Oil / Water / Sand Quality Measurement

Key Enabler for Subsea Separation Development

SUT Control Down Under - 19th October 2016

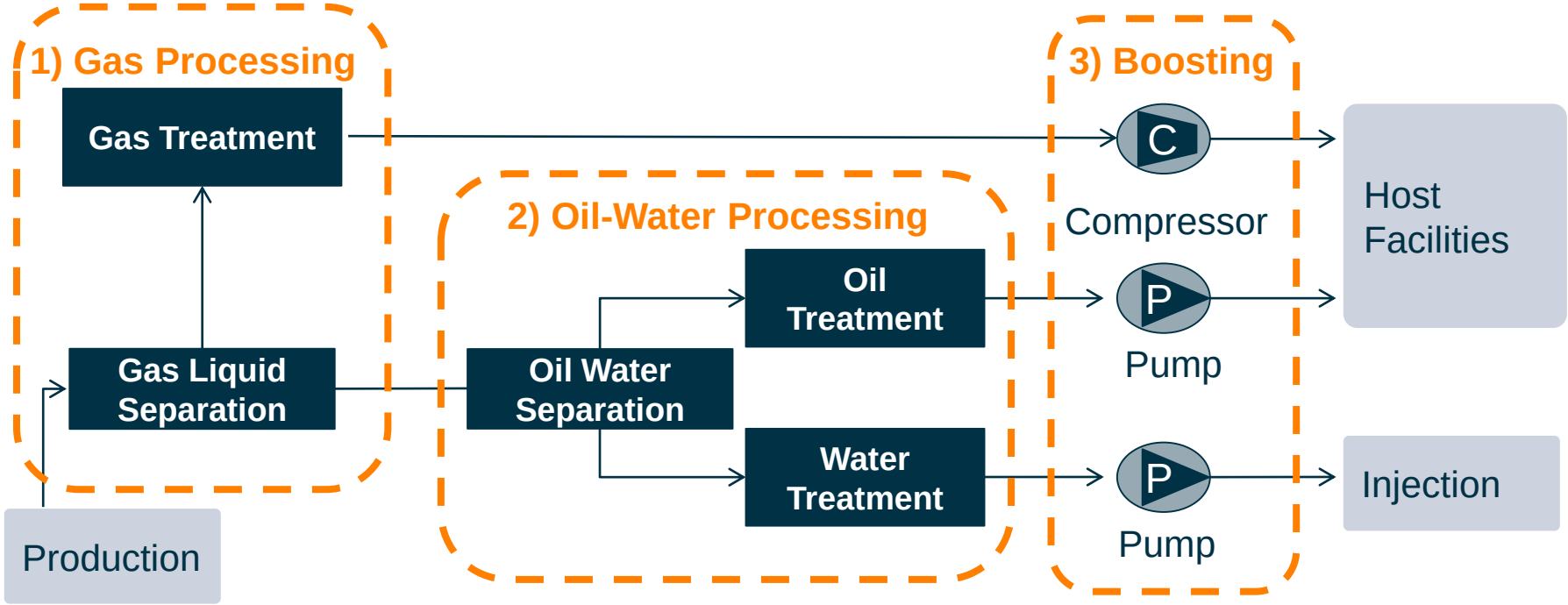
Si Huai Yeaw – Senior Process Engineer

Agenda

- Introduction
- Subsea Separation Process Overview
- Oil / Water / Sand Quality Measurement
- Conclusion

