

COMPLETE UPSTREAM PRODUCED WATER TREATMENT SYSTEMS



CETCO[®] MONARCH[™]

Produced Water Treatment Systems



CETCO
OILFIELD
SERVICES





CETCOMONARCHTM

Produced Water Treatment Systems

Integrated design engineered and manufactured exclusively by CETCOMONARCH for both oilfield and industrial oil & water separation and deoling applications.

CETCOMONARCH's Produced Water Treatment Systems epitomize performance, value, and quality. Our systems rid our customers of the frustrations associated with non-performance, size, and costs that come with most equipment. They are capable of handling everything necessary for separating/treating gas/oil/water from a production stream.

With more than forty years cumulative experience, CETCO Oilfield Services Company and Monarch Separators Inc. have been able to focus on the design, technology, engineering, and manufacturing to provide their customers treatment systems with unparalleled removal efficiency, maintenance-free design, reliability, and durability.

The results speak for themselves—with installations around the world and proven results, CETCOMONARCH Systems are the technology of choice for produced water treatment.

The difference is clear.

Upstream Produced Water Treatment

Free Oil Content
>2,000 ppm Inlet @ >150 Microns >Oil Droplet

Primary Treatment

Reduces oil in water levels
from 20,000 ppm
to 200-300 ppm

Secondary Treatment

Reduces oil in water levels
from 200-300 ppm
to 25-30 ppm

<10 ppm Outlet @ > 10 Microns >Oil Droplet

Tertiary Treatment

Reduces oil in water levels
from 50-75 ppm
to <10 ppm

Primary Treatment:

- Corrugated Plate Separators
- Liquid/Liquid Hydrocyclones

Secondary Treatment:

- Horizontal Induced Gas Flotation/Dissolved Gas Flotation Vessels
- Vertical Induced Gas Flotation/Dissolved Gas Flotation Vessels
- Compact Flotation Vessels

Tertiary Treatment:

- Walnut Shell Filters
- Hi-Flow[®] Filters
- CrudeSorb[®] Filters
- GAC Filters
- Desanding Equipment
Wellhead Desanders
Solid-Liquid Hydrocyclones



Primary Treatment

CETCOMONARCH CPI & SCPI Oil Water Separators

Performance, Value, and Quality

For various oilfield and industrial separation applications, the CETCOMONARCH Corrugated Plate Interceptor (CPI) fulfills all of the prerequisites necessary for separation of oil, water, and solids from a wastewater or produced water stream. Buyers and end-users alike enjoy a technology epitomizing performance, value, and quality.

A Leading Standard in Oil/Water Separation

CETCOMONARCH has engineered and manufactured CPI's that emphasize complete customer satisfaction. With their combination of removal efficiency, maintainability, and durability, the CETCOMONARCH CPI Separator remains a paragon of oil, water, and solids separation technology. The results speak for themselves. With well over two thousand worldwide installations, CETCOMONARCH's CPI Separator is the preferred technology for oil, water, solids separation.

Benefits

- Standard Models to 150,000BWP/4500gpm
- High Performance and Reliability
- No Moving Parts and Fully Customizable Design
- API 421 Design & ASME Code Vessels Available
- Complete Skid Mounted Packages Available

Applications

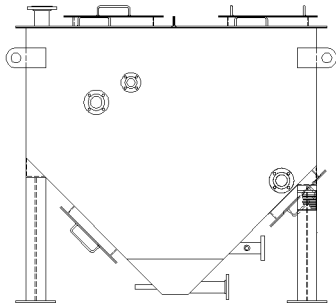
- Oil/Water Separation in Petroleum Refineries
- Oil/Produced Water Separation on Platforms
- Open Drains Oil/Water Separation
- Treating Ship/Terminal Bilge & Ballast Water
- Oil Separation from Industrial Wastewaters
- Oil/Water Separation in Chemical Plants
- Oil Removal from Environmental Remediation



