

# IX Water OG

## Treatment of Oil & Gas Produced Water for Beneficial Use

**99.81%**

removal of hydrocarbons, H<sub>2</sub>S  
metals, metalloids, scalants



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# Treatment of Oil & Gas Produced Water for Beneficial Use

*IX Water OG is the most advanced system for eliminating contaminants from produced water — and at the lowest cost!*

The oil & gas industries generate over 150 billion barrels of produced water each year. Treatment and disposal of oil & gas produced water costs over \$75 billion annually, and accounts for 98% of the entire waste stream of the industry—from well to refinery. The cost per barrel varies widely, based on location and availability of treatment and disposal options.

Traditional methods of dealing with produced water include disposal via deep well injection, evaporation using open pits and ponds, and mechanical evaporation systems. These methods often present environmental challenges and/or cost too much to be viable. What the industry needs is an integrated system for treating produced water so the water can be recycled or reused for beneficial use...for less cost than traditional methods. IX Power Clean Water has created just such a system!

IX Water OG is a complete treatment train based on industry best practices and innovative technology from a unique collaboration between IX Power, Los Alamos National Laboratory, the University of Texas at Austin, and the New Mexico Institute of Mining and Technology.

IX Water OG is a complete solution to a complex problem: the disposition of oil & gas produced water, both offshore and onshore.

IX Water OG can also be used for industrial waste water, industrial process water, and surface water/groundwater reclamation at point of use.

## Oil & Gas Contaminated Water

Oil & gas produced water is naturally occurring water brought up with oil and natural gas. This water contains a toxic mix of metals, organic hydrocarbons, metalloids, scalants, and other elements dangerous to humans and the environment. While sand, mud, and free-floating oil and grease are easy to remove, the most difficult to remove compounds are those dissolved into the water; they often have no color, taste, or smell. Oil & gas produced water is traditionally left to evaporate or injected into deep underground wells which not only can cause cross-contamination with the environment, but earthquakes too — in addition to the loss of this valuable resource in water-stressed regions. Produced water costs industry \$75 billion each year.



Two to fifty barrels of contaminated water are generated with each barrel of oil and two gallons of water for each MMBTU of gas.



The contaminated water is left to evaporate in ponds or trucked to disposal wells.



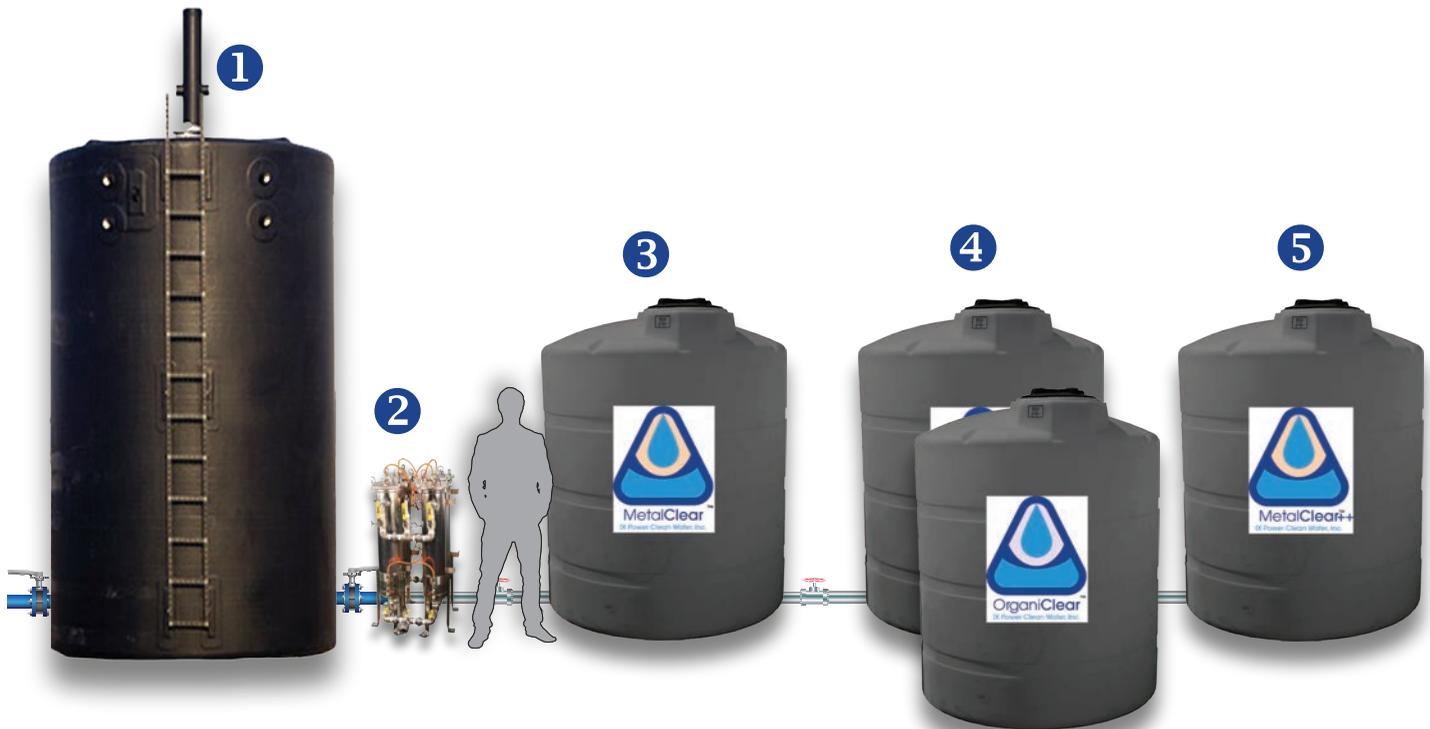
Produced water disposal wells have been linked to fault slippage (earthquakes) and require a significant investment to drill and maintain.



