

Benefits Overview

WaterWolf™ Dynamic Oil Recovery System Managing produced water to increase profitability and extend field life



Our WaterWolf Dynamic Oil Recovery (DOR) system is an innovative, new water treatment system that recovers oil and removes suspended solids from produced water in a single stage of treatment without the use of chemicals or filters. This revolutionary technology increases oil recovery revenue, delivers maximum operational efficiencies with proven cost savings, achieves environmental, health and safety benefits, and significantly reduces the overall footprint for onsite water treatment and waste removal processes.

The Technology Behind WaterWolf

The WaterWolf DOR combines deoiling and desanding hydrocyclones with the non-shearing action of industry-leading Moyno™ progressive cavity pumps. The WaterWolf builds on the heritage of proven hydrocyclone technology—long used in offshore oilfields to optimize produced water handling and extend well life—and improves the process by operating without upstream pressure requirements and independent of flowrate variation. Less shearing, or turbulence, produced by conventional methods means larger oil particles that remain far easier to capture and recover. The WaterWolf unit itself is compact, easy to transport, quick to install and simple to operate.

Compelling Benefits

Compared with traditional water treatment methods, the WaterWolf DOR is a superior solution that offers proven financial, operational and environmental benefits:

- **Maximum hydrocarbon recovery.** The WaterWolf process adds value

by recovering more of the usable hydrocarbons in the produced water, from 1 to 10 additional barrels of oil for every 10,000 barrels of water produced. More valuable hydrocarbons recovered in the process means less hazardous waste to treat, store, transport, and dispose of later.

- **Efficient process.** Water treatment and hydrocarbon recovery takes place in one integrated process, eliminating or reducing the need for expensive treatment chemicals or filters. The need for multiple skim tank configurations and gas flotation devices is reduced or eliminated.
- **Reduced total water treatment costs.** The total cost reduction using the WaterWolf DOR system versus conventional methods can be as much as \$US 0.15 per barrel of water. Reductions often represent treatment chemical and equipment costs and savings associated with sludge movement, storage, transportation, and disposal.

- **Environmentally sound.** The closed-loop, contained approach eliminates air emissions and the associated need for flaring. Cleaner air is safer and better for the environment, neighboring communities, and plant personnel.
- **Easily installed and operated.** The technology is ultra light, compact, and can be shipped by standard container or flatbed truck. Most installations can be completed in one day with a modest work crew and crane truck. Startup and operation is simple and training can be accomplished on site in approximately one hour.
- **Extends well life, delays end-of-life decisions.** When a well's produced waters become too expensive in relation to oil produced, the producer has a difficult decision to make regarding when to shut in the well. Dealing with high water production challenges in a more efficient way keeps more wells producing longer—with cleaner, safer, and more profitable results.

Increased Predictability, Decreased Risk, Longer Well Life

Our innovative approach to water treatment and oil recovery is valuable, efficient, economical, environmentally beneficial, and simple to install and operate. The benefits of increasing valuable oil and decreasing waste are undeniable, but the ancillary benefits of improving process predictabilities and decreasing risks are less tangible. Every barrel of oil recovered is one fewer that must be treated, stored, transported and disposed of safely, often by third-party vendors. Eliminating the need for additional resources in the treatment and handling process means eliminating human error and exposure in what is inherently already a hazardous process.

About National Oilwell Varco (NOV)

Throughout every region in the world and every area of drilling and production, we have the people, capabilities and vision to service the needs of a challenging and evolving industry. With 900 locations in 70 countries, our family of companies provides the expertise, equipment and operational support necessary for success—now and into the future.

For more information about the WaterWolf Dynamic Oil Recovery system, contact us at pft@nov.com.

Who Benefits from WaterWolf?

- Mature fields with high water production
- Conventional producing wells
- Areas with high HSE and regulatory concerns
- Operators with high chemical costs
- Saltwater disposal operators
- Offshore production facilities

BENEFITS OF THE WATERWOLF

Increased Revenue

- Recovers more oil
- Returned oil is cleaner (more valuable)
- Keeps aging wells pumping longer
- Delays costly shut-in/site remediation

Reduced HSE Exposure

- Zero air emissions or pollutants
- Fewer waste streams to manage
- Reduced organization exposure
- Reduced odor in production area
- Eliminates need to store, transport and treat waste streams
- No tank cleanouts
- Reduces confined-space entry and slip-and-fall exposure
- Eliminates hazardous solid waste
- Low utility costs to operate

Reduced Costs

- No chemical flocculants
- No skim tanks or gas flotation devices
- No hazardous slops
- No filters or membranes
- No tank cleanouts/reduces shutdowns
- No construction costs for pumps, tanks, controls, vapor recovery, gas blanketing, emission permitting
- Fewer waste streams
- Improves injection well health

Streamlined Operations

- Single-stage, dynamic water treatment system
- Compact size and weight
- Smaller overall footprint
- Ships on flatbed truck or common shipping container
- Simplified winterization for cold climates
- Easy startup and operation
- Compatible with low-pressure separators
- Multiple flowrate configurations

NOV
 Process and Flow Technologies
 2500 CityWest Boulevard
 Suite 2000
 Houston, TX 77042
 Phone: (713) 335-6600
 Email: PFT@nov.com

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