity and cost - Challenge with water flooding as secondary recovery method
 - Injection requirements (flowrate, OIW, SO_4^{-2} , particles, pressure, etc.)
 - Potential for formation damage



Technology Solutions

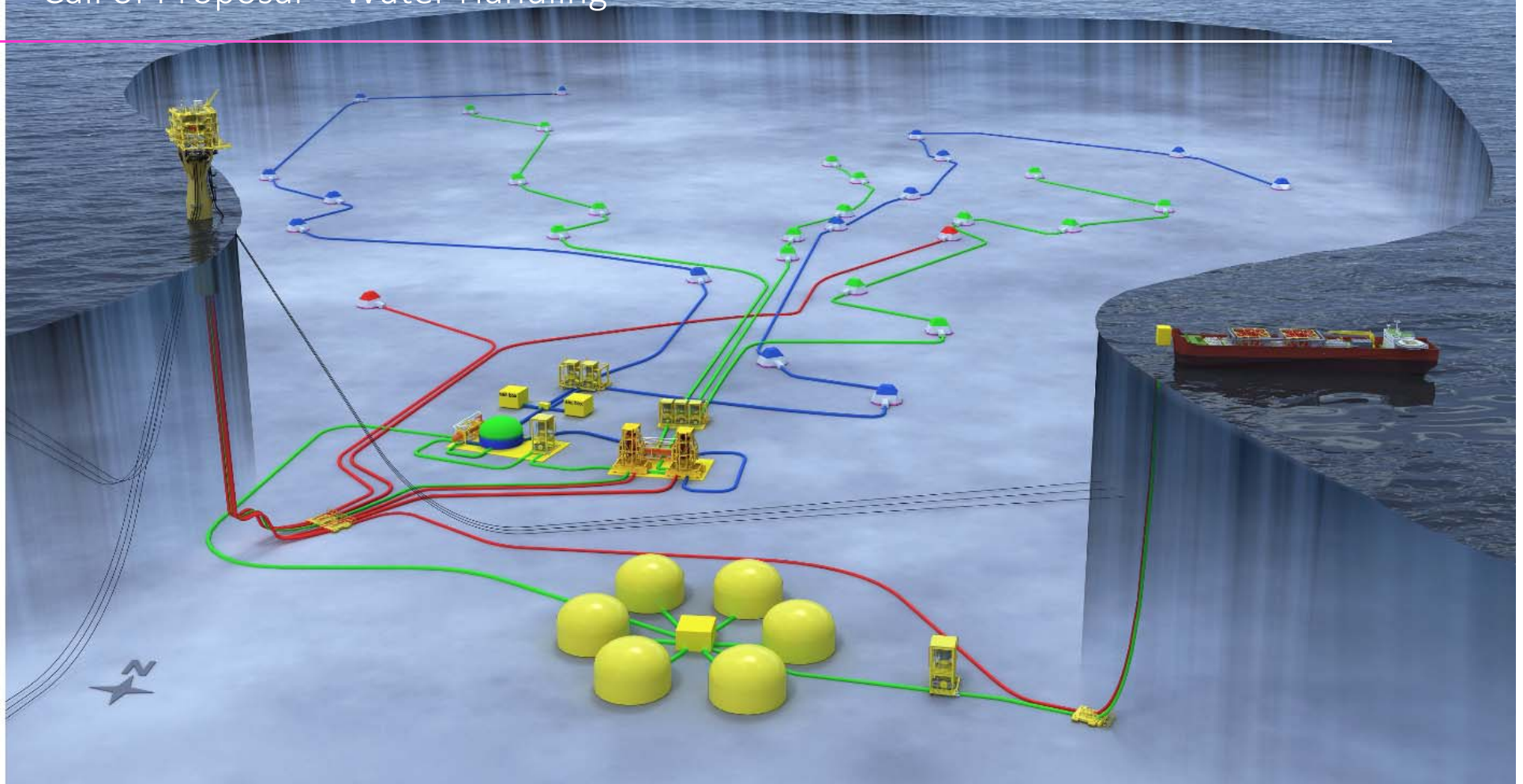
Call of Proposal – Water Handling

- Zone control in well
 - Inflow control devices
 - Injection of chemicals in reservoir
- Subsea processing
 - Reinjection into reservoir or dumping well
 - Subsea discharge to sea
- Topside processing of water
 - Deepwater marine risers
 - Cost effective riser with large diameter
 - Material challenges wrt welding and fluid content