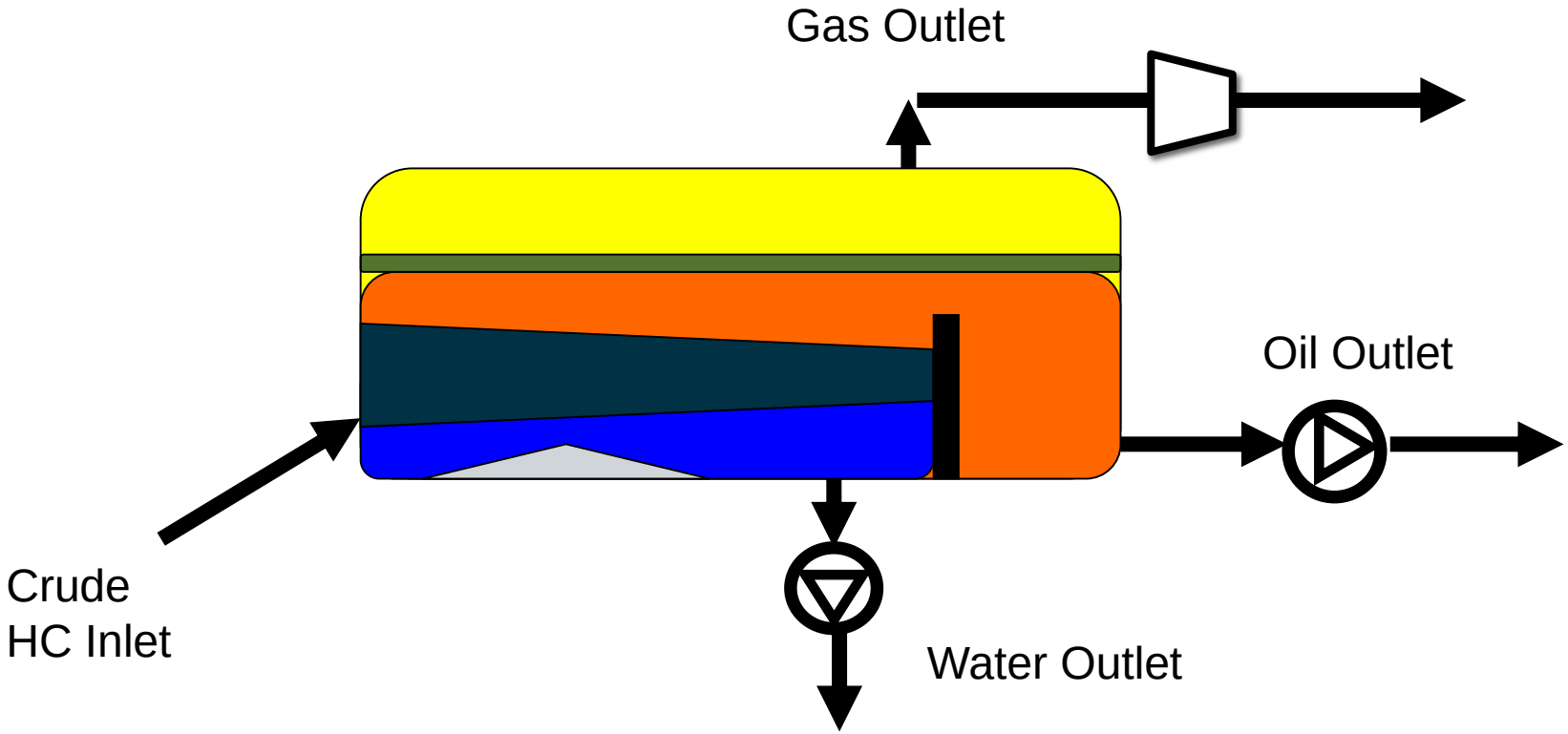
Advanced Subsea Production

Typical Subsea Process Block Diagram - Building Blocks

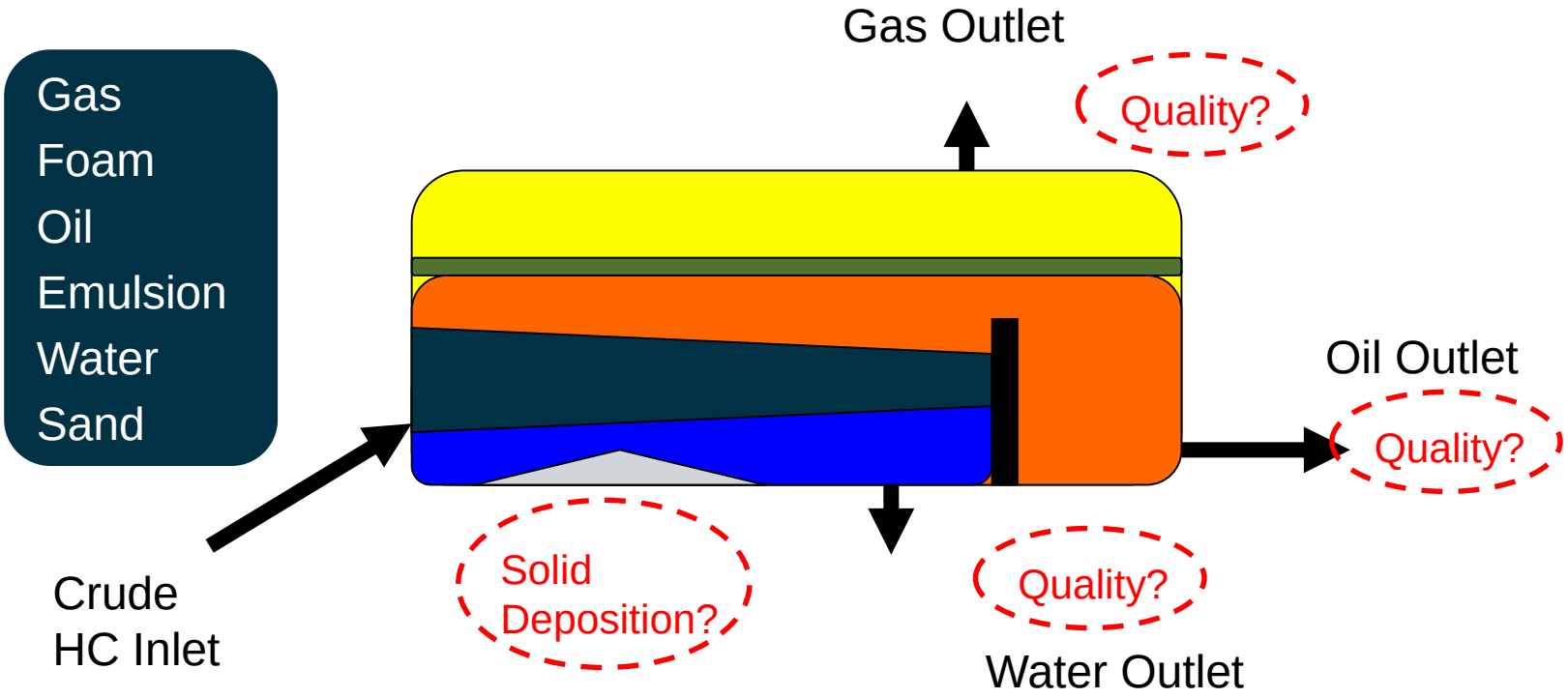


AkerSolutions

Subsea Separation Process



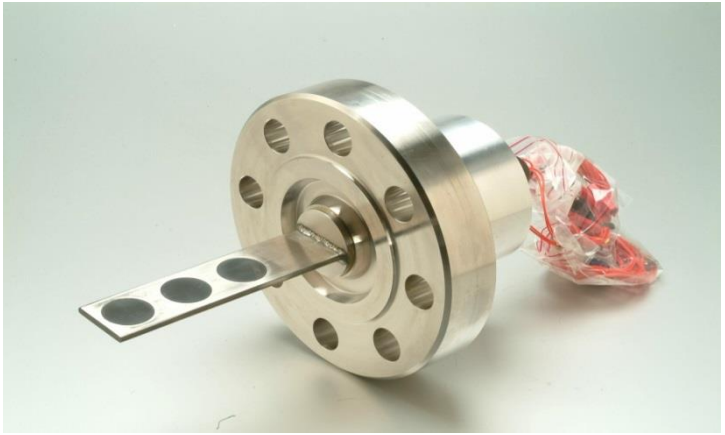
Subsea Separation Process – Sensing & Control