CETCOMONARCH™ Atmospheric CPI Oil Water Separator

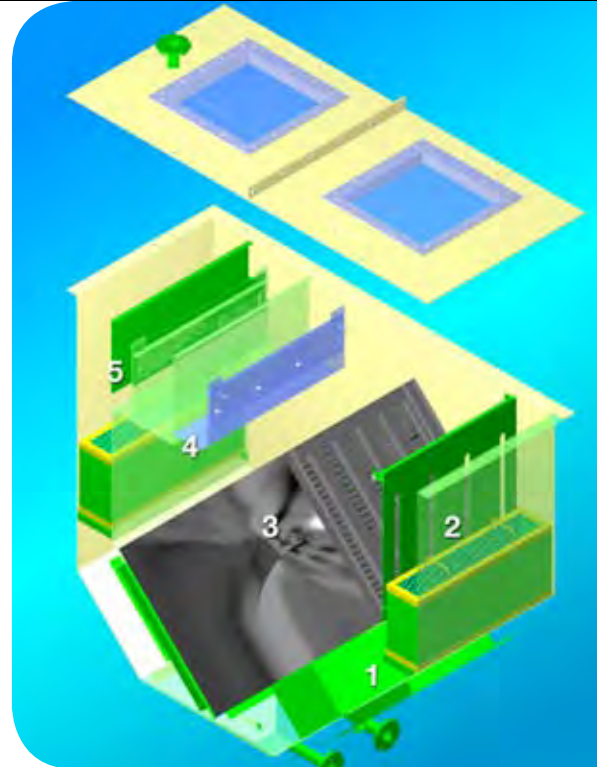


CETCOMONARCH™ ASME Coded CPI Oil Water Separator



Operation of the CETCOMONARCH CPI Separator : Simple & Efficient

- (1) Liquid flow is introduced into the CETCOMONARCH CPI separator via gravity or at a specific pressure.
- (2) The CETCOMONARCH CPI Separator distributes flow and creates the necessary laminar flow for proper oil & water separation.
- (3) The CETCOMONARCH CPI Separator and its internal CETCOMONARCH CPI Pack provides the necessary surface area to successfully separate oil from water and solids into their various distinct phases.
- (4) The lighter liquid or oil flows upwards and discharges via the CETCOMONARCH CPI Separator oil discharge sump.
- (5) The heavier liquid or water and flows downward and discharges via the CETCOMONARCH CPI Separator water discharge sump.



CETCOMONARCH's CPI Separator is designed to many U.S. industrial codes and incorporates advanced features such as a unique packaging design to enhance space and maintainability, long lasting materials of construction to extend the life of the system, and a flexible design providing an array of sizes, connections, and ancillary choices to meet individual client needs and requirements.

General Specifications

Functional

Service

- Oil Production
- Refining
- Chemical Processing
- Wastewater Treatment
- Hazardous Waste Remediation

Design Temperatures

Standard

- Up to 200F (93C)
- Custom Available

Design Flow Rates

Standard

- 150,000BWP/4,500 GPM
- Larger Flow Rates Available

Physical

Material of Construction

Tank or Vessel

- A-36 or 516 Gr. 70
- 304 or 316 SS
- Custom Available

Packs

- 304 or 316 SS
- Galvanized
- Custom Available

Gasket

- Neoprene
- Viton
- Custom Available

Hardware

- 304 or 316 SS
- Teflon Coated Available

Options

Packaged Systems

ASME Section VIII, Div. I Vessel

- Piping per Code
- Fully Tested
- Customization Available
- Various Materials of Construction

PLC Based Control System

- Complete System Functionality
- Remote DCS or Local Control

Complete Instrumentation Package

- Process Control, Indication
- Integral Design

Pumping System

- Various Designs and Capabilities
- Automated Process

CETCOMONARCH Deoiling & Desanding Hydrocyclone Separators

Simplicity & Value

Great technological advancements share two common traits: simplicity and value. CETCOMONARCH's Deoiling Hydrocyclone series uses centrifugal motion to cause two liquids having different specific gravities, such as oil and water, to separate in an efficient process. The advanced CETCOMONARCH Deoiler Hydrocyclone separates significantly more oil from water than conventional oil and water separation equipment, allowing our customers to operate under more stringent environmental standards and regulations.