Example subsea processing

Call of Proposal – Water Handling

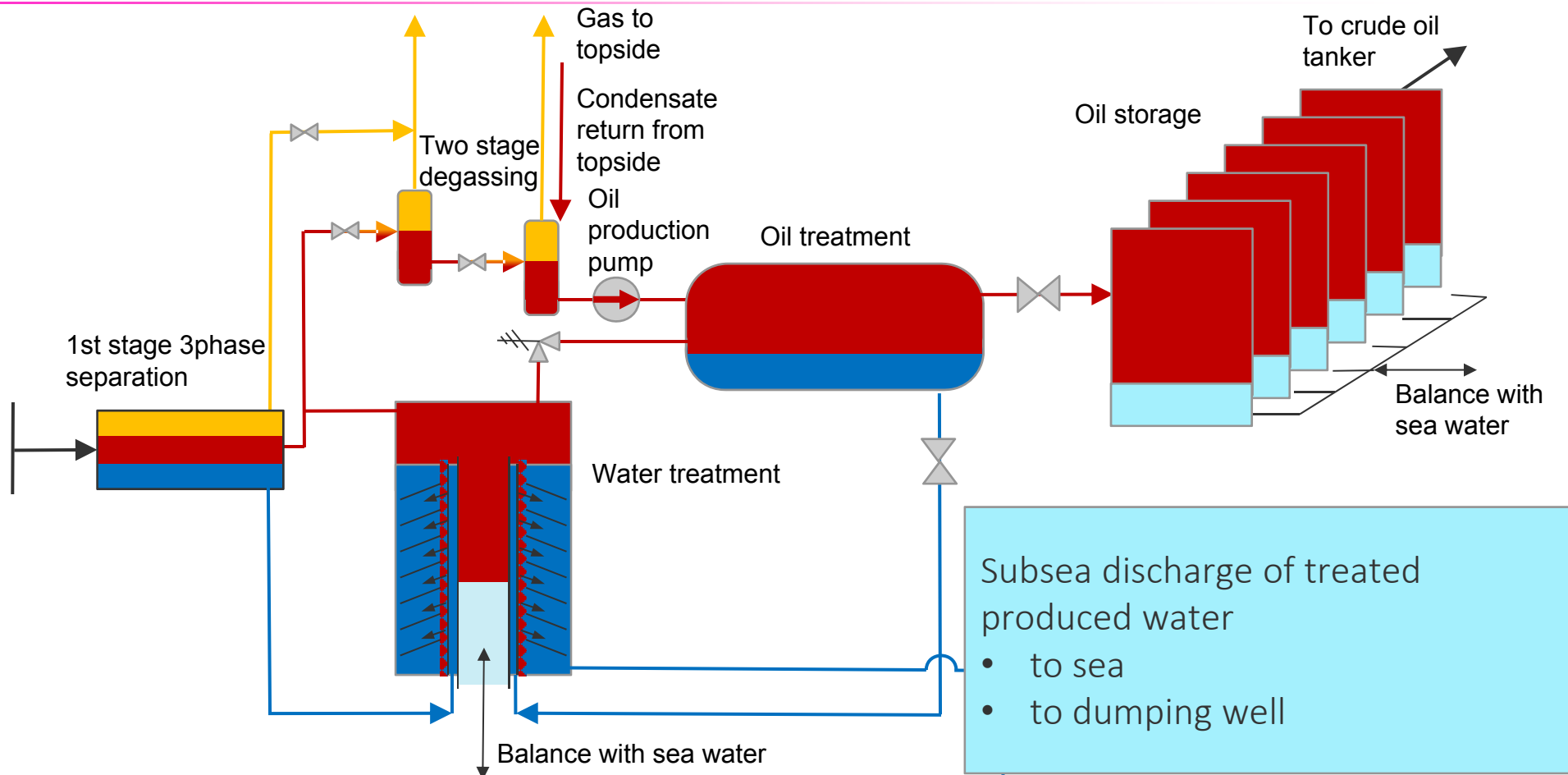


Example subsea processing

Call of Proposal – Water Handling

Statoil technology needs:

