



WATER TREATMENT

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CETCO
OILFIELD
SERVICES
COMPANY



Water Treatment Applications

CETCO Oilfield Services provides water treatment services for all phases of oilfield production, from the well head to the refinery. Whether on a platform or in a tank farm, we can be found treating a variety of streams:

- Produced water treatment and polishing
- Well stimulations and acid flow backs
- Pipeline maintenance
- Decommissioning waste waters
- Initial well flow backs/completions
- Workover fluids and coiled tubing job
- Brine filtration and recycling
- Heating/cooling medium treatment

The CETCO Oilfield Services Process

CETCO Oilfield Services provides a unique and effective service to help customers manage unusual or temporary situations, such as off-spec discharges. Drawing on years of experience in water treatment, we have designed a rental fleet that meets a wide range of flow rates, temperatures, and pressures. Our technical and service teams have extensive training and are available at 24 hours notice. CETCO Oilfield Services Water Treatment Division specializes in the removal of hydrocarbons, solids, toxic materials, and other contaminants from oilfield wastewater streams produced during oil and gas operations, transportation, and storage.

CETCO's highly trained personnel optimize equipment and technologies to ensure our customers remain compliant with overboard water quality regulations while reducing waste disposal costs.



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Benefits of Using CETCO Water Treatment Services

- Ensuring overboard compliance
- Eliminating cost of waste transport and disposal onshore
- Segregation of waste streams so as not to impact process
- Employing innovative technologies to enhance production
- Avoid costly down-time

Features

- Single solution for complex wastewater
- Handles high solids and a broad range of ph
- Removes toxic heavy metals
- Drastic reduction in volume of waste

FlexTreat™ Treatment of Problematic Fluids

CETCO Oilfield Services waste water treatment experience has culminated in the design and implementation of a multi-stage treatment package. FlexTreat is a system which combines conventional water treatment technologies and proprietary media to effectively process waste water of wide ranging and uncertain composition. Waste water from a variety of different sources which contains solids, crude oil, drilling waste and production chemicals is treated to stringent discharge criteria. By employing gravity separation, chemical treatment, clarification, filtration, polishing and aeration FlexTreat provides a complete solution to problematic fluids.

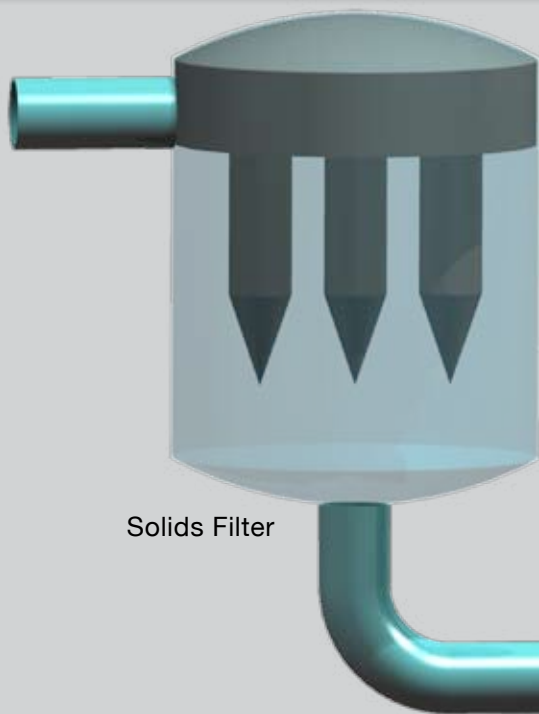
Typical design inlet parameters in the region of 100,000ppm oil and 80,000ppm solids can be effectively treated to <20ppm oil and <30ppm solids concentration at a rate of 6m³ per hour. Simple operability and process flexibility are the key to the effectiveness of the FlexTreat package.

FLEXTREAT™

PATENTED MEDIA TECHNOLOGY

Benefits

- Removes free, emulsified and dissolved organics / hydrocarbons
- Can reduce contaminant levels to zero
- Solids Tolerant



Solids Filter

Features

- Extremely efficient at removing oil, grese and soluble organic
- Easy changeout of media
- Tolerates surging inflow
- Handles high concentrations



CrudeSorb Vessel

CRUDESORB®

CrudeSorb® is packaged for quick media change outs – essential on temporary flow back applications or at remote locations.



Proprietary Adsorption Media for Water Treatment

CETCO's CrudeSorb technology is a proprietary media based on resin, polymer and clay chemistry. It is a proven media, shown to be extremely efficient at removing oil, grease and soluble organics from water systems. CrudeSorb has been developed for the treatment of various waste systems and is packaged in canisters with a perforated central core for use in bespoke Radial Flow Vessels (RFV) which allow for a convenient media replacement procedure in oilfield applications.