AkerSolutions

Oil Quality - Sensing

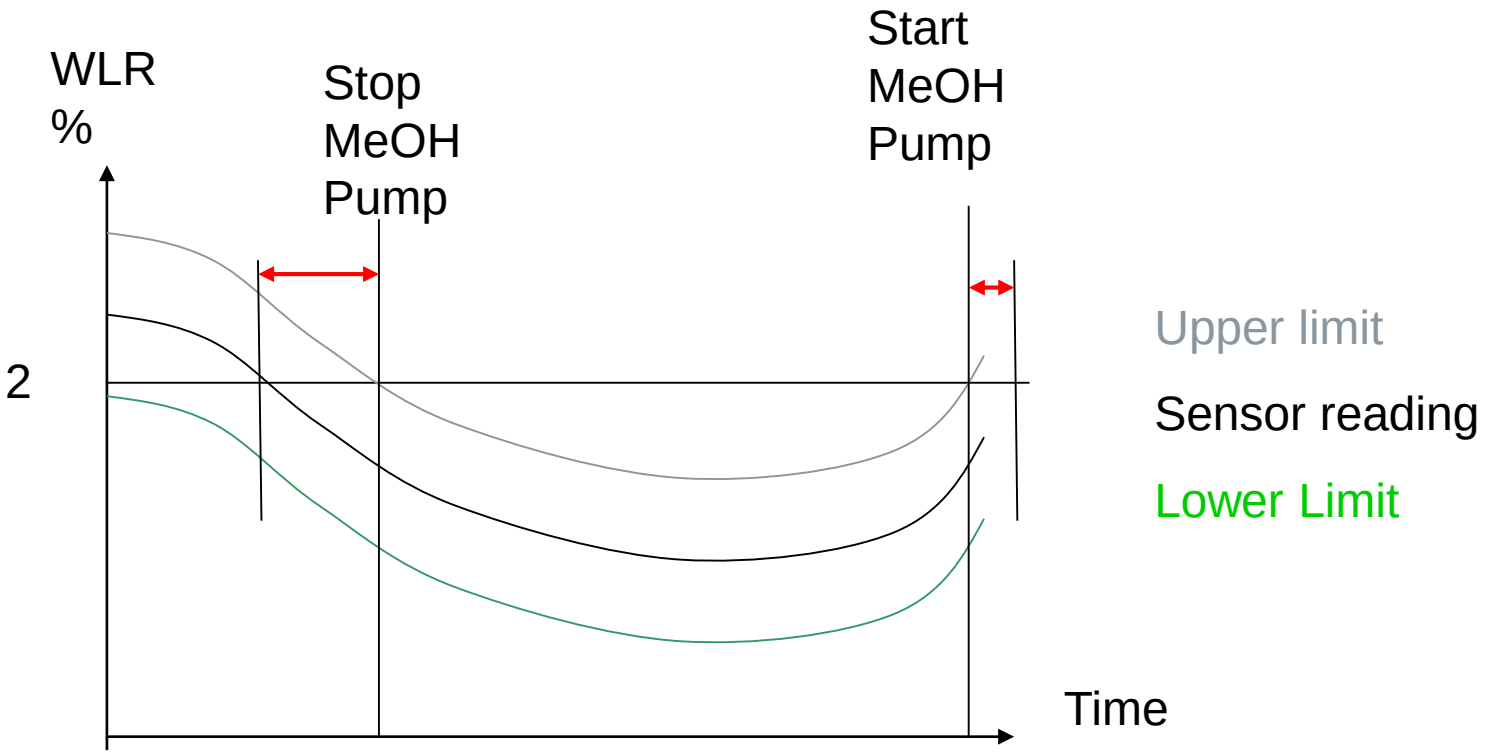
- What to measure?
  - Water in oil (WIO) quality
- How to measure?
  - Water content sensor
  - Typically – microwave, capacitive



- Why measure?
  - Understand the performance of separator
    - Lower the oil/water interface level, increase oil retention time
    - Addition of chemicals (eg. emulsion breaker)
  - Injection of hydrate inhibition chemicals (MEG / Methanol), as hydrate prevention measurements

