

Produced Water Treatment

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Definition

- **Produced water** is a term used in the oil industry to describe **water** that is **produced** as a by-product along with the oil and gas. Oil and gas reservoirs often have **water** as well as hydrocarbons, sometimes in a zone that lies under the hydrocarbons, and sometimes in the same zone with the oil and gas.
- Many oil formations can produce as much as five barrels of contaminated water for every one barrel of oil
- Fracking and SAG-D processes produce similar waste water
- Produced water is conventionally treated through different physical, chemical, and biological methods.

Produced Water Contaminants

- Produced water is a complex mixture the detailed constituents of which are determined by the nature of the oil and gas reservoir and to a lesser extent by field maturity.
- Contains dissolved inorganic salts and organic compounds (such as PAH's, Benzene) characteristic of the geological formation as well as bacteria
- Dispersed, insoluble oil droplets (hydrocarbons)
- residual production and treatment chemicals including demulsifiers, corrosion inhibitors, antifoaming agents, anti-scalants.
- It may also contain some corrosion products.
- May contain radioactive minerals
- VOCs

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Environmental and Health Impact

- Petroleum contains organic chemicals that are toxic to the environment and health like PAHs and Benzene
- Radioactivity can have mutagenic effects
- Excessive brine in produced water can contaminate potable water aquifers or rivers or poison soil
- Suspended solids in produced water will cause murkiness if discharged to rivers
- Chlorination of Produced Water will produce DBPs like THMs if improperly managed

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Treatment Options

- Coagulation/flocculation and settling
- Dissolved Air Flotation (ex. CFUs = Compact Flotation Units)
- Aeration – treatment through a degasifier to remove dissolved gases
- pH adjustment
- Coalescing Oil Water Separators/CPI (Corrugated Plate Interceptors)
- Evaporation (boiling off the water) – crystallization (used in ZLD plants)
- Filtration: Sand, Nutshell, Multi-Media, Active Carbon
- Ultra Filtration
- Bio-remediation (biological waste water treatment)

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Treatment Options - II

- Using Directional Solvents (solvents that selectively absorb water ex soy bean oil which when hot absorbs water)
- Ceramic membranes
- Reverse Osmosis
- Chlorination
- Sludge dewatering
- Hydro cyclones for sand and/or oil separation
- High tech media such as RECAM
- Mercury Removal Specialized media
- VSEP-RO, vibration shear enhanced process

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Process Monitoring

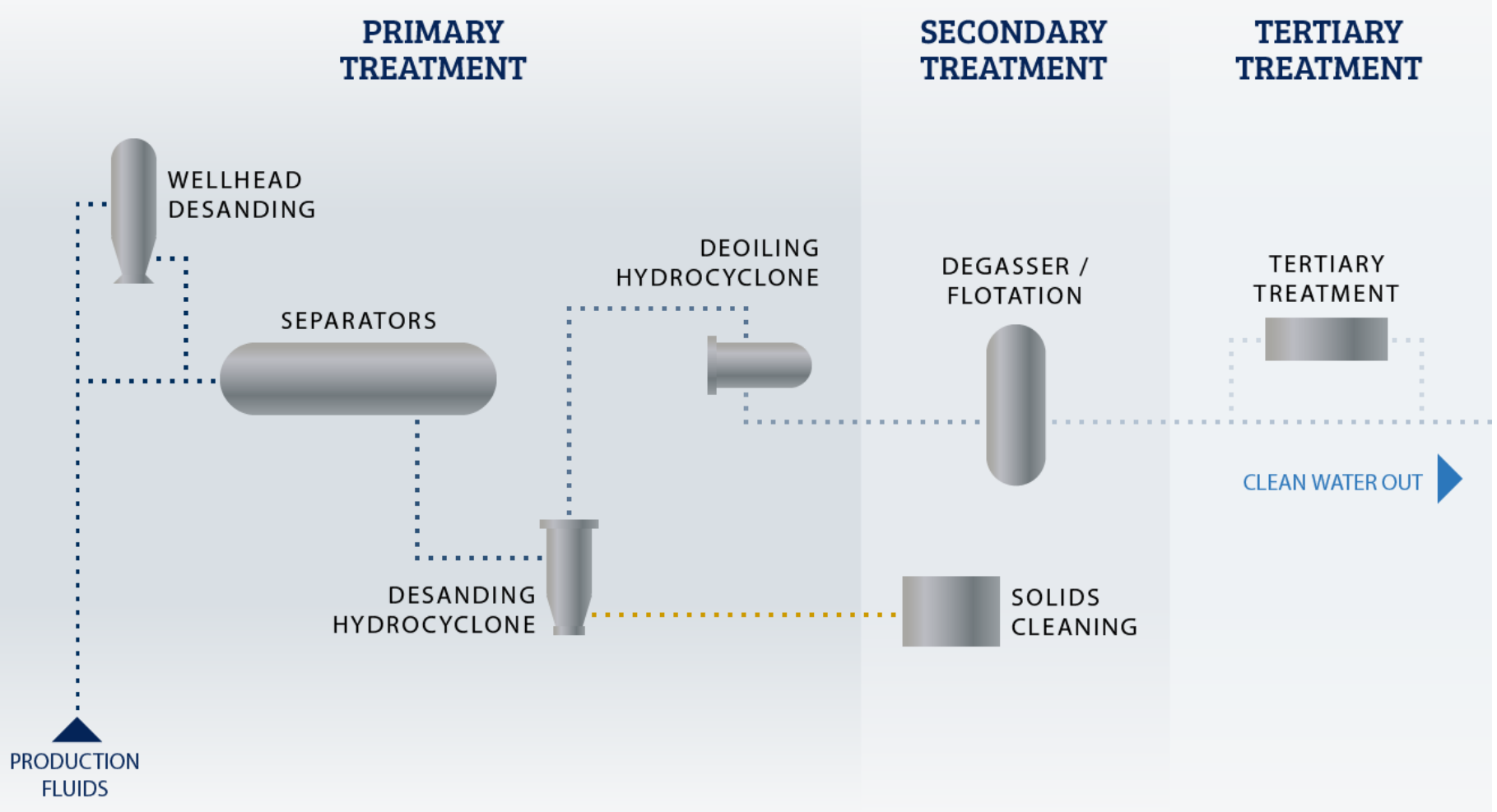
- Oil in water test
- TDS/Conductivity
- pH
- Turbidity
- Light Microscopy
- Macro lens Video Cameras
- Phase Separation Detectors
- TOC analysers
- Particle counters/detectors
- Bacteria tests
- Wet chemistry tests
- Density monitoring
- TPH, total petroleum hydrocarbons
- COD

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Sample Process Diagram



Legislation

- Disposal options of Produced Water depend on country:
 - USA legislation tends to be Lax
 - EU legislation tends to be very strict
 - Canada/Australia Legislation somewhere in-between

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Suppliers of Produced Water Treatment Systems/Chemicals

- OVIVO
- GE Water
- Siemens
- Veolia
- Enhydra (UK)
- Nalco
- Ashland
- Schlumberger

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