The process fluids pass initially through the sock filter units to remove solids then enters the CrudeSorb vessel where they pass through the vertical columns of canisters, any free oil droplets will float to the surface where they are bled off.

The flow continues radially through the wall of media canisters where the Free, Emulsified and Dissolved Organics/ Hydrocarbons are adsorbed onto the CrudeSorb media.

The CrudeSorb RFV adsorption skid packages comprise of dual sock filter vessels and media containing vessels. The sock vessels can be arranged for series or parallel flow as a fluid pre-filter stage before media exposure. The adsorption vessel flow pattern is also flexible to allow series or parallel flow depending on required flow rates of a particular process or if retention time is critical for treatment.

Process Capabilities

A range of varying Skid unit sizes can be provided on a temporary basis to handle the following process parameters:

Design Pressure: up to 254 psig (17 barg)

Design Temperature: up to 100° C

Flow Ranges: 24-132 m³/hr (3600-20,000 BPD)

Bespoke units can be manufactured for installation to client specifications.

System Requirements

Inlet line pressure of approximately 4 barg, with a differential pressure across the system of 2-3 barg.
(Pumps can be provided if required)

Utility Requirements

Instrument air at 100 psig

Potable water for flushing/draining

System Performance

- Dependent on the condition of the process fluids, CETCO CrudeSorb can achieve almost zero discharge of Hydrocarbons.
- Current installations in the discharge daily between 2-4 ppm on permanent produced water duties.
- Discharge targets of <30 ppm are readily achievable on drilling flow back applications.
- CETCO CrudeSorb is also very effective in the removal of soluble components achieving 90%+ removal efficiency in some cases.

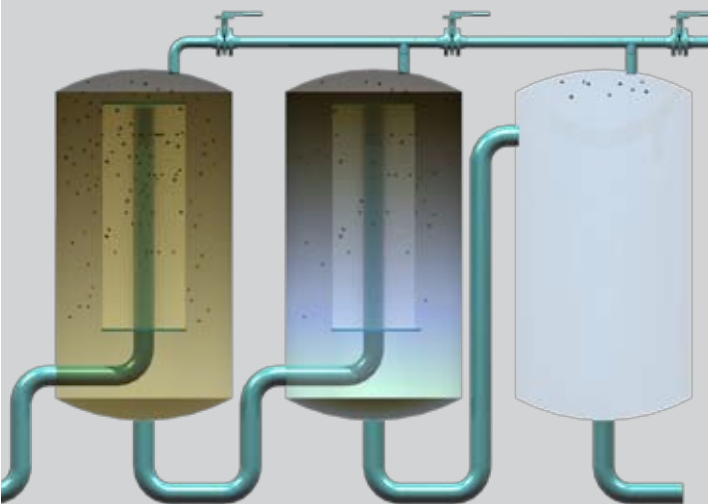


Benefits

- Improves existing Process to meet discharge criteria
- Low Opex
- Lower Capex costs for flow capacity
- Less deckspace and weight requirements
- Low media replacement costs
- Reduced chemical usage
- Downstream solids protection

Features

- Can reach environmental discharge requirements without further treatment
- Reduced media costs
- High turndown capability
- Handles fluctuating inflow without affecting performance
- Simple robust system with minimum operator intervention
- Small footprint
- Regenerate by backflushing



High-efficiency free oil
in water treatment process

Hi-Flow™ Process

CETCO Oilfield Services Hi-Flow Process is a simple and robust system that can treat high rates of free oil in water, allowing the operator to discharge fluid back into the environment in compliance with legislative requirements.

The Hi-Flow Process utilises a specifically designed media composition and orientation within canisters which are stacked and sealed onto internal guide rods.

The fluid is forced through the media where the physical pathways and media interactions force free oil to merge and release for accelerated gravitational separation.

The Hi-Flow Process can deliver oil in water reductions from 1,000ppm and can achieve discharge levels of below 10ppm on a constant basis for extended periods without media replacement.

The Hi-Flow Process can handle small to large volumes of liquid from 275 BWPD trial systems to more than 20,000 BWPD skid mounted units. It is not impacted by large fluctuations in free oil inlet concentrations and can be used on projects of short or long duration.

Technical Parameters

Current equipment can be provided on a temporary basis to handle the following process parameters:

Design Pressure: up to 16.5 barg (240 psi)

Design Temperature: 0° C-100° C

Design Flow Rates: No minimum flow

Units can be manufactured for installation to client specifications.