- Investigation of alternative separation principles
- Enable subsea disposal of PW
- Dissolved gas in discharged water
- Quality monitoring technologies (particles)



Technology Solutions

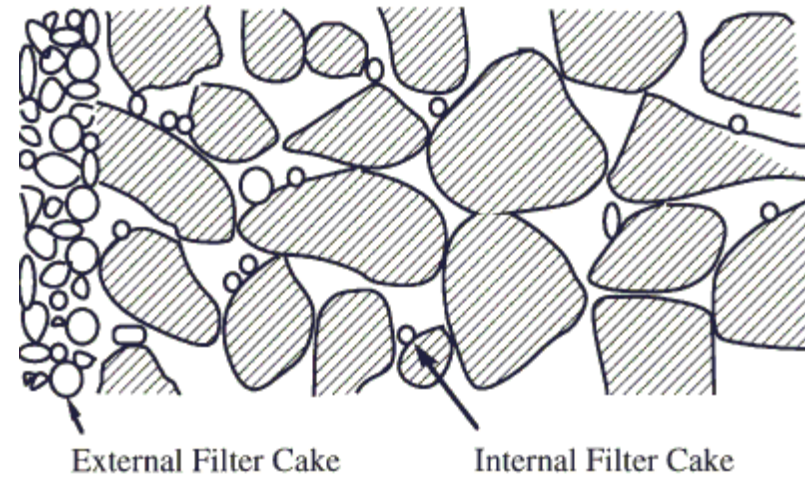
Call of Proposal – Water Handling: Water injectivity

Challenge

- Selection of injection water can influence injectivity and reservoir performance
- Near well plugging can be caused by particles, oil components or biomass, - separately or combined. Plugging mechanisms must be known to be able to
 - model and predict injectivity
 - to recommend mitigation strategies

Statoil technology needs

- Improved understanding of near wellbore plugging mechanisms
- Robust modelling and prediction tools
- Mitigating actions



Technology Solutions

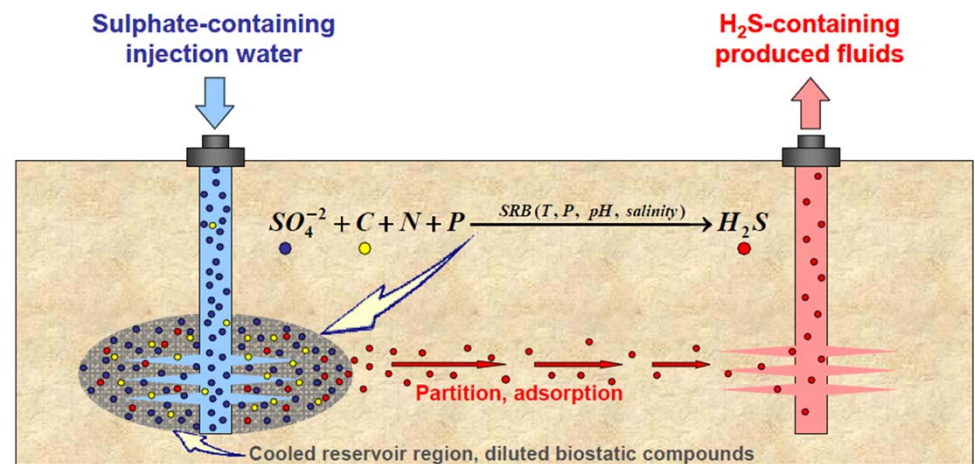
Call of Proposal – Water Handling: Reservoir souring

Challenge

- Complex processes not fully understood, gives increased H₂S in production volumes.
- Challenging to model and predict transportation of H₂S in the reservoir.
- Lost oil production
- Pipeline material specification requirements (corrosion)

Statoil technology needs

- Improved understanding of reservoir souring processes
- Improved prediction of reservoir souring
- Mitigating actions with respect to reservoir management and production technology