Treating produced water instead of throwing it away creates a new source of this valuable resource.

## IX Water OG Process Description

- 1 Produced water is piped or trucked to the treatment location and temporarily stored in tanks. Oil and water is separated using a variety of methods, usually provided by the customer since they want to recover as much oil as possible.
  - 2 Produced water is pumped through PartiClear to remove suspended solids (e.g., iron, manganese, sand).
  - 3 The water is then pumped through MetalClear where metals, including aluminum, antimony, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, thallium, zinc, etc., are trapped by IxMZ-S media.
  - 4 The water is then pumped through the OrganiClear tank, where dissolved and emulsified organic hydrocarbons are trapped and then converted to innocuous by-products (CO<sub>2</sub> and water) via IxMZ media. This includes dissolved hydrocarbons (BTEX), polyaromatic hydrocarbons (PAHs), and NPD (napthalenes, phenanthrenes, dibenzothiophenes).
  - 5 The final step in the IX Water OG system is to remove scalants via MetalClear++ using IxMZ++ media. The result is clean water, containing salts, which can then be concentrated via a variety of commercial methods, depending on the amount of salt in the water, the intended use of the water, and disposal methodology for the concentrated brine.
- 2 (A & B) Should H<sub>2</sub>S and/or NORM be present, two additional treatment reactors are used — SulfurClear and NORMClear.



The IX Water OG Module treats 2,500 to 5,000 bbls/day. Additional capacity is gained by adding additional modules to create plants that can treat as many as 50,000 bbls/day.

## The IX Water Solution

The IX Water OG treatment train is a series of standardized, scalable modules that provide treatment specific to your needs without the cost and variability of a custom water treatment plant. These modules simply link together using standard fittings. Need additional treatment volume? Our modular design gives you virtually unlimited scalability. Select the modules you need to create a system just right for you.

