

Bench Scale Testing Services for the Upstream Oil & Gas Industry



Eco-friendly wastewater reclamation & treatment systems since 1988

Bench Scale Testing Services

Scope of Services – Wastewater Resources Inc. (WRI) offers the most adaptable and scalable upstream wastewater treatments plants – **AquaTex™ COG** (Coal, Oil & Gas), a pretreatment plant for well wastewater, and **AquaTex™ COG Advanced**, advanced treatment technology coupled with our pretreatment train. WRI also offers producers bench scale test services at our laboratory in Scottsdale, AZ, prior to purchasing our wastewater treatment plants or deploying them under a water service agreement.

Business Case – Knowing the concentration of the chemicals of concern (COCs) in wastewater generated by drilling and completion operations is the first step in managing environmental risks at a wellsite. Bench scale testing is the second step. The bench scale test (“Bench Test”) is an inexpensive solution for evaluating the treatability well-specific wastewater using our pretreatment and advanced treatment final design and settings of our technology to most effectively treat your wastewater. Testing well-specific water samples in our laboratory is the most cost-effective method of ensuring the maximum success of our treatment technologies in the field.

Applications – Our Bench Test services are for wastewater samples from drilling, completion, and production operations for crude oil, natural gas, and coalbed methane (CBM):

- Drilling fluids
- Frac flowback and
- Produced water.

Bench Scale Testing – Commonly overlooked, Bench Tests provide treatment outcome data for well-specific water samples. It is a scaled water treatment evaluation process conducted under controlled laboratory conditions to study the effectiveness of a treatment technology (i.e. materials, methods, or chemical processes) to remove specified contaminants at the wellhead or wellsite. The purpose of bench testing is to optimize treatment conditions and devices in a laboratory setting before deploying the wastewater treatment plant to the wellsite.



Benefits – A Bench Test is sometimes called a treatability test and offers many benefits:

- Creates well-specific conditions in a controlled laboratory setting
- Aids in the proper design of devices in the treatment train
- Improves design efficiency of a custom treatment train
- Verifies successful results prior to deployment to wellsites
- Establishes the preliminary costs of chemical and power consumption
- Ensures recycling, reuse and/or regulatory specifications are met and
- Establishes the lowest possible cost of the wastewater treatment plant.

Chemicals of Concern (COCs) – The physical and chemical properties of well wastewater vary considerably with the geographic location of the field, the geologic formation of the field, the type of hydrocarbon being produced, and the chemical additives used during drilling and production. In fields using waterflooding, the properties and volumes of the produced water may vary dramatically after injecting additional water into the formation to increase hydrocarbon production.

Our Bench Testing Services evaluate the ability of our wastewater treatment technologies to treat well-specific wastewater under laboratory conditions.

Knowing the chemicals of concern (COCs) in well wastewater is the first step in reducing environmental risks.

The Bench Test is the second step in effectively removing COCs from well wastewater.

Our Bench Test Services evaluate the treatment of wastewater samples under laboratory conditions.

We test shipped samples of drilling fluids, flowback and produced water in our lab.

The purpose of bench testing is to optimize treatment conditions and devices in a laboratory setting before deploying the treatment plant to the field.

A Bench Test offers many benefits that ultimately reduce treatment costs while improving the effectiveness of treatment to meet regulatory limits or specifications.

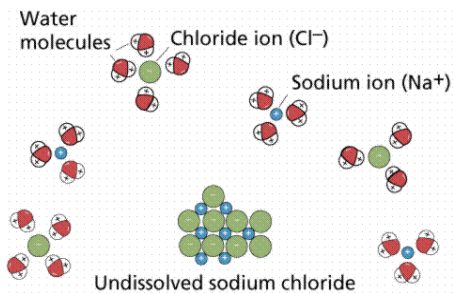
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Based on site and regulatory factors, major constituents of concern (COCs) are salt content, expressed as salinity, conductivity or total dissolved solids (TDS); oil and grease (organic compounds associated with hydrocarbons in the formation); inorganic and organic compounds used as chemical additives to improve drilling operations; and naturally occurring radioactive material.

Untreated wastewater samples may contain ingredients other than stated COCs or unusual levels of a COC that may affect our treatment devices and settings. Consequently, Bench Tests provide a starting point from which modifications are made to achieve the desired treatment outcomes.

Bench Scale Testing Process

For each Bench Test, the client executes a low-cost Bench Test Agreement. The agreement specifies the time periods of the testing process, the specific well from which the wastewater sample is taken, wastewater sample shipment procedures, the end use or disposal option for treated wastewater, existing water condition reports, if any, and the desired levels of contaminants to be achieved following treatment.

We operate a Bench Test laboratory at our headquarters in Scottsdale, Arizona. Water samples are received by laboratory staff, and the Bench Test is immediately conducted to prevent excessive decomposition of or changes in the wastewater samples. Actual bench testing processes are videotaped, and outcome data is entered into a computer program.

A final report is prepared upon completion of all Bench Test procedures. Initial and final COC concentrations are reported, as are the method, material, and equipment used in the laboratory. Removal efficiencies of our wastewater treatment technologies are also calculated and compared to reuse, permit or discharge limits. Tested treatment technologies are also evaluated for other performance criteria such as chemical and power consumption and cost.

Bench Test Deliverables

For testing water samples using AquaTex COG (pretreatment technology) or COG Advanced (pretreatment and advanced treatment technology), WRI and the client will provide:

Client to Provide:

- Ship 3 x 5 gallon raw water samples shipped to WRI in Scottsdale
- Samples clearly identified and shipped on a Monday using priority shipment and
- Complete list of effluent parameters required for treated water

WRI to Provide – AquaTex COG Pretreatment:

- Broad spectrum analytical analysis of raw water sample
- Chemical testing
- AquaTex COG bench-scale processing of sample water
- Broad spectrum analytical analysis of AquaTex COG processed water
- Consumable calculations (chemicals, power, etc.) and
- Detailed written report.

WRI to Provide – AquaTex COG Advanced:

- Broad spectrum analytical analysis of raw water sample
- Chemical testing
- AquaTex COG bench-scale processing of sample water
- Broad spectrum analytical analysis of AquaTex COG processed water
- Computer software model projections for UF/RO treated water
- Consumable calculations (chemicals, power, etc) and
- Detailed written report.

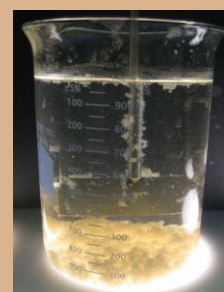
Final Report Components:

- Scope of work
- Methods & materials
- Analytical test results
- Chemical & power consumption results and
- Summary & conclusions.

COCs include a variety of Total Suspended Solids and Total Dissolved Solids that have to be removed or reduced to achieve the desired outcome.



Raw Wastewater



After COG Flocculation



After COG Filtration

A final Bench Test Report includes the scope of work, methods and materials, analytical test results, chemical and power consumption results, and a summary and conclusions.

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