The New Standard in Oil/Water Separation

CETCOMONARCH's Deoiler Hydrocyclones are engineered and sized to cover a wide range of capacities and applications using standard designs to provide reliability, cost-effectiveness, service accessibility, and shortened delivery time. Designed to be highly efficient, compact, and durable oil water separators, CETCOMONARCH's Deoilers exceed the various demands of oilfield and industrial applications throughout the world. CETCOMONARCH packages its hydrocyclones in vessels or manifolds to specific engineering and manufacturing specifications.

Advantages

- Oil/Produced Water Separation on Platforms
- Treating Ship/Terminal Bilge & Ballast Water
- Oil Separation from Industrial Wastewaters
- Oil/Water Separation in Chemical Plants
- Oil Removal from Environmental Remediation



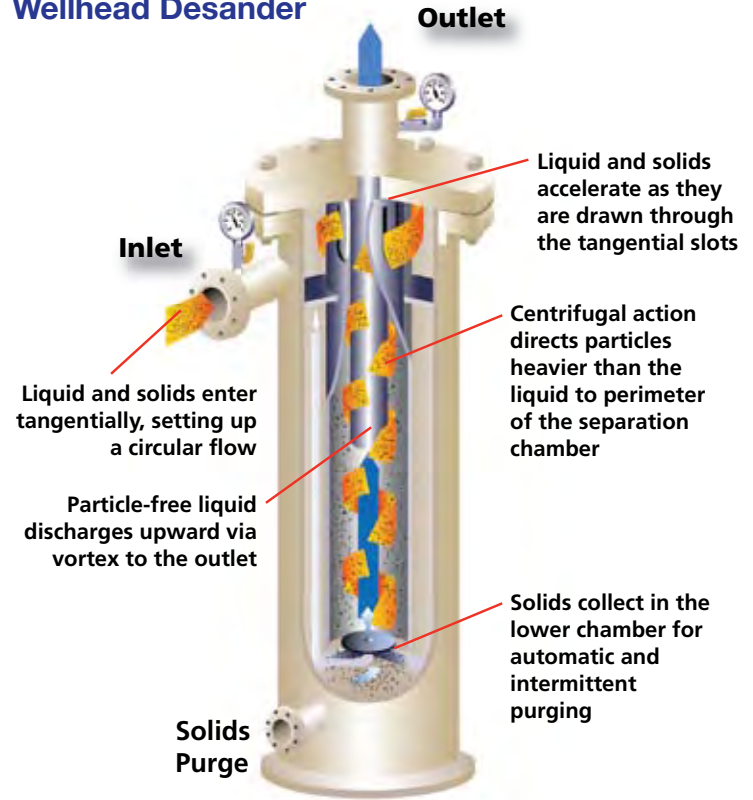
Benefits

- High Performance and Reliability
- No Moving Parts and Modular Construction
- Lightweight and Small Footprint
- Not Affected by Fluctuations in Motion
- Complete Skid Mounted Packages Available

Benefits

- Pressure loss range: 3-12 psi (0.2-0.8 bar)
- Maximum particle size: 0.375 inch (9.5 mm)
- Standard pressure ratings up to 1,480 psi (102 bar), other pressure ratings available up to 10,000 psi (690 bar)
- ANSI flanged inlet and outlet connections; DIN and other connections available
- Carbon steel with 1/8 inch (3mm) corrosion allowance or 316 stainless steel is standard construction
- Special coating and other materials available