Category	Constituents	Method	Product
Oil & Water	Oil, water, suspended particles	Oil/Water/Solids physical separation.	a) Gun barrel separator b) Separation tank
Particles	Suspended solids (e.g., iron, manganese, sand, grit)	MicroFiltration. Change filters daily, depending on water content.	 PartiClear™ IX Power Clean Water, Inc.
Metals	Aluminum, antimony, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, thallium, zinc, etc.	Adsorption & Ion Exchange Simple backwash once a week.	 MetalClear™ IX Power Clean Water, Inc.
Dissolved & Emulsified Organics, Metals	Volatile and semi-volatile organic compounds (VOCs and SVOCs) (e.g., benzene, toluene, ethylbenzene, & xylenes—BTEX), arsenic, etc.	Adsorption. Four-hour duty cycle; air strip to regenerate media. Dual tanks for continuous operation.	 OrganiClear™ IX Power Clean Water, Inc.
Scalants	Magnesium, calcium, strontium, barium, etc.	Ion Exchange. Simple backwash once a day.	 MetalClear+™
NORM	Radioactive materials	Precipitation. Solvent regeneration, depending on use.	 NORMClear™ IX Power Clean Water, Inc.
H <sub>2</sub> S	Hydrogen sulfide	Contact Oxidation. Sodium hypochlorite regeneration, depending on use.	 SulfurClear™ IX Power Clean Water, Inc.
Salts	Sodium chloride, and others	Multi-Effect Distillation.	 SaltClear™ IX Power Clean Water, Inc.

## Treatment That Grows with Your Needs

The modular design of IX Water OG allows for stand-alone operation or integration with existing treatment systems. Each transportable module treats 2,500 to 5,000 barrels a day (bbls/day) and can be ganged to process up to 50,000 bbls/day. Increased treatment volume is achieved by adding additional modules.

## Cost

The total cost for treatment using IX Water OG (CapEx and OpEx) ranges from \$0.17 to \$0.24 a barrel, depending on contaminants in the water and the intended use of the treated water. Cost per barrel depends on the amount of water treated daily, the specific constituents needing removal, and the ultimate disposition of the water.\*

## What We Sell

IX Power Clean Water sells the IX Water OG system: machines, setup and validation, training, technical support, and maintenance. IX Water OG is simple enough for a single, part-time operator to manage all functions. The Company can also help customers find qualified personnel, but we do not charge a by-the-barrel fee nor additional licensing costs to use IX Water OG.



Produced water (left) and IX Water OG treated water

## Regulatory

Regulations regarding the disposition of oil & gas produced water vary in each jurisdiction. IX Power Clean Water is expert at navigating discharge and reuse regulations for the treatment and disposition of produced water, and can assist customers in navigating these regulations.

## Philosophy

IX Power Clean Water has an open design philosophy with three distinct elements:

1. Minimize OpEx. The Company recognizes the oil & gas industry is under enormous pressure to maintain profitability despite variable market conditions for crude oil and natural gas. IX Water OG is specifically designed to minimize use of power and consumables.
2. No Additives. Flocculants, coagulants, and other additives are fine for municipal waste systems, but oil & gas operations should not have to endure daily deliveries of expensive consumables. IX Water is designed to pull out contaminants (subtractive), with consumables minimized to just media regeneration compounds.
3. IX Water OG is designed to treat oil & gas produced water to U.S. EPA and OSPAR discharge standards. While individual operators, various regulations, and the ultimate disposition of the treated water will vary, the design of IX Water OG assures that virtually any input and output can be achieved in a consistent and economical manner.

## Other Methods of Treating Produced Water

The oil and gas industry has been bombarded for years with proposed solutions to their produced water problems. These supposed solutions are promoted using misleading claims and have proven to be fraught with enormous cost over-runs and endless plant add-ons to achieve acceptable results.

IX Water OG is a proven solution that delivers as promised.

\* Essentially everything but salt. The Company prices salt concentration separately given the wide variation in salt/TDS and intended use of the treated water.

# **IX Water OG Is the Only Complete System for Treating Oil & Gas Produced Water and Is the Best Value for Money on the Market**

## **1. Proven technology**

IX Water OG meets or exceeds U.S.A. EPA, China EPA, and OSPAR regulations for discharge of treated produced water. Unlike other solutions, IX Water technology was designed by the most respected chemists and engineers in the world. Hundreds of peer-reviewed papers on our foundation technology provide unequalled credibility in the industry.

## **2. Dedicated to simple, low-cost solutions**

Unlike large diversified companies, we don't sell plants that require hundreds of cubic meters of concrete and tons of steel. To get your system up and running, IX Water OG only requires a gravel, compacted dirt, or concrete pad, access to electricity and some piping or hose. You don't have to spend tens or hundreds of millions of dollars to treat produced water!

