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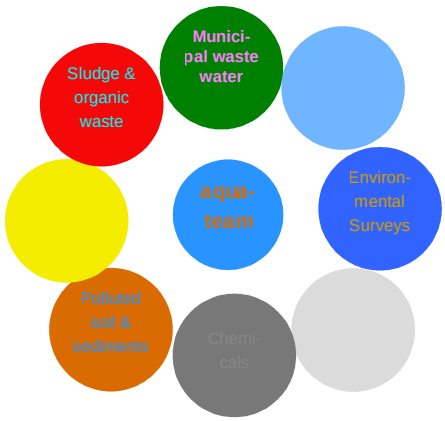

Technology transfer/bridging the gap/reducing time from development to validated product

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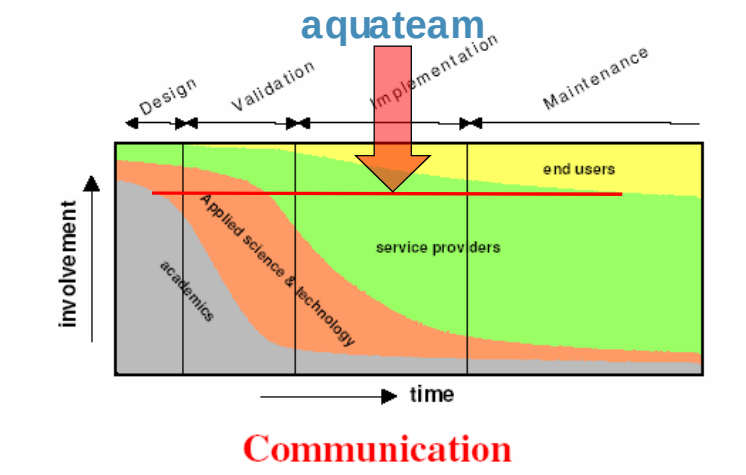

Clients-project examples

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- Shell – Draugen / Ormen Lange
- StatoilHydro – Statfjord, Snorre, Heidrun, Norne, Troll, Oseberg / Mongstad, Kollsnes, Melkøya
- BP – Ula, Gyda, Valhall
- ConocoPhillips – Ekofisk
- Vendors: Typically R&D with the small and innovative; Epcon→M-I Swaco [Compact Flotation Unit (CFU)], Kaldnes →Veolia [Mixed Bed Bio-Reactor (MBBR)], and concept studies for operators/engineering companies

Aquateam's speciality

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- Solving complex environmental problems requiring interdisciplinary project teams of highly qualified personnel within the following cathegories:
  - Chemistry
  - Microbiology
  - Biology
  - Toxicology
  - Process technology
- Support larger project teams and co-ordinate R&D

Degree of water treatment is defined from quality, quantity and recipient (offshore, onshore, reservoir, water and air).

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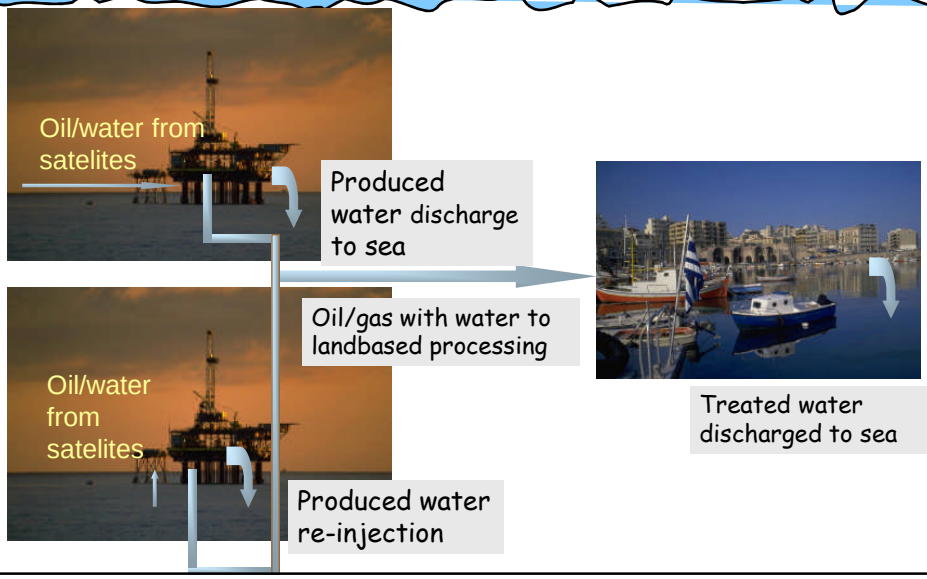

"Sustainable" and innovative water management requires:

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- Integrated water management (onshore, offshore, injection and re-injection)
- Holistic environmental impact assessment including:
  - Total discharges (land based and offshore) to sea/rivers (continuous and accidental)
  - Energy usage (CO_2, VOC to air)
  - Chemical usage and discharges

On-shore oil and gas processing

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- Water treatment for refineries, gas processing plants and petrochemical plants.
- Process design and evaluation for water and sludge treatment.
- Biological, chemical and physical processes.
- Training of operators.
- Laboratory investigations and pilot testing.
- Sampling and monitoring programs.