Wellhead Desander



General Specifications

Model	Flow Rate		Inlet/ Outlet	Purge size	Collection Chamber Capacity		Weight		Weight w/Water	
	bbl/d	m ³ /hr			gal	liters	lb	kg	lb	kg
ESI-0015	2,200-3,800	15-25	2	2	0.8	3	150	68	221	101
ESI-0020	3,000-5,400	20-35	2.5	2	0.8	3	194	88	278	126
ESI-0030	4,600-8,400	31-55	3	2	0.8	3	202	92	290	132
ESI-0045	7,000-12,000	47-79	4	2	1.6	6.1	327	149	507	231
ESI-0065	9,900-19,900	66-131	4	2	5.4	20.5	474	256	758	345
ESI-0100	15,500-31,000	103-205	6	2	6.7	25.4	697	378	1132	525
ESI-0150	22,700-45,400	151-300	6	2	10.4	39.4	898	413	1554	706
ESI-0185	35,000-63,000	232-417	8	2	14	53	1,200	544	2,266	1,028
* ESI-0265	41,000-81,300	272-538	8	2	20.5	77.6	1,411	641	2,665	1,211

* Desanders for smaller and larger flow rates are also available

Efficiencies

Expected performance for most produced water applications to be

- 98% for 74 micron and larger particles
- 95% for 73 to 40 micron particles
- 84% for 39 to 20 micron particles
- 50% for 19 to 1 micron particles

These efficiencies are based on particles with specific gravity of 2.6. For particles with specific gravities of 1.5 to 2.5, expected performance to be

- 98% for 74 micron and larger particles
- 75% for 73 to 40 micron particles
- 45% for 39 to 20 micron particles
- 8% for 19 to 1 micron particles



Secondary Treatment

Induced Gas Flotation (IGF) and Dissolved Gas Flotation (DGF)

A Leading Separation Technology H-IGF & HDGF

Take advantage of top-notch technology and experience solutions to your water problems with the performance-packed Induced Gas Flotation Systems (IGF) engineered and manufactured by CETCOMONARCH. Accomplish water discharge or re-use goals, customize your CETCOMONARCH IGF to improve facility or field integration, and optimize your CETCOMONARCH IGF with performance options and tightly integrated auxiliary equipment. One of the most effective and efficient technologies available for removing oil and suspended solids from large volumes of produced water or wastewater streams is CETCOMONARCH Induced Gas Flotation (IGF) Systems.

CETCOMONARCH offers an advanced Dissolved Gas Flotation system which utilizes a unique recirculating pump and improved technology to inject a myriad of micro-bubbles into a process stream. CETCOMONARCH system's micro-bubbles massive surface area creates exponential contacting potential, producing superior separation performance of oil and suspended solids from the process water. Available on skid packages or standalone configurations, CETCOMONARCH routinely builds to our US industrial standards or customer specifications.

Benefits

- Standard Models to 170,000BPWD/5000gpm
- Fully Customizable Design
- High Performance and Reliability
- ASME Code & None Code Vessels Available
- Complete Skid Mounted Packages Available

Applications

- Oil/Water Separation in Petroleum Refineries
- Oil/Produced Water Separation
- Treating Ship/Terminal Bilge & Ballast Water
- Oil Separation from Industrial Wastewaters
- Oil/Water Separation in Chemical Plants
- Oil Removal from Environmental Remediation



CETCOMONARCH™ ASME Section VIII, Div. 1 IGF Separator



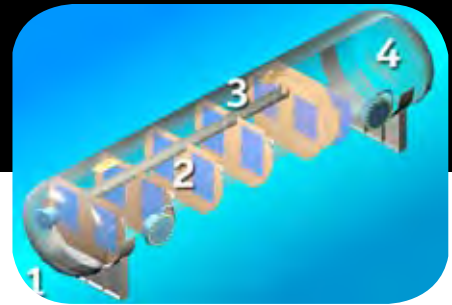
CETCOMONARCH™ Non-Coded IGF Separator

Operation of the CETCOMONARCH IGF Separator

Operation of the CETCOMONARCH IGF Separator is simple and efficient.

