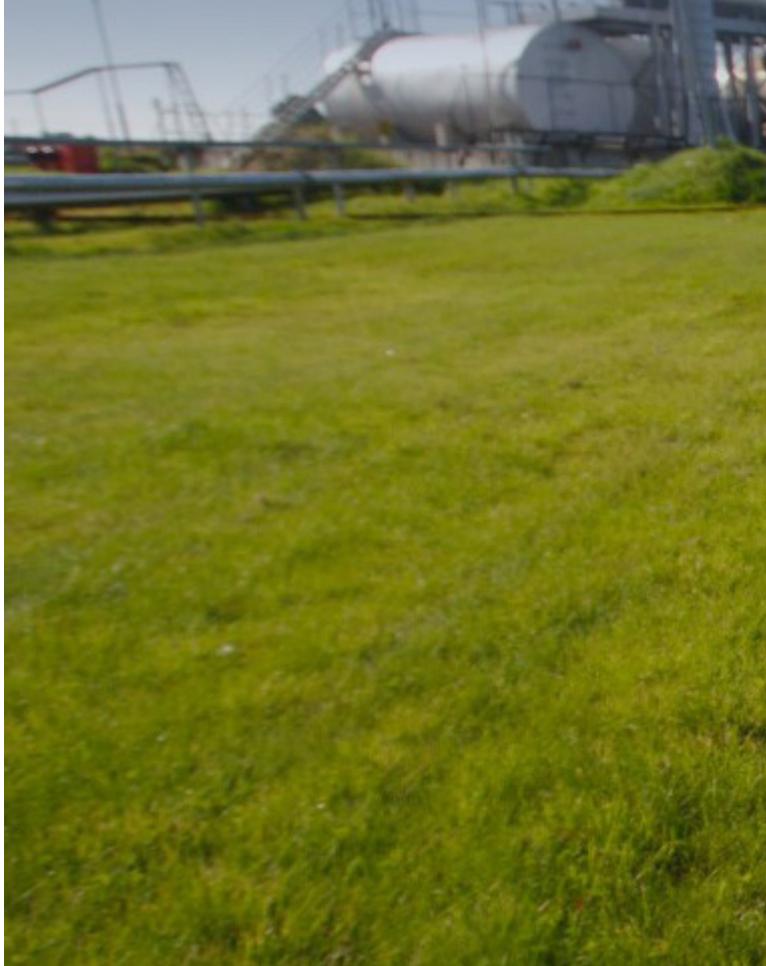


WATER TO ENERGY

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KAIZEN FLUID SYSTEMS



A technology that extracts valuable
minerals, metals and salt products



There has been a major advancement in water recycling and reuse—turning water into energy.

Kaizen Fluid Systems (KFS) can now take produced and/or flowback water as feedstock and extract any valuable minerals, metals and salt products. Once these components are removed, the operator can reuse the pure water as a fuel to power generators, heavy equipment and compressor pumps.

This scientific breakthrough is especially valuable to operators in Pennsylvania. Oil and gas producers in the commonwealth put the average cost to dispose their produced and flowback water at between \$10 and \$14 per barrel.

With the Kaizen System, the operator has clean water for fuel. Any water remaining can be evaporated into the atmosphere for less than half the current cost of disposal. Because the produced water is near distilled-water quality, the evaporation process does not emit any toxic components into the atmosphere.

This new technology has been in continuous operation and testing for the past seven years. To confirm that it works on all types of equipment, it's been on ships, heavy earth-moving equipment, mining excavators and generator sets. Testing in different industries with complete success is proven evidence the integration of the technology into your operation will be successful.

Remote locations are challenging and expensive. Long hauls back and forth from remote sites are now easily overcome.

These systems are as simple as plug and play into your operation. Our proprietary technology connects directly to your production line. At this point, the equipment takes over and does the rest.