- We have small test/trial unit—275 BPD (4.6 m3/hr)
- Other units currently up to—25,000 BPD(165m3/hr)
- Pressure drop across complete system at 2 barg

Utility Requirements

Instrument air at 7 barg (100 psig)

Potable water for flushing/draining

HI-FLOW™

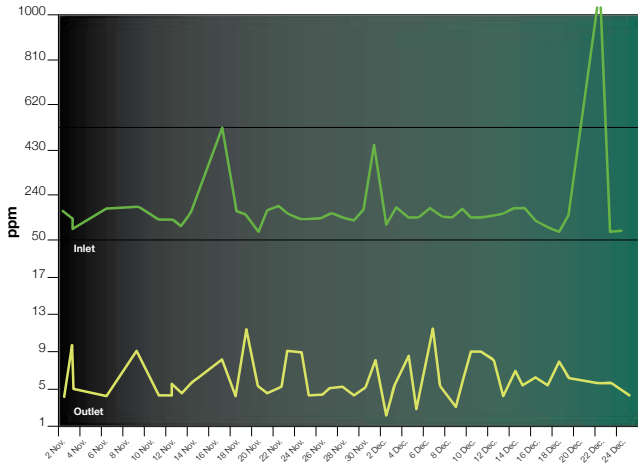
LONG LIFE MEDIA



Field Results in Gulf Of Mexico

| Date | Sample Time | LP Separator | Overboard | Oil | Total |
|----------------|-------------|--------------|------------|--------------|---------------|
| | | out | water | Removal | |
| | | Inlet PPM | Outlet PPM | Efficiency | Barrels |
| 1 Oct | 15:00 | 457 | 4 | 99.99 | 311 |
| 2 Oct | 15:30 | 189 | 3 | 99.98 | 554 |
| 5 Oct | 15:00 | 107 | 3 | 99.97 | 804 |
| | 18:00 | 219 | 14 | 99.94 | 2,320 |
| 6 Oct | 6:00 | 188 | 6 | 99.97 | 3,758 |
| | 12:00 | 33 | 7 | 99.79 | 4,688 |
| | 18:00 | 20 | 6 | 99.70 | 5,968 |
| 7 Oct | 12:00 | 228 | 6 | 99.97 | 8,160 |
| | 18:00 | 80 | 5 | 99.94 | 9,480 |
| 8 Oct | 6:00 | 256 | 8 | 99.97 | 11,848 |
| | 12:00 | 34 | 5 | 99.85 | 12,623 |
| | 18:00 | 27 | 6 | 99.78 | 12,998 |
| 9 Oct | 11:00 | 10 | 5 | 99.50 | 17,393 |
| | 13:00 | 20 | 6 | 99.70 | 18,285 |
| | 19:00 | 12 | 4 | 99.67 | 18,787 |
| 10 Oct | 0:00 | 20 | 4 | 99.80 | 19,200 |
| | 6:00 | 18 | 2 | 99.89 | 20,266 |
| | 12:00 | 17 | 4 | 99.76 | 20,884 |
| | 18:00 | 18 | 4 | 99.78 | 21,111 |
| Average | | 103 | 5 | 99.84 | 11,023 |

Results from CETCO Oilfield Services Hi-Flow Process



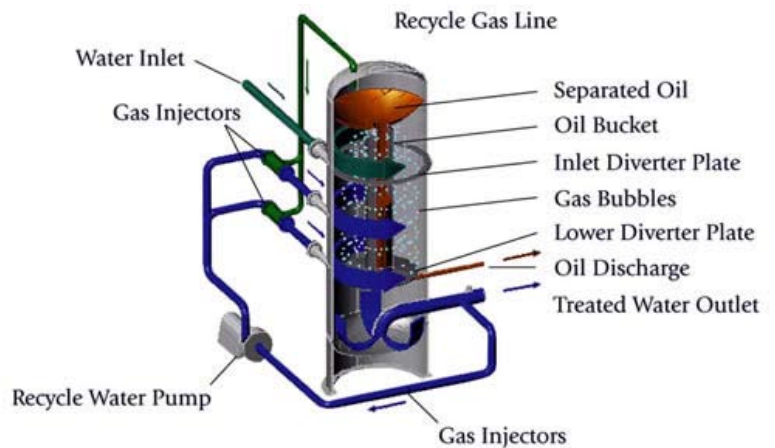
Produced Water Treatment System for high-efficiency removal of oil, gas, and solids

Benefits

- Efficient oil removal
- Low chemical usage
- Better performance/discharge compliance
- Less deck space and weight
- Ease of operation
- Small vessels
- Solids tolerant
- No moving parts
- Infinite turndown

Features

- Applied fluid dynamics
- Small footprint
- Short residence time
- Four phase separator
- Supplements existing process



CrudeSep® is a compact 4-phase separator designed to treat produced water, reducing oil content in the water to acceptable discharge levels over a wide range of flow rates and conditions. Oil in water reduction to 5 ppm (or below 10 ppm) are achievable dependent on water conditions.