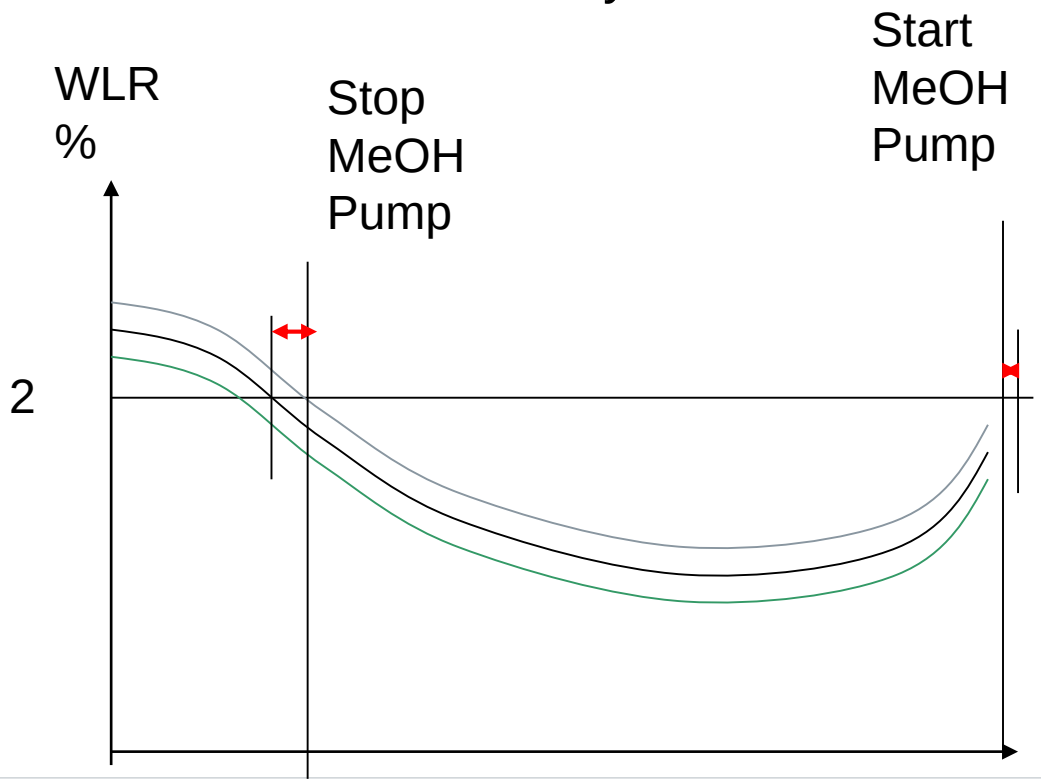
Oil Quality Sensing Example (1)

- Consider 0.5% accuracy



Oil Quality Sensing Example (2)

- Consider 0.2% accuracy



A more accurate sensor will give less MeOH usage

Upper limit

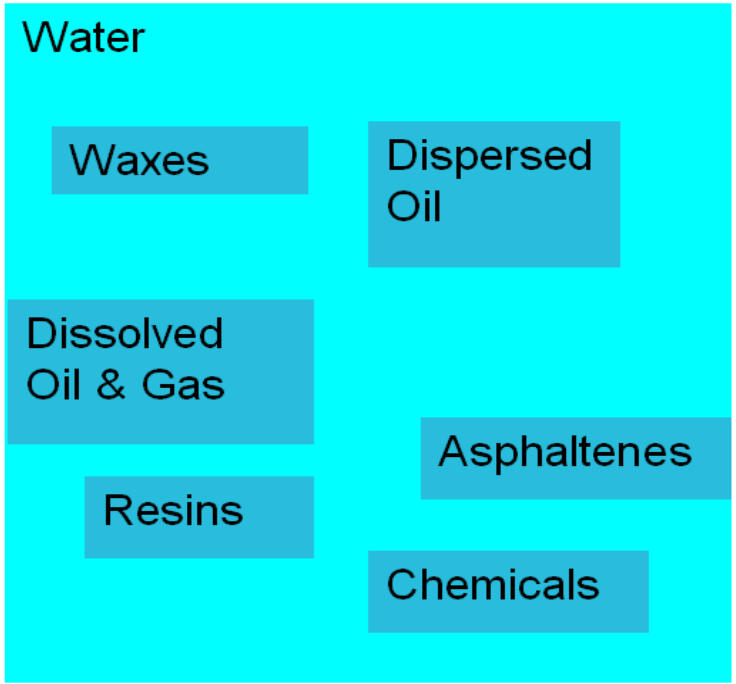
Sensor reading

Lower Limit

Water Quality - Sensing

- What to measure?
  - Amount of the oil (HC liquid) in the water phase
- How to measure?
  - Several types of technology
  - Photo-acoustic, fluorescent, optical, ROV sampling
- Why measure?
  - For water disposal to sea
    - Satisfy the environmental limits for water disposal to sea
  - For water reinjection to well
    - Ensure that the smooth operation, as offspec water may affect well injectivity
    - Reduced injectivity from excessive oil content is often reversible, i.e. will get better over time when clean water is injected

Water Quality Sensing – What is the “Oil in Water (OiW)”?

