

Multi-CideSM Delivers a Safe, Cost-Effective and High-Performance Biocide Program

MULTIPLE HYDRAULIC FRACTURING OPERATORS ARE SEEING THE BENEFITS OF THIS SAFE, SYNERGISTIC APPROACH TO MICROBIAL MANAGEMENT

U.S. SHALE PLAYS

CHALLENGES

- » Reduce Health, Safety, and Environment (HSE) exposure during stimulation operations
- » Provide effective bacterial control to mitigate corrosion failures
- » Exceed current biocide effectiveness over the long-term (downhole)

SOLUTIONS

- » Recommended Multi-Cide service, which includes:
 - Pre-job review of treatment types
 - Rapid implementation of specialized pumping equipment and personnel
 - Implemented low-dose, 'on-the-fly' metering, with post-job monitoring to confirm results

RESULTS AND BENEFITS

- » Low vapor pressure, less off-gassing than ClO₂, bleach, and PAA
- » Successful treatment of more than 66.4 M barrels of water in 22 months for multiple operators
- » Eliminates sulfate reducing and acid producing bacteria (SRB/APB) with monitoring confirming ongoing results
- » Long-term bacteria control during the frac job and downhole
- » Less susceptible to UV degradation than other oxidizers
- » More compatible with stimulation fluids than other oxidizers

OVERVIEW

Multi-Chem, a Halliburton Service, is helping hydraulic fracturing operators develop cost-effective biocide programs that deliver short- and long-term protection against microbial contamination and well souring without impacting safety, production goals and operating expenses.

Each operator has its own unique challenges and key performance indicators, requiring a solution that is customizable to align with all of their objectives, including cost and performance.

Multi-Chem has been using the Multi-Cide service to deliver consistent results across shale plays in the U.S. Although the proposed programs may be different with respect to chemistries, dosages and applications, the results are positive and consistent.

CHALLENGES AND SOLUTIONS

For hydraulic fracturing operators, oxidizers are the common solution to mitigate against the risks of short-term bacteria control. However, product selection is key, as oxidizers vary in their protection performance. Some work faster than others, and can create HSE hazards through off-gassing. Another challenge with oxidizers is they provide no long-term, downhole protection.

Multi-Cide provides sustained long-term bacteria control. It is a multi-component application consisting of a stabilized bromine oxidizer combined with a preservative biocide to provide optimum bacterial control. These specialty chemicals solutions are pumped by Multi-Chem service representatives with Halliburton's equipment to ensure their applications expertise maximizes the value of your assets.

The Multi-Cide service begins with a pre-job treatment review to determine the most effective biocide program to address specific needs. It also includes post-frac monitoring programs through data input into Multi-Chem's APX™ (Analysis of Performance eXecution) digital tool for easy interpretation and reporting to help operators make improved decision-making.



PERFORMANCE AND SAFETY RESULTS

Multi-Cide eliminates sulfate reducing and acid producing bacteria (SRB/APB). Customers see significant reduction in bacteria counts 30, 60 and 90 days after stimulation.

The following table presents the volume of barrels treated by Multi-Chem in some of the basins we operate in.

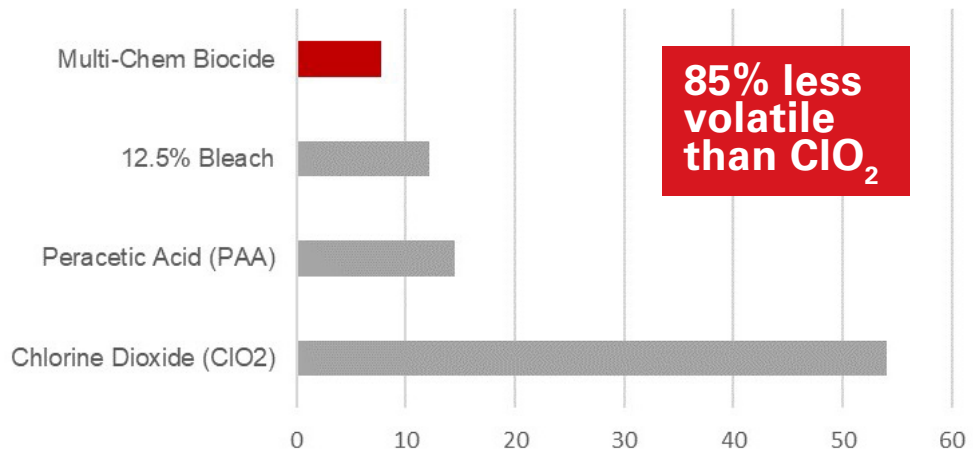
Area	Well Count	Stage Count	Barrels Treated
Central Texas (Barnett)	15	707	8,494,501
East Texas/Louisiana (Haynesville)	51	2,432	25,832,044
West Texas (Permian)	105	3,210	32,104,716
Total (September 2018 to July 2020)	171	6,349	66,431,261

Committed to safety

Multi-Cide provides significant reduction in gaseous fumes compared to common oilfield oxidizers, which mitigates the HSE risks associated with off-gassing.

The following graph presents the relative off-gassing when diluted to field concentrations of a Multi-Chem biocide compared to common oilfield oxidizers – chlorine dioxide (ClO₂), peracetic acid (PAA), and bleach. The Multi-Cide technology is 85 percent less volatile than ClO₂, resulting in a significant reduction of potential fumes and gaseous hazard cause by mixing in blender and fac tanks.

Vapor Pressure of Common Oilfield Oxidizers (mm Hg @ 25)



For a specialty chemicals treatment program characterized by superior service and chemical applications expertise that maximizes the value of your assets, contact us at multichem@halliburton.com

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