NO POWER LINES, FUEL HAULS

The system eliminates the need for power lines, hauling fuel to the site or other trucking needs, thus saving time and money. Part of the beauty of this complete system is no contaminants are emitted into the atmosphere, and any products used are Department of Environmental Quality



◀ Electronic brain

compliant. The first complete system is currently in operation within the oil patch.

One unique water-to-energy system benefit is it effectively eliminates the cost and the time lost in productivity. Therefore, there is no need for power lines. This greatly reduces the cost from construction to production, and the time lost from both. This enhances your bottom line not only in production,

Kaizen Fluid Systems can easily adapt existing onsite equipment to work with our systems or install modern state-of-the-art equipment in a new configuration. Working with a producer's existing system, and not requiring an investment from start to finish, makes this an economical option for even a small producer.

PURIFYING PRODUCED AND FLOWBACK WATER

A client, like many in the oil and gas industry, needed a solution to economically and safely purify the mass volumes of their produced and flowback water to meet the strict Department of Environmental Quality guidelines.

This client's area of operation is in Pennsylvania. Because of the laws there and very few disposal wells, not only the issue of the costly expense of storage had to be addressed, but the rising cost of transporting the water for disposal. The company had worked with other companies without any notable success.

Because the produced water is near distilled-water quality, the evaporation process does not emit any toxic components into the atmosphere.



◀ Component number eight of our nine-component train

Working with a producer's existing system, and not requiring an investment from start to finish, makes this an economical option for even a small producer.

KFS and the client made a site visit to evaluate specific needs. Samples of produced water were taken and sent to our lab for analysis to determine how to best meet the producer's requirements.

The producer's water sample had a TDS of 318,000 (all units of measure are mg/l), TSS of 297, turbidity of 226, pH of 4.4, barium of 11,600, iron 102, magnesium at 1820, strontium at 7270 and zinc at 6.7.

All other constituents were well within reasonable concentrations for produced water.

After analysis was completed, it was determined all nine of our technologies would be required to clean the water to a level to meet state and federal rules, so that it could be legally discharged into the environment.

CLEANING STEPS

By following this procedure, we would

- extract all benign and usable solids, which would, therefore, have no disposal costs
- destroy all chemicals
- change the ionic metals back into their oxide form, thus rendering them benign
- extract all the chlorides from the brine stream in either a concentrated heavy brine form for drilling operations or as high-quality dry salts ready for other commercial or industrial use
- be leaving pure water that is near distilled-water quality that is ideal for fracing, drilling use or to safely discharge into the environment without any worry of discharge violations
- and last, but not least, extract any valuable metals

The client's corporate mandate was to procure a system giving the option to use the clean water within their operations as their needs required. The producer also needed an option to safely dispose or evaporate the balance into the environment.

This represents a challenge when you are working with produced water that has more than 300,000 ppm of total dissolved solids and chlorides to make sure the water is clean enough to meet state and federal guidelines.

STRICT GOVERNMENT GUIDELINES

To meet guidelines, the water must be free of all chemicals, metals, salts and virtually free of all total suspended solids (TSS) and total dissolved solids (TDS). The extracted solids must meet the strict state and federal guidelines for disposal or reuse, and the operator must ensure that NORM (naturally occurring radioactive materials) concentrations remain within limits for conventional disposal wells.

LAB-TEST RESULTS

Having completed the full process, the produced water had undergone a substantial improvement in overall quality. An industry-respected and independent third-party lab reported the following results:

- barium was diminished to 0.115 ppm from the original 11,600 ppm
- iron to 0.01 ppm from 102 ppm
- magnesium to 0.1 ppm from 1,820 ppm
- strontium to 0.113 ppm from 7,270 ppm
- zinc to 0.0039 ppm from 6.7 ppm
- aluminum to 0.0031 ppm from 3.0 ppm
- all other metals were at a fraction from their starting point
- turbidity dropped to 0.18 from 226
- TDS to 144 ppm from 318,000 ppm
- chlorides dropped to 3.98 ppm from 181,000 ppm
- TSS to 5.4 ppm from 297 ppm
- pH can be adjusted with accuracy to any level specified to meet the producer's specific needs.