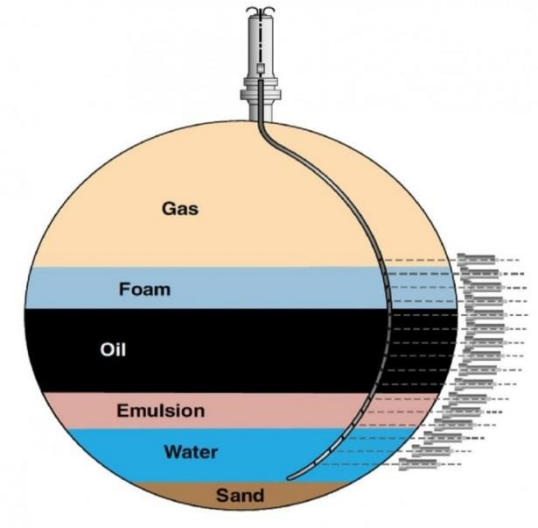


- Oil (HC) may exists in different form in continuous water phase
- The definition of OiW is not uniform
- Also, different types of oil sensors and analysis react to different HC components in the mixture.
- Key → understand the definition of OiW for any given specific application

AkerSolutions

Sand Deposition - Sensing

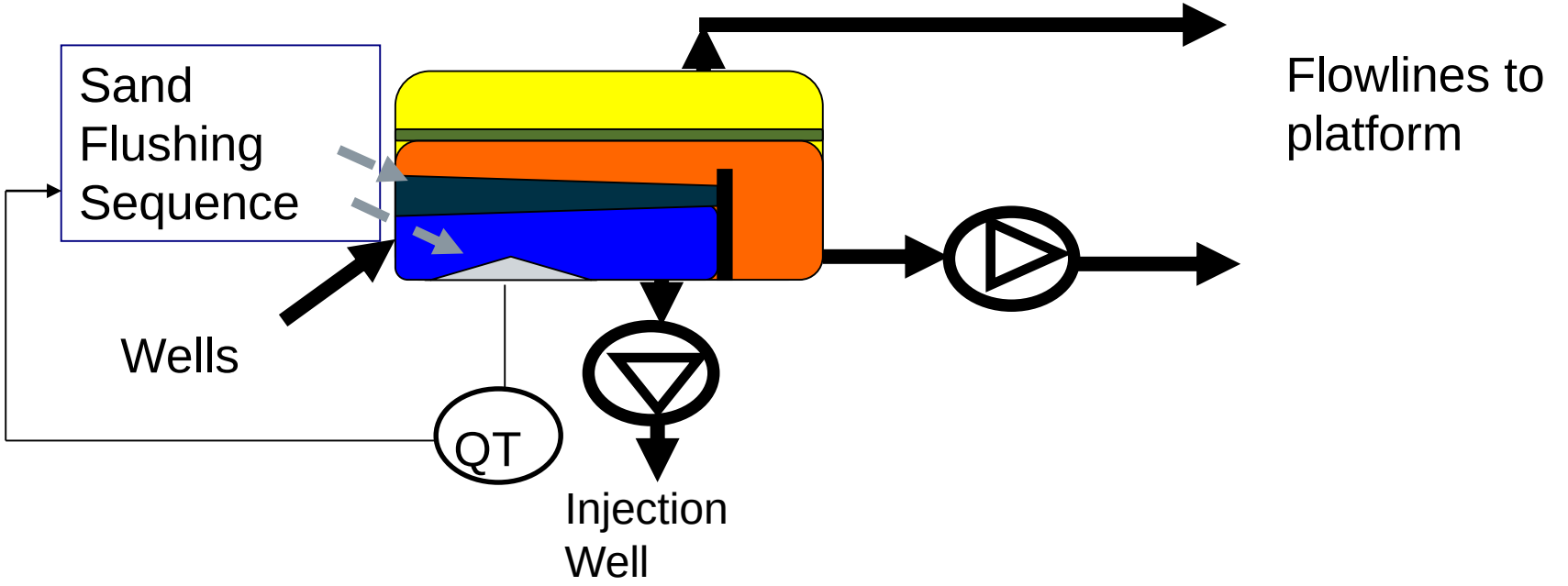
- What to measure?
  - Sand accumulation in the separator
- How to measure?
  - Several types of sensor available
  - Nucleonic, thermal, ultrasonic



- Why measure?
  - To determine the when sand flushing is required
    - Flushing has a cost (performance of the separation, pump duty etc.), so one does not want to flush too often
  - If you flush too late, you may not be able to get the sand out (flushing system overwhelmed)

