

Verza360[®] Enables Cost Savings with Effective Biocide Potentiation in Produced Water

Challenge

High Program Cost versus Performance

An operator was using two biocides, THPS and DDAC, to treat 45,000 bbl/day in their produced water recycling (PWR) system to control sulfate reducing and general bacteria activity going into their above-ground storage tanks (ASTs) and inground water pits. At the frac site itself, the operator was also using a glutaraldehyde/quaternary-based biocide. Due to the observance of bacterial growth despite treatment and increasing program cost, the operator wanted to trial more effective solutions.

Solution

Verza360[®] XT W20 for Biocide Potentiation

To reduce costs and enhance performance, Solugen proposed trialing Verza360[®] XT W20 (Verza) for biocide potentiation. While not a biocide itself, Verza is a carbon-negative, biodegradable, and non-toxic organic acid typically used for iron control in stimulation, completion, and production applications. Verza can also be winterized for cold weather climates. Previous microbiological studies via Adenosine Triphosphate (ATP) analysis demonstrated Verza's ability to act as a biocide potentiator, enhancing the effectiveness of the various biocides evaluated.

Trial

Applying Verza to the PWR System

The initial goal of this trial was to eliminate THPS, replacing it with Verza as a complement to DDAC. If successful, a secondary goal was to reduce DDAC use until performance no longer improved.



The trial was split into three phases to assess Verza's impact on enhancing biocide performance:

- Phase 1: 120 ppm DDAC (Baseline)
- Phase 2: 120 ppm DDAC and 120 ppm Verza
- Phase 3: 60 ppm DDAC and 60 ppm Verza

Note: A baseline using THPS and DDAC as originally used could not be obtained due to time constraints and chemical injection maintenance of the pump feeding THPS.

Within each phase, samples were taken continuously from the inlet water coming from three different fields/batteries (Inlet) and outlet water dispensing directly to the frac (Outlet). ATP values were captured for each sample and averaged to calculate the relative percent in ATP from Inlet to Outlet as a reflection of performance across each phase.

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Results

Verza Enhances Biocide Performance and Reduces Overall Chemical Use

Prior to the trial, the operator was using the following biocides and dosages (Table 1).

Table 1

Biocide Use Before Trial

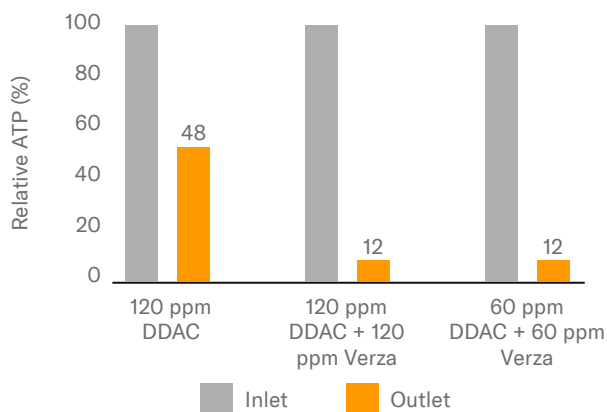
Biocide	Pre-Trial Dose (ppm)	Injection Points
THPS, 75%	120	AST, pit
DDAC, 50%	120	AST, pit
25% Glut/12% Quat	100-150*	Frac

*Dose dependent on incoming bacteria levels.

As presented in Figure 1, the addition of 120 ppm down to 60 ppm Verza along with DDAC improved performance, yielding 12% versus 48% relative ATP value using 120 ppm DDAC alone.

Figure 1

Relative % ATP from Inlet to Outlet across phases



As a result, the following chemicals and dosages were achieved (Table 2).



Table 2

Chemical Use Post-Trial

Chemical	Post-Trial Dose (ppm)
THPS, 75%	0
DDAC, 50%	60
Verza360 XT W20	60
25% Glut/12% Quat	100-150*

*Dose dependent on incoming bacteria levels.

Thus, relative to how much chemical the operator was originally using before the trial (Table 1), Verza allowed for 50% reduction in overall chemical use.

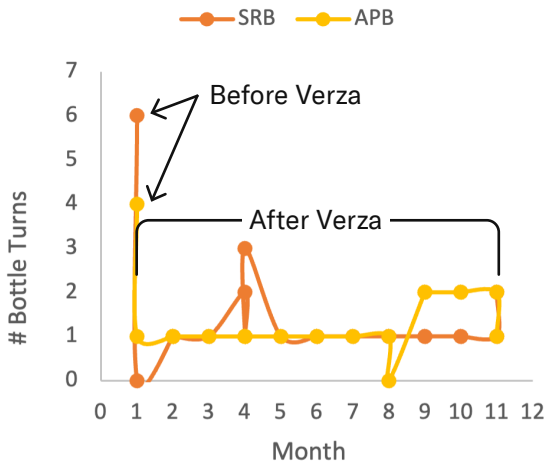
Long-Term Verza-Based Treatment Reduces Bug Bottle Turns Across Two Different Sites

Given the initial success of this trial, the operator conducted a subsequent 10-to-11-month bug bottle study with Verza-based treatment programs across two different sites containing both SRB and APB.

During the first month of the trial, baseline samples were taken without Verza, yielding an average 5-6 bug bottle turns across both sites and bacterial types (Figures 2 and 3). Going forward, a key performance indicator (KPI) for Verza-based treatment was 2 bug bottle turns.

Within 1-to-2 months of introducing Verza into the system and over the course of the long-term study, the number of bug bottle turns was reduced by an average of ~60-80% across both sites and bacterial types, meeting the operator's KPI of 2 turned bottles (Figures 2 and 3).

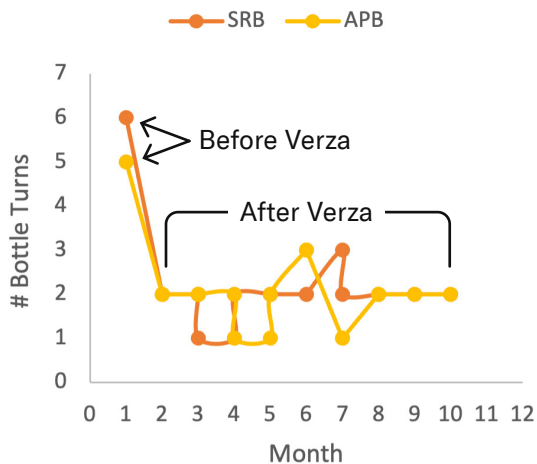
Figure 2
Site 1 Bug Bottle Turns over 11-Month Period



Conclusion

This trial supported conclusions drawn from prior internal data – when co-fed with biocide, Verza demonstrated a biocide potentiation effect, helping to reduce incumbent biocide and overall chemical use plus associated costs without sacrificing performance.

Figure 3
Site 2 Bug Bottle Turns over 10-Month Period



Overall, Verza enabled the following improvements across this year-long study:

- **50% reduction** in overall chemical use
- Est. **\$2MM/year** in chemical cost savings
- **60-80% reduction** in bug bottle turns
- **>85% reduction** in H₂S scavenger
- **Enhanced** biocide performance
- **Reduced** environmental impact.

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Having also observed a reduction in H₂S generation over the course of this study, the operator was able to reduce the use of H₂S scavenger by >85% (from ~36,000 gallons to <5,000 gallons) during the first year of the Verza-based treatment program.

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