- (1) Liquid flow is introduced into the CETCOMONARCH IGF Separator via gravity or at a specific process pressure.
- (2) The CETCOMONARCH IGF Separator distributes flow and creates “plug flow” via four (4) separate and distinct flotation zones. These four (4) flotation zones provide the necessary area for micobubbles, created from CETCOMONARCH's Eductor Technology, to contact oil and/or suspended solids, making them buoyant, and rising them to the surface for skimming.
- (3) The CETCOMONARCH IGF Separator has an unique oil skimming trough and skimming system which is automatically set and adjustable external from the unit.
- (4) Clean water is maintained via level transmitters and discharged for disposal or additional treatment.

A percentage of the collected clean water is recycled and used by CETCOMONARCH's unique eductor manifold (not depicted to maintain picture clarity) to mix with the IGF's blanket gas to form a myriad of micro-bubbles. As with all CETCOMONARCH products, CETCOMONARCH's IGF Separator is designed to many U.S. industrial codes and incorporates advanced features such as a unique packaging design to enhance space and maintainability, long lasting materials of construction to extend the life of the system, and a flexible design providing an array of sizes, connections, and ancillary choices to meet individual client needs and requirements.



General Specifications

Functional

Service

- Oil Production
- Refining
- Chemical Processing
- Wastewater Treatment
- Hazardous Waste Remediation

Design Temperatures

Standard

- Up to 200F (93C)
- Custom Available

Design Flow Rates

Standard

- 170,000BWPD/5000gpm
- Larger Flow Rates Available

Design Pressures

Standard

- Atmospheric or Per Code
- Custom Available

Physical

Material of Construction

Vessel

- A-36 or 516 Gr. 70
- 304 or 316 SS
- Custom Available

Eductors

- 304 or 316 SS
- Custom Available

Gasket

- Neoprene
- Viton
- Custom Available

Hardware

- 304 or 316 SS
- Teflon Coated Available
- Custom Available

Blasting & Coating Standard

- SSPC-SP-10
- In/Out 6-8 Mils C.T.E.
- Custom Available

Options

Packaged Systems

ASME Section VIII, Div. I Vessel

- Piping per Code
- Fully Tested
- Customization Available
- Various Materials of Construction

PLC Based Control System

- Complete System Functionality
- Remote DCS or Local Control

Complete Instrumentation Package

- Process Control, Indication
- Integral Design

Pumping System

- Various Designs and Capabilities
- Automated Process

Safety Shutdown System

- Various Designs and Capabilities
- Automated Process

Upstream Primary Oil Separator

- Add a CETCOMONARCH Skimmer
- Add CETCOMONARCH Hydrocyclones
- Add a CETCOMONARCH CPI

Compact Flotation Unit (CFU)

CrudeSep® Produced Water Treatment System for High-Efficiency Removal of Oil, Gas, and Solids

CrudeSep is an unparalleled technology which separates oil, water, gas, and solids at variable flow ranges. Based on application of fluid dynamics, the CrudeSep is a novel technology which eliminates the dependency on gravitational separation prolific in traditional methods.

The inlet and outlet are located at the bottom of the vessel. The whole body of water is directed in a controlled vertical flow pattern towards a primary interface where droplets break out and accumulate. The return flow interacts with a series of specially engineered interfaces which encourage swirling eddies to form. These forced eddy currents propel the oil droplets towards additional gas interface surfaces for breakout and collection. Accumulated oil on these surfaces combines to form much larger oil droplets which join the main body of flow. These are now of a significantly larger size and interact with the initial interface at the top of the fluid column.

The vessel also works as a degassing unit as entrained gas will break out and be released with the separated oil particles. Solids and heavier particles will accumulate at the bottom of the vessel to be flushed out on an intermittent basis.