On-shore oil and gas processing, examples of clients

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- ExxonMobil
  Pilot → Full-scale biological water treatment.
- StatoilHydro
  Kollsnes gas terminal: Operational assistance; process evaluations; process design for extension; removal of BTEX; biological treatment.
  Snøhvit LNG: Third party verification of wastewater treatment plant; commissioning; operator training; trouble shooting.
  Hammerfest LNG: Third party evaluation of treatment; commissioning; operator training; trouble shooting; operation support; risk assessments; biological treatment, amines, BTEX.
  Mongstad refinery and terminal: Evaluation of biological, physical and chemical treatment processes; sampling and monitoring; ECOTOX.
- Shell
  Ormen Lange gas terminal: Risk assessment of water treatment plant

On-shore oil and gas: CO_2-capture examples of studies

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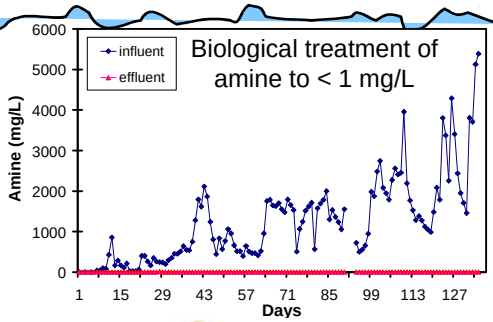
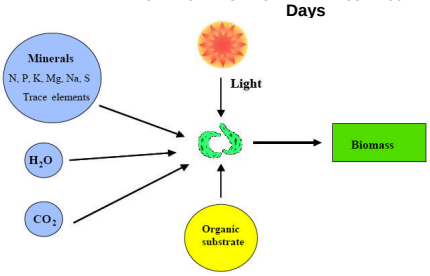
- Amine absorbers to capture CO_2 from flue gas and crackers. Amine polluted water need to be treated.



- Growth of algae to capture CO_2 and produce renewable and sustainable bio-fuel from the biomass.



PW, PWRI & Challenges

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- Environmentally sensitive areas (Arctic, Lofoten)
  - **95%** of all PW to be reinjected
  - Maintain uptime!!
  - Equipment, spare parts, pumps, materials
  - Environmental drivers!!!
- Reservoir souring control (nitrate/biocides?)
- Topside PW quality control (microbiology, solids)
- High pressure reservoirs - Injectivity

JIP – Sustainable PWRI

StatoilHydro, Total, BP, ConocoPhillips, YPF, Shell, Yara

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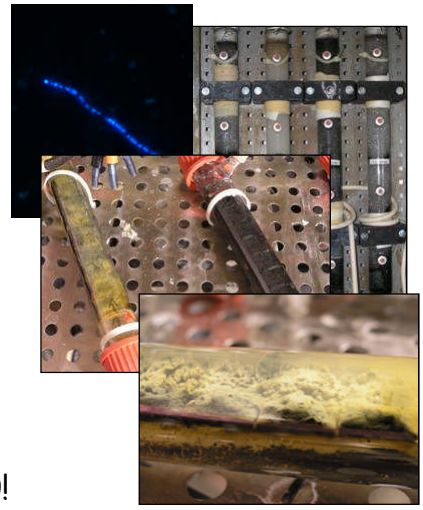
- Aquateam initiated a JIP in 2007
- Mitigation of reservoir souring applying nitrate to produced water
- Controlling MIC corrosion
- Utilises traditional methods, molecular microbiology and microsensors
- 12 "reservoir columns" and topsides being tested



Seeking a final partner for 2010!

Produced water treatment

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- Independent concept and pre-feasibility studies
- Third party investigations
- Trouble shooting
- Operational assistance
  - Biofouling, sulphide, MIC, emulsion formation
- Equipment rental
- Operator training

Chemical Hasard Assessment and Risk Management (CHARM)-OSPAR

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Aquateam supported jointly with TNO the OSPAR authorities, chemical suppliers (EOSCA) and the operators (E&P Forum, OLF, NOGEPA, UKOOA) in their development of an environmental risk assessment method for chemicals . The CHARM model was developed in a EUREKA project.

Aquateam - PWRI

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- Feasibility studies, technology & verification
- Souring mitigation
- Injectivity
- Ula 1992 – 1994
- Snorre 1998
- Ekofisk 2001 – 2004
- Draugen 2003 – 2005
- Statfjord backflows
- Gyda feasibility study
- Reservoir souring mitigation 2006-2010

- Ekofisk
  - Backflows
  - Feasibility studies
  - Souring & mitigation
  - Treatment technology
  - Verification
- Draugen
  - Feasibility
  - Souring & mitigation
  - Injectivity
  - Corrosion
- Petrobras
  - Courses and standars for backflowing wells