

CleanWave® Water Treatment Service

Mobile Service for Produced and Flowback Water

For every barrel of oil or gas produced in the world, approximately three barrels of water are produced along side. Furthermore, 10-40% of the fluid volume used in fracturing operations flows back during the subsequent cleanup stages. At the same time, changing climatic conditions along with socioeconomic and geopolitical concerns make access to fresh water increasingly difficult for operators around the world. Balancing the disposal, and/or reuse of all this water and access to fresh water in a way that is environmentally acceptable and economically feasible, remains a challenge to the oil and gas industry.

Halliburton's mobile CleanWave® service uses an electrical process that has the capacity to destabilize and coagulate suspended colloidal matter in water. When contaminated water passes through the electrocoagulation cells, the anodic process releases positively charged ions which bind onto the negatively charged colloidal particles in water resulting in coagulation. At the same time, gas bubbles, produced at the cathode, attach to the coagulated matter causing it to float to the surface where it is removed by a surface skimmer. Heavier coagulants sink to the bottom leaving clear water suitable for use in drilling and production operations.

Reduce Environmental Footprint

Halliburton's focus with the CleanWave service is to treat produced and flowback water to a standard suitable for reuse in fracturing or drilling fluids. In doing so, the volume of waste water sent for disposal is minimized. Water acceptable for use in fracturing or drilling fluids is returned to the operator, reducing their demand for fresh water.

Additionally, the CleanWave service can result in significant reduction of truck use in water management. On average, each CleanWave service unit working monthly would eliminate 175 truckloads of water, 6,300 miles of truck traffic, and 900 hours of road time and emissions.

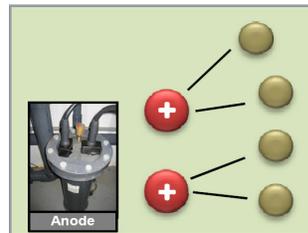
Operational Benefits

Halliburton's mobile CleanWave service unit has a design treatment capacity of approximately 20 barrels of water per minute. With easy scalability, this gives operators the ability to quickly treat the large volumes of water in reserve and flowback



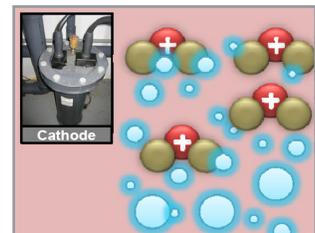
HAL32902

CleanWave service unit with 20 electrocoagulation cells treats 20 barrels per minute. Each electrocoagulation cell is capable of treating 50 gpm.



HAL32409

Electrocoagulation



HAL32408

Electroflotation



HAL32411

Coagulation of solids after CleanWave service treatment.

pits and, depending on the operation, to treat flowback and produced water online during a fracturing operation.

The CleanWave service was designed to remove suspended solids, oil, other insoluble organics, and bacteria from the water. The operating conditions are regulated depending on the total dissolved solids (TDS) present in the water.

Key Features

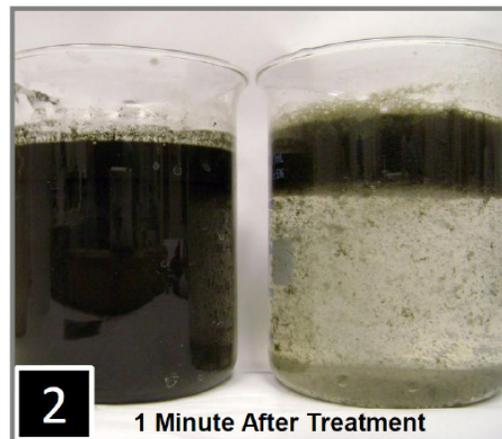
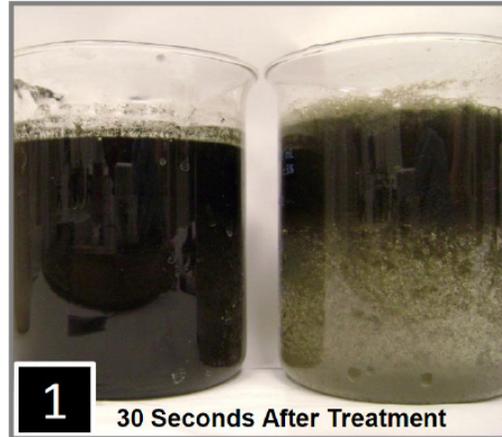
- 99% reduction in total suspended solids (TSS)
- Treats water with TDS ranging from 100 – 300,000 mg/L
- Coagulates particles < 1 micron
- Reduces turbidity to < 10 NTU
- Non-polymer based water treatment contributes up to 75% reduction in sludge generation
- Breaks emulsions
- Removal of divalents and heavy metals*
- Fully automated
- Scalable
- Self-cleaning
- One operator per shift

Most effective at treating the following contaminants:

- TSS
- Total petroleum hydrocarbons (TPH)
- Turbidity
- Bacteria

* Partial removal only.
Complete removal requires further treatment.

General Specifications	
Power Requirement	150 kVA / 120 kW
Throughput	20 BPM
Hydraulic Capacity	1,000 GPM
Weight	48,000 lb
Dimensions	9'L X 42'W X 12'H



Post CleanWave treatment.



CleanWave water treatment service effectively removes oil from contaminated water.