Tertiary Treatment

Applications

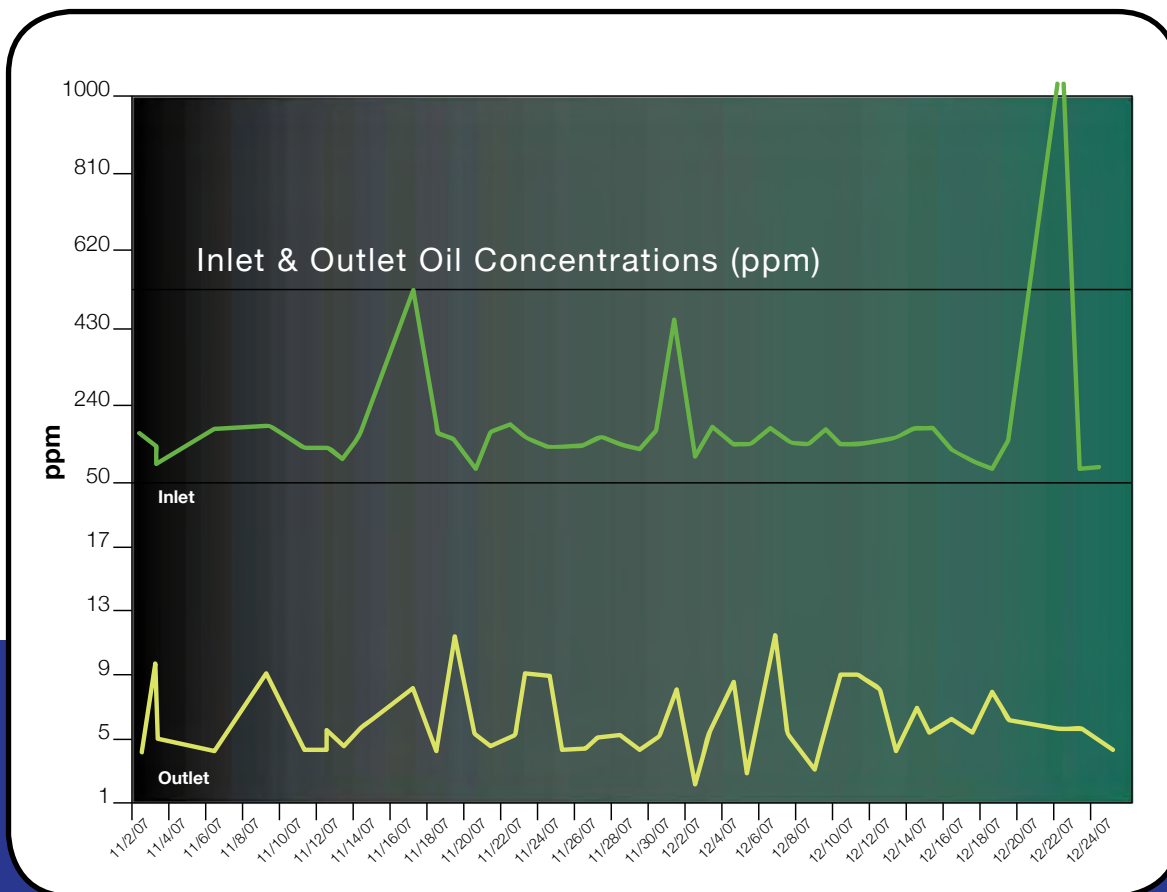
- Permanent Produced Water Treatment and Polishing
- Diversion Skid
- System Upsets
- Increase Produced Water Handling Capacity



Hi-Flow® Coalescer

CETCO Oilfield Services Hi-Flow Process can treat high rates of produced water, allowing the operator to return the produced water back into the environment in compliance with governmental regulations. Our Hi-Flow Process gives you the flexibility you need in having one solution for many applications—the Hi-Flow process can handle small to large volumes of liquid, from 1,000 BWPD to more than 40,000 BWPD; it is not hindered by large fluctuations in oil and grease inlets; and it can be used on projects with short or long durations.