## **3. Rechargeable media**

IX Water OG is way cheaper and more efficient than air stripping, chemical flocculants, activated carbon, paper filters, clogged membranes, exploding pressurized vessels, and artificial polymer medias that require steam for recharge. IX Water OG media uses air or table salt and water for recharge, instead of costly steam or caustic chemicals.

## **4. Zero harmful discharge**

Organics are degraded to CO<sub>2</sub> and water, and metals and scalant capture can be land-filled. In some cases, metals capture will require special handling, but the reduction in contaminated water averages 99.19%

## **5. Wide range of operating conditions and influent concentrations**

IX Water OG handles virtually any pH, temperature, and contaminant concentrations. The only pre-treatment required is oil/water separation — which we can provide as part of a total solution.

## **6. Complete solution**

IX Water OG is a complete solution that treats for organics, metals, metalloids, and scalants, with optional equipment for H<sub>2</sub>S and NORM removal and salt concentration. Traditional water treatment systems are not designed to handle contaminants found in oil & gas produced water.

## **7. Modular design**

The modular design of IX Water OG ensures you only pay for what you need, as part of a complete system or integrated with your current treatment train.

## **8. Scalable**

IX Water OG is scalable, from modest per day treatment of a few hundred barrels up to 50,000 barrels a day in a single system.

## **9. 24/7/365 support**

We take pride in providing what you need, when you need it. This extends to our world-class maintenance and support contracts that operate when you need it, not just during office working hours.

## **10. We make treatment of produced water a reality**

For the first time, effective treatment of oil & gas produced water is available at a price point that is often less than disposal via truck and well dump procedures — turning what has traditionally been a liability into an asset.

## IX Water OG Exceeds All National and Global Regulations for Produced Water Treatment

The chart below contains real-world test results from the IX Water OG system.

Contaminant	Units	Pre-Treatment	Post Treatment	Effective Removal	Meet or Exceed Standards?
Benzene	mg/L	3.68	0.0050	99.99%	YES
Ethylbenzene	mg/L	1.33	0.0030	99.74%	YES
Toluene	mg/L	8.73	0.0102	99.88%	YES
Xylenes, total	mg/L	4.21	0.0036	99.91%	YES
Aluminum	ug/L	18,300	35.7	99.80%	YES
Arsenic	ug/L	87.9	ND	100%	YES
Barium	mg/L	2.01	0.004	99.99%	YES
Beryllium	ug/L	14.1	ND	100%	YES
Cadmium	ug/L	18.1	ND	100%	YES
Calcium	mg/L	1,030	0.050	99.99%	YES
Chromium III	ug/L	330	1.7	99.48%	YES
Copper	ug/L	634	ND	100%	YES
Iron	ug/L	9,950	25.6	99.97%	YES
Iron (Suspended)	mg/L	80	ND	100%	YES
Lead	ug/L	1,250	ND	100%	YES
Magnesium	mg/L	407	ND	100%	YES
Manganese	ug/L	17,100	ND	100%	YES
Nickel	ug/L	290	7.5	97.41%	YES
Potassium	mg/L	151	ND	100%	YES
Thallium	ug/L	8.6	ND	100%	YES
			Average	99.81%	

### *Produced Water in the Oil & Gas Industry:*

- *Highly toxic*
- *1:1–50:1 water to oil ratio*
- *98% of industry waste*
- *\$75 billion a year problem*



IX Water OG transportable skid-mounted unit treats 2,500 to 5,000 bbls of oil & gas produced water a day or more. The capital cost of this unit is about \$468,000 and the total “all in” costs are \$0.24 per bbl treated — of which less than 1 cent per bbl is the cost of power. Click together these modular units to process up to 50,000 bbls a day.



IX Water OG portable unit treats 350 – 400 bbls of oil & gas produced water a day. The capital cost of this unit is less than \$100,000 and total “all in” costs are \$0.24 per bbl treated— of which less than 1 cent per bbl is the cost of power.

**IX Power Clean Water, Inc.**

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