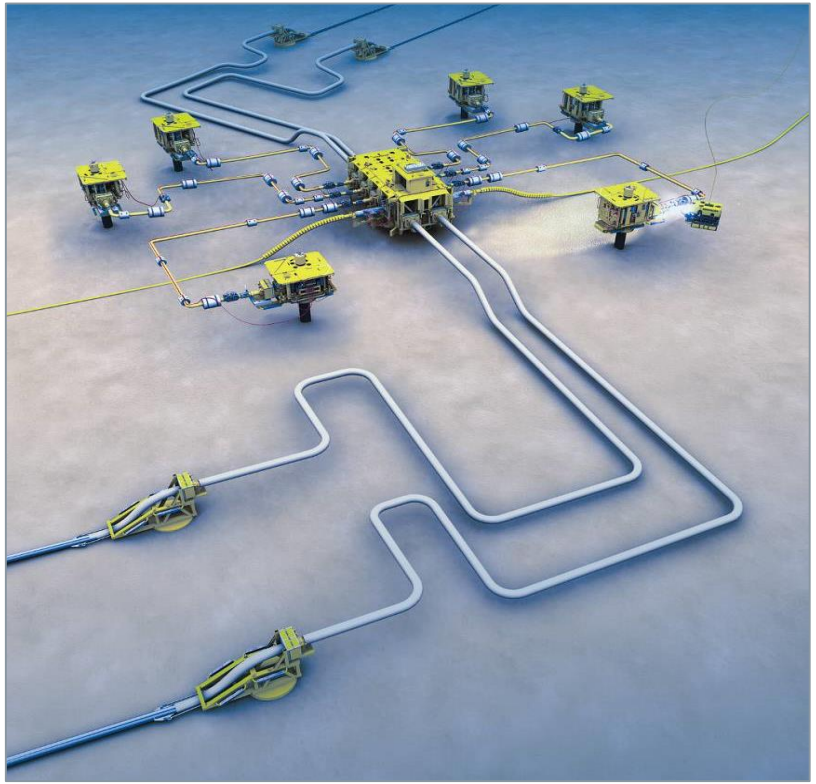
AkerSolutions

Quality Control Loops: Sand Flushing



Key Takeaway

- **Quality measurements** are vital during the design and operation phase of any given subsea system
- The **type and suitability** of the sensors are dependent on the system design and specific applications
- **Key to involve** subsea system vendor for the system design prior determining the sensors requirements



Thank You / Questions

Ready for the Advanced Subsea Production Systems

Uniquely positioned to **design, equip, build and maintain** the subsea systems of the future

AkerSolutions

Copyright and Disclaimer

Copyright

Disclaimer

This Presentation includes and is based, inter alia, on forward-looking information and statements that are subject to risks and uncertainties that could cause actual results to differ. These statements and this Presentation are based on current expectations, estimates and projections about global economic conditions, the economic conditions of the regions and industries that are major markets for Aker Solutions ASA and Aker Solutions ASA's (including subsidiaries and affiliates) lines of business. These expectations, estimates and projections are generally identifiable by statements containing words such as "expects", "believes", "estimates" or similar expressions. Important factors that could cause actual results to differ materially from those expectations include, among others, economic and market conditions in the geographic areas and industries that are or will be major markets for Aker Solutions' businesses, oil prices, market acceptance of new products and services, changes in governmental regulations, interest rates, fluctuations in currency exchange rates and such other factors as may be discussed from time to time in the Presentation. Although Aker Solutions ASA believes that its expectations and the Presentation are based upon reasonable assumptions, it can give no assurance that those expectations will be achieved or that the actual results will be as set out in the Presentation. Aker Solutions ASA is making no representation or warranty, expressed or implied, as to the accuracy, reliability or completeness of the Presentation, and neither Aker Solutions ASA nor any of its directors, officers or employees will have any liability to you or any other persons resulting from your use.

Aker Solutions consists of many legally independent entities, constituting their own separate identities. Aker Solutions is used as the common brand or trade mark for most of these entities. In this presentation we may sometimes use "Aker Solutions", "we" or "us" when we refer to Aker Solutions companies in general or where no useful purpose is served by identifying any particular Aker Solutions company.