Results from CETCOMONARCH Tertiary Filtration Equipment



Nutshell Filter (NSF)

Nutshell media is a resilient media utilizing a high flux rate to remove both oil and oil-wet solids. With a deep media bed channeling is eliminated. Backwashing the media easily removes oil and solids from the vessel. Pneumatic or electrically actuated valves control the vessel functions automatically via skid PLC or facility DCS. Flow rates of up to 50,000BWPD per vessel are easily handled.



Benefits

- Handles Small to Large Volumes of Liquid, from 1,000 BWPD to More Than 50,000 BWPD
- Performs Well with Large Fluctuations in Oil and Grease Inlets
- Ensures Discharge Compliance
- Allows Flexibility – Can be Used on Projects with Short or Long Durations
- Media that Regenerates In-situ
- Handles Variations in Flow Rate and Level of Contaminants
- PLC Controlled and Self-cleaning Actuated by Differential Pressure or Time



Case History: Brownfield Improvement Hydrocyclones and CrudeSep®



2 x 24" Hydrocyclones



48" CrudeSep

Problem:

The Angsi A platform in the South China Sea had cracked its existing Hydrocyclone vessel. The company approached CETCO Oilfield Services – Malaysia for a temporary fix, and then again for a long-term solution to its onboard produced water treatment.

Solution:

CETCO Oilfield Services mobilized a Hi-Flow™ rental package to replace the malfunctioning Hydrocyclone and maintain the platform's production. Following the rental's success, CETCO designed, and installed two 24" Hydrocyclones and a 48" CrudeSep® compact flotation vessel to solve their produced water treatment problem with a permanent solution.

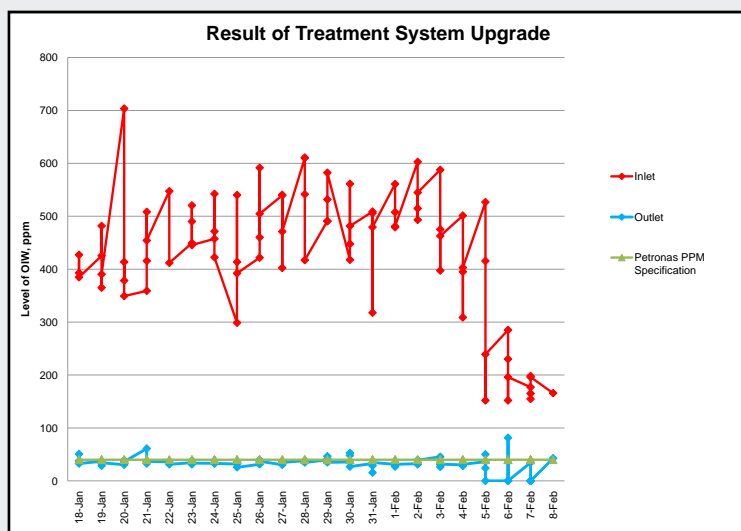
Method:

The Hi-Flow™ equipment could accommodate flow rates of 70,000 bbls/d and treat produced water inlet flows up to 1000 PPM oil-in-water and achieve overboard discharge quality of less than 40 PPM. The platform also experienced sanding issues, so the Hydrocyclone liners were coated with tungsten carbide to prolong their life span.

This permanent package had to fit in a congested area, so CETCO utilized and modified the existing structure when designing the new equipment. The Hi-Flow™ rental unit was in place, allowing for uninterrupted platform production, as the permanent equipment was installed in phases; first installing the Hydrocyclone vessels, then the CrudeSep® polishing unit downstream.

Outcome:

The effluent quality met and exceeded overboard discharge requirements and was subsequently discharged overboard. Throughout the process, as a result of using the Hi-Flow rental package, the platform experienced no operating downtime before or during the replacement of the permanent water treating package thus preventing lost revenue. CETCO Oilfield Services' performance was recognized by the company for minimizing their chemical usage, and allowing maximum production flow rates.





WATER TREATMENT | PIPELINE | WELL TESTING | WASTEWATER | RENTALS | NITROGEN | COILED TUBING



CETCO
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