Produced Water Treatment to Enhance Oil Recovery

Siemens Oil & Gas
Water Technologies
Produced Water Treatment to Enhance Oil Recovery

Content

- Up-stream Water Treatment
  - Produced Water Treatment
  - Water Injection/Reinjection
  - Steam Assisted Gravity Drainage

- Downstream Water Treatment
  - Process Water Treatment
  - Wastewater Treatment
Serving All Sectors of the Petroleum Industry

Production (Oil Well)

Transportation (Pipeline or Boat)

Refining (Retail Products)

Marketing (Terminal and Filling Station)

Petrochemical/Chemicals
Oil & Gas Production
Produced Water Treatment Process Map

Produced Water

Solids Separation → Primary Produced Water Separation → Secondary Produced Water Separation → Tertiary Produced Water Separation

To Discharge, Reinjection or Reuse

Advanced Treatment → Solids Handling → To Disposal

Chemical Feed

VOC Control

Auxiliary Equipment
Oil & Gas Production
Produced Water Treatment

**Solids Separation**
- Wellhead Solids/Liquid Hydrocyclone

**Primary Produced Water Separation**
- Corrugated Plate Separators (CPS)
- API Separators
- Solid/Liquid Hydrocyclone
- Liquid/Liquid Hydrocyclone

**Secondary Produced Water Separation**
- Induced Gas Flotation Separators
- Dissolved Gas Flotation Separators
Oil & Gas Production
Produced Water Treatment

Tertiary Produced Water Separation
- Walnut Shell Filters
- Media Filters
- Cartridge Filters
- Activated Carbon Filters

Advanced Treatment
- Biological Treatment
- Membranes

Solids Handling
- Gravity Thickeners
- Filter Press
- Belt Filter Press
Oil & Gas Production
Water Injection/Reinjection Process Map

Well or Surface Water Feed

Coarse Screening/Strainers

Fine Solids Separation/Filtration

Deaeration

Sulfate Removal

Softening Systems

Solids Handling

To Injection

To Polymer Or Steam Flood

To Disposal

Chemical Feed Systems

Chlorine Generation/Feed Systems
Oil & Gas Production
Water Injection/Reinjection

Coarse Screening
- Back Flushing Strainers
- Traveling Water Screens

Fine Solids Separation/Filtration
- Media Filters
- Gravity Clarifiers
- Solids Contact Clarifiers
- Absorption Clarifiers
- Microfiltration Filters

Deaeration
- Vacuum Dearators
- Degasifiers
Oil & Gas Production
Water Injection/Reinjection

Sulfate Removal
- Sulfate Removal Systems

Softening Systems
- Brine Softeners
- Weak Acid Cation Softeners

Solids Handling
- Gravity Thickeners
- Filter Press
- Belt Filter Press
- Centrifuges

Chemical Feed Systems
- Chemical Feed Systems

Chlorine Generation/Feed Systems
- Electro-Chlorination Systems
Oil & Gas Production
Steam Assisted Gravity Drainage (SAGD)

Well or Surface Water Feed → Primary Oil/Water Separation → Secondary Oil/Water Separation → Silica Removal → Suspended Solids Removal → Softening → To Steam Generator → Solids Handling → To Disposal or Oil Recovery

- Chemical Feed Systems
- VOC Control
Petroleum Refining and Petrochemicals Process Water Treatment


Cooling Tower → Solids Handling
Petroleum Refining and Petrochemicals
Process Water Treatment

Screening/Grit Removal
- Bar Screens
- Trash Rakes
- Traveling Water Screens

Suspended Solids Removal
- Solids Contact Clarifiers
- Absorption Clarifiers
- Circular and Rectangular Gravity Clarifiers
- Gravity Filters
- Pressure Filters
- Microfiltration
Petroleum Refining and Petrochemicals
Process Water Treatment

Dissolved Solids Removal
- Hot and cold softeners
- Demineralization
- Continuous Deionization
- Reverse Osmosis
- Condensate Polishers

Dissolved Gas Removal
- Degasifiers
- Deaerators

Solids Handling
- Belt Filter Press
- Filter Press
- Gravity Thickener
- Centrifuges
Petroleum Refining and Petrochemicals
Typical Wastewater Treatment System

Raw Influent
- Screening/Grit Removal
- Primary Oil/Water
- Secondary Oil/Water
- Biological Treatment
- Biological Clarification
- Tertiary Treatment

Process Unit Wastewater
- In Process Treatment
- Solids Handling
- Oil Recovery
- Effluent Recycle/Reuse
- To Oil Recovery/Reuse
The Petroleum Industry Leader in Technology and Application Experience

Technologies Developments for the Refining and Petrochemical Industry

- Introduced Tow-Bro Clarifier - 1928
- Introduced API Separator - 1937
- Introduced Wet Air Oxidation - 1950
- Introduced DAF Separator - 1953
- Introduced RBC/SBC - 1969
- Introduced PACT® System - 1972
- Introduced Jet Aeration - 1981
- Introduced GAC Fluid Bed - 1987
- Over 1500 Installations Worldwide
Petroleum Refining and Petrochemicals Wastewater Treatment Technologies

Screening/Grit Removal
- Bar Screens
- Grit Collectors

Primary Oil/Water Separation
- API Separators
- Corregated Plate Separators
- Hydrocyclones

Secondary Oil/Water Separation
- DAF/DGF Separators
- IAF/IGF Separators
- Walnut Shell Filters
Thank you for your attention!