Reservoir Souring

A reservoir process with multidisciplinary implications

Monitoring H₂S surveillance
Input to
- simulations
- design basis

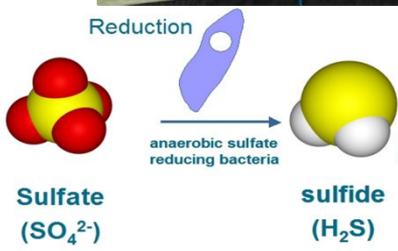
Production Optimization

Material Design & Spec

Well location

Drainage strategy

Flooding regime impact



Technology Solutions

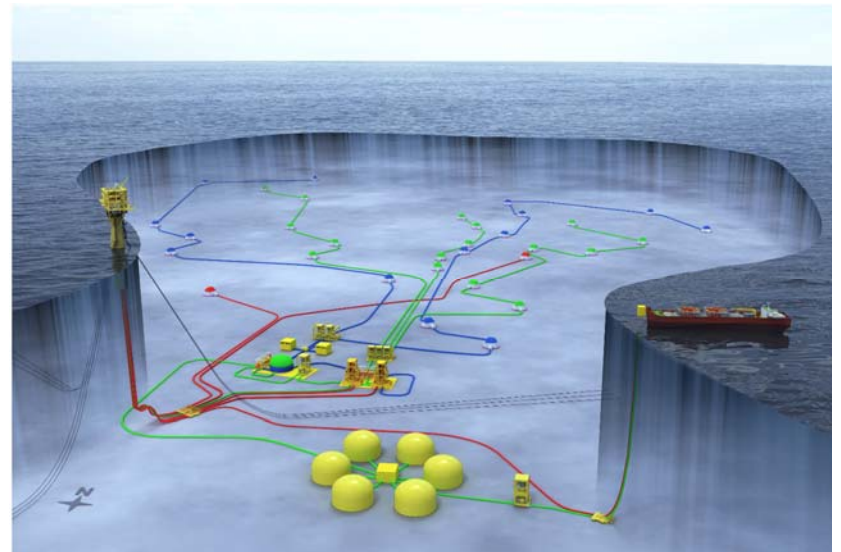
Water Treatment and Quality Assurance

Challenges

- Strict OIW requirements related to disposal of produced water into the sea
- Matrix injection may require strict quality requirements related to particles (PW, SW) and oil (PW)
- Subsea measurement of water quality: reliability and robustness
- Subsea disposal of PW (possible enabler of certain oil fields)
- Cost-effective subsea factories with high production efficiency

Statoil technology needs

- Investigation of alternative separation principles
- Enable subsea disposal of PW
- Quality monitoring technologies



Technology Solutions

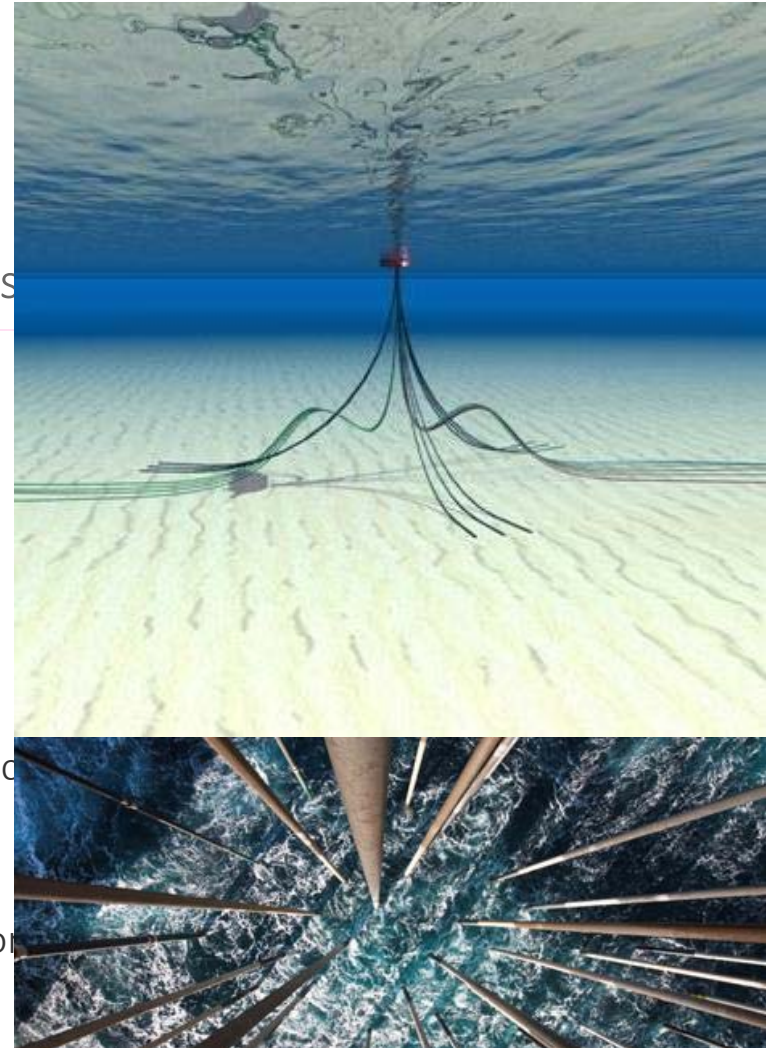
Topside processing of water: Steel deep-water risers