CrudeSep is a produced water treatment vessel operating at near atmospheric pressure. Oil recovery and solids removal is achieved by induced gas flotation and a cyclonic motion system. Produced water enters the CrudeSep vessel through tangential nozzles which are geometrically spaced to eliminate the effects of surge or slug flow. Influent fluid enters a treatment zone where continuous recycle maintains a minimal spin providing sufficient centrifugal force for immediate oil/water separation. Gas bubbles are injected with recycled water below the inlet water nozzles to maintain a continuous supply of 'floatation' gas.

Flotation effects and centrifugal forces will bring the oil droplets to the surface where they are subsequently skimmed to the oil bucket. CrudeSep can also be used upstream of CETCO's Hi-Flow and CrudeSorb technologies as a primary oil separation system.



Performance

CrudeSep achieved up to 95% efficiency in oil in water reduction and regularly meets discharge criteria below 30 ppm without chemical usage.

Further reductions to 5 ppm have been achieved with appropriate chemical application.

Technical Parameters

We have a small test unit capable of 2 x 1,500 BPD
2 x (10m³/hr) to handle the following process parameters:

Design Pressure: up to 16.5 barg (240 psi)

Design Temperature: 0° C-100° C

Design Flow Rates: test unit 275 BPD (4.6 m³/hr)

Pressure drop across unit: 0.5 barg

24" and 48" units are currently under manufacture.
Units can be manufactured for installation to client specifications.

Utility Requirements

Clean instrument air at 7 barg (100 psig)

HMI Panel (PLC) 1 x 93-240 VAC

1 Phase-Max 10 amps



CrudeSep

EQUIPMENT SPECIFICATIONS

| Model | Vessel Diameter (in) | Vessel Height (mm) | Design Capacity (bpd) | Design Capacity (m ³ /hr) |
|-------------|----------------------|--------------------|-----------------------|--------------------------------------|
| CrudeSep 18 | 18 | 1200 | 1,500 | 10 |
| CrudeSep 24 | 24 | 1300 | 3,300 | 22 |
| CrudeSep 30 | 30 | 1650 | 7,800 | 52 |
| CrudeSep 36 | 36 | 1950 | 15,100 | 100 |
| CrudeSep 40 | 48 | 2600 | 36,200 | 240 |
| CrudeSep 50 | 60 | 3250 | 73,300 | 485 |
| CrudeSep 60 | 72 | 3900 | 120,900 | 800 |

CRUDESEP®

SAFE REMOVAL OF MERCURY AND ARSENIC

Benefits

- Safely captures mercury and arsenic
- Can reduce contaminant level to <2ppb
- Utilizes existing CrudeSorb RFV equipment design

Features

- Removes all four forms of mercury
- Combines hydrocarbon, mercury and arsenic removal



Mercury

200.59

33

As



Arsenic

74.922



CrudeSorb®MR Mercury Arsenic Removal Media

CrudeSorb MR is a new media material that can be packed in the canister similar to the CrudeSorb media. This new media is still based on organoclay technology but it has been heavily modified to enhance mercury and arsenic adsorption through both physical removal and chemical bonding. CrudeSorbMR is effective on all sources of mercury including the organic type of mercury, mercury element (zero valent), and mercury ions (both I and II valent). Additionally, CrudeSorbMR can also be as effective as the traditional CrudeSorb media to remove oil, grease, and other organic contaminant molecules when needed.

CRUDESORB®MR

SOLIDS REMOVAL TREATMENTS

Bulk Oil, Solids Control and Chemical Treatment

CETCO Oilfield Services can remove bulk oil through gravity and flotation technology. The process stream enters the 120 barrel separation (weirbox) comprised of four individual compartments. Each compartment has chemical injection, sparging, and oil skimming capabilities. The tank provides a great deal of flexibility in breaking emulsions, segregating solids, and oil recovery. Any unexpected surges of oil, solids, and undesirable waste products can be isolated and treated independently. Oily water is progressively cleaned from one compartment to the next.

Solids Removal

CETCO can provide various solids filter skids depending on the rate desired. Various micron sizes and fabrics are available for specific applications. All dual vessel skids are designed for duty-standby operation.

Desander

The wellhead cyclonic de-sander is an innovative product from CETCO Oilfield Services which enables the recovery of sand from multi-phase well streams during well clean-up operations.

Complete Solutions Provider

Our turnkey approach to the treatment of oilfield wastewater streams places personnel and safety first. Consistent results produce environmentally compliant assets with increased oil recovery and ultimate production maximizing your return on investment.

Additional Services

- Pump rental (4,000-25,000 bbls/day)
- Partical size distribution analysis (Jorin)
- Research and develop chemical treatment solutions



Weirbox



Solids Removal Skid

WATER TREATMENT



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