LITHIUM REMOVAL

One parameter requested by the producer was the extraction of lithium. The produced water has a level of 227 ppm of lithium. Our technology was successful in removing 226.9961 ppm. Lithium is a prime component in batteries for electric cars, cellphones and other electronic devices, which makes the extraction of any valuable metals such as lithium, cobalt and vanadium so important.

Because all water is processed in real time, except for buffer capacity, before entering our equipment, we developed a special protocol for this client at certain strategic intervals in our system and at the discharge stage.

The purpose of this special protocol is to greatly reduce costly large-volume storage or transportation cost while adhering to all state and federal regulations. By utilizing this protocol, producer costs and environmental concerns are reduced while processing any volume of water at a site. This also allowed KFS to monitor and control each phase of the operation.

ELECTRO-MECHANICAL PROCESS

By using various technologies, we developed the most advanced systems for cleaning contaminated water and extracting any valuable metals in the process. Our process is classified as electro-mechanical. The technology converts extracted solids, liquids and/or gases into useful commodities. This virtually eliminates the need for any type of costly disposal.

Our technology successfully removes or destroys all chemicals, and is not limited by high levels or concentrations of contaminants such as chlorides. As long as the contaminated water can be pumped, we can treat it.

Most other systems are limited by the levels of contaminants such as silts, clays, chlorides, bacteria, fungus and parasites. We return pure, clean and clear water that is of potable standards and may then be used for many additional purposes.

Our Advanced Water Recycling System has been used for the past 30 years. The technology has proven successful at cleaning produced and flowback water. It can process and handle any volume of contaminated water different sizes of treatment trains used in tandem.

EXTRACTING LUCRATIVE MINERALS AND METALS

We have also been recognized for our ability to extract valuable minerals and metals that are often overlooked by the oil and gas industry. Because of the current market value for crude oil and gas, some producers are looking outside the box for additional revenue streams. Often overlooked precious metals and minerals are more valuable than the oil and gas itself.

For a lot of producers, the daily rise and fall of crude and gas prices is just business as usual. There is a new group of producers that look for new ways to create revenue. They are focused on anything that creates revenue without increasing expenses. For example, lithium, cobalt and vanadium are extremely valuable and can very well offer a higher return in revenue than the oil and gas itself.

The current commercial market value for these minerals range between \$14,000 to \$90,000 per ton. Our proprietary technology has the capability of extracting any and all valuable minerals or precious metals from your produced water, thereby creating additional revenue streams.



◀ Component number eight of our nine-component train



▲ Component number seven of our nine-component train

Several companies have attempted to extract metals and minerals from produced water, but failed because the water must be clean or the metals and minerals are contaminated by chemicals entrained within the produced water. This revenue stream has typically not been realized, leaving millions of unrecovered revenues.

TWO-STAGE PROCESS

Our electro-mechanical process has two stages, with pH adjustment, solids removal, chemical destruction and metals removal completed using eight of our technologies in the first stage. For salt removal, we use a nonconventional desalination in the second stage. If a client desires evaporation for the remaining water, an additional component is used.

The first stage is designed to remove any and all impurities from the produced-water input stream creating a “pure brine” for the second-stage feedstock. This planned

process keeps all resultant fluids and solids pure, clean, non-toxic and non-hazardous.

The discharged water is classified as high grade and close to distilled quality, suitable for reuse in operations, agriculture or can be safely discharged back into the environment. This completely mitigates the need for imported potable water by the producer for fracing purposes.

The process is unique in that we can successfully process the concentration of total dissolved solids from 1,000 to 400,000 plus mg/l entrained in the water column as long as the column can be pumped, is somewhat fluidic and has the ability to successfully flow.

Water with lower TDS or chemical properties may require a much simpler process. Our suite of technologies has components that can function independently for specific tasks or be placed in sequence for a more complex water-purification system.