

# It's been a long time since the oil & gas industry had a new technology to treat fracking water.

The wait is over. In 2019, there is a new water treatment technology coming to market that can handle many of the chemicals and the challenges of fracking water reuse and disposal.

## Ferrate Solutions Inc.

- Reduce the amount of sludge/residual requiring expensive hazardous waste disposal
- Increase the amount of fracking water available for reuse
- Pre-treat water before desalination to prevent fouling of RO membranes, make the process more efficient and affordable
- Provide one treatment for disinfection, oxidation, precipitation of chemicals compared to a patchwork of expensive, numerous treatments
- Treat the toughest chemicals currently known to be contained in fracking waste, including radionuclides and organics

**You may still have to desalinate your water, but Ferrate can make that process less complicated, more affordable, and more efficient.**

Cost and process predictability.  
Meeting federal and state discharge standards.  
The Ferrate Solution.

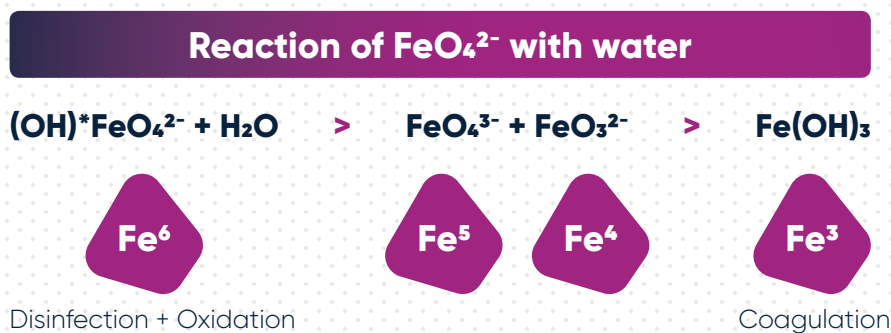
Learn more at [Ferrate-Solutions.com](https://www.ferrate-solutions.com)



# What are Ferrates?

High valence (+4 through +7) oxo anions of iron (ferrates) have been studied by chemists for over 300 years. Commercial utilization of these unusual compounds has been extremely limited, primarily because of the difficulty in synthesizing them and their inherent instability. However, because of the high valence iron in these compounds they are strong oxidants and disinfectants, and because the residual from any chemical reaction is ferric iron (the most common element on earth) they should be commercially useful.

Ferrate(VI) is a powerful oxidant (and disinfectant) that rapidly decomposes to ferric iron forming a hydroxide that has unique surface properties allowing for enhanced co-precipitation of metal ions. **The amount of Fe added is usually small therefore the amount of sludge generated is minimal, thereby reducing the cost of disposal (as a hazardous waste).**



## Ferrate Solutions Systems – No Competition Exists

After many years of research and experimentation in pilot studies, *FS* engineers have been able to design proprietary blends of inexpensive, commercially available feedstock chemicals, that when reacted together under proprietary conditions can produce a concentrated ferrate solution that is stable for weeks. This allows a workable solution of ferrate to be continuously generated nearby its point of use; either in remote locations, or central to several users of the compound.

Treatment systems. In conjunction with our OEM partner, *FS* designs, fabricates, tests, installs, guarantees and maintains all components for site-specific designed Ferrate – based treatment systems. Our OEM is a world-class, award-winning equipment integrator, manufacturer and process expert headquartered in Orlando Florida. The *FS* Ferrate

systems can be scaled to any size application. The unit operations of the systems are modular and easily transported to any location. These systems can be stand-alone, or interface with existing facilities. Total system design includes proprietary Ferrate synthesis, feed systems, flash mixing, flocculation, and clarification systems as required. Facilities for storage and handling of feedstock chemicals (ferric, caustic, and bleach) can also be designed and fabricated if the feedstocks are not already present at the site. All *FS* systems are fully process controlled and can be remotely controlled from central locations. *FS* engineers can interface their systems into any existing water, wastewater or industrial waste treatment system. *FS* treatment systems can be purchased outright or leased through one of several programs provided by *FS*.

## Affordability

Ferrate systems are comprised of a chemical process skid (synthesizer) plus mixers and clarifiers as needed at specific location. They are totally process controlled, and can be operated remotely. The dose of ferrate required to achieve broad treatment of fracking water is small (less than 5 mg/L of  $\text{FeO}_4^{2-}$ ) therefore the sludge generated from that dose would

be only (< 3 mg/L Fe), thereby significantly reducing the cost of disposal as a hazardous waste.

Estimated chemical cost for ferrate treatment @ 1 mg/L dose is approx. \$0.21 per hundred bbl treated. **(This level of treatment would produce recyclable water either for direct injection or desalination)**