Challenge

- Number of risers – larger diameter
- Riser dynamics
- Riser concept/configuration/material/termination
- Installation of risers: marine operations
- Cost-effective subsea factories with high production efficiency

Statoil technology needs

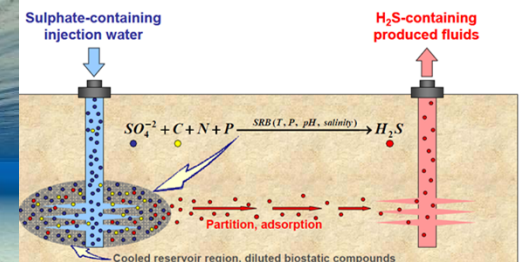
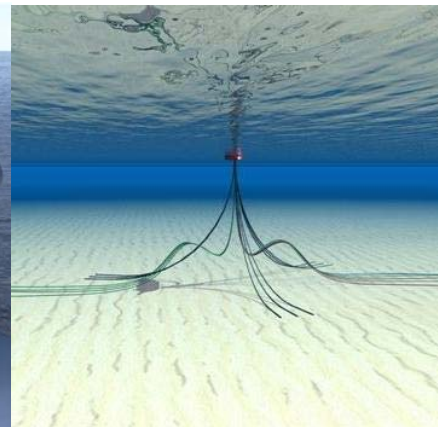
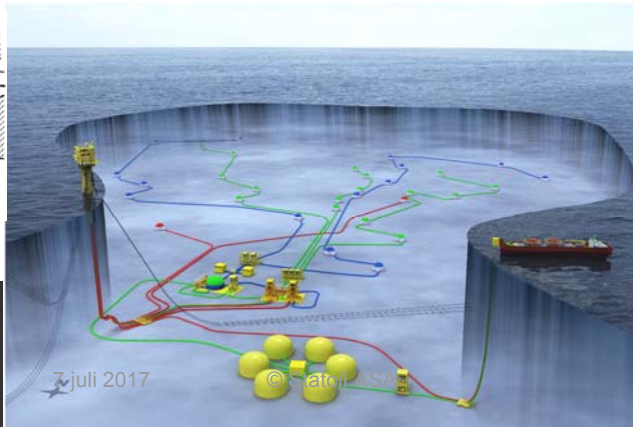
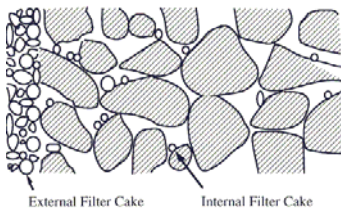
- Cost effective deep-water risers with simple cross-section
- Cost effective installation methods
- Documentation of sour service resistance
- Documentation of integrity and fatigue life



Statoil Expectations

Call of Proposal – Water Handling

- From incremental to disruptive innovation
 - Investigation of novel solutions to treat produced water and sea water and monitor quality
 - Feasibility of subsea discharge of produced water in deep water
 - Robust modelling and prediction tools of reservoir injectivity
 - Investigation of the fundamental processes behind reservoir souring and formation damage caused by SO_4^{-2} induced scaling and particles naturally occurring in produced water and sea water
 - Material technology to document integrity and fatigue life of structural components
 - Cost effective deep-water risers with simple cross-section (eg. steel)



There's never been a better
time for **good ideas**

ERC-RPM
Engineering Research
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