

# Bellacide<sup>®</sup> 355

high performance, multifunctional in fracturing applications compared to DBNPA

## Challenge

While DBNPA is fast acting, it disappears quickly and, as a liquid, contains glycol, which acts as a food source for APB's and SRB's. Therefore, bacteria remaining can quickly lead to problems in the well's production. It is also ineffective at elevated temperatures or in the presence of reducing agents (H<sub>2</sub>S).

## Solution

Using Bellacide 355 delivers fast kill, while providing stable, long lasting control against APBs. Regrowth of bacteria does not occur with Bellacide 355, as seen in Graph 1. Bellacide 355 works when reducing agents are present and at elevated temperatures (Table 2).

## Conclusion

At an effective dose of 250 ppm, Bellacide 355 is fast acting, long lasting and outperforms DBNPA.

**Bellacide 355** is a fast acting, broad spectrum biocide with superior activity compared to other non-oxidizing biocides. Highly effective against problematic organisms, Bellacide 355 MMC (minimum microbicidal concentration) against sulfate reducing bacteria (SRB) is 100 ppm in 1 hour.

Benefits of Bellacide 355 (TTPC)

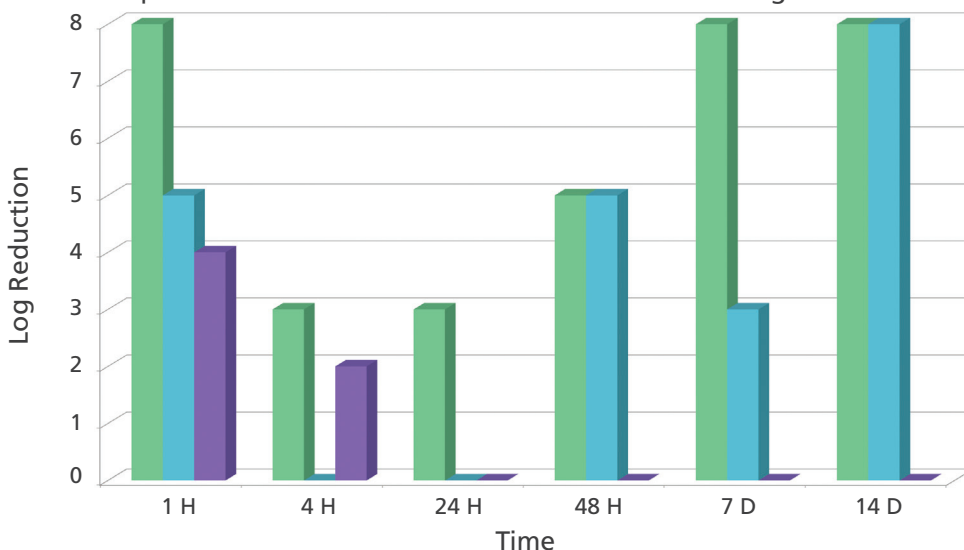
- Procedure - Cell disruption through membrane wall
- Operational – No persistent foaming
- Operational – Provides >80% corrosion inhibition

Bellacide 355 is a 5% aqueous solution of tributyl tetradecyl phosphonium chloride (TTPC).

### Bellacide 355 - Fast acting, long lasting

|                           |                         |
|---------------------------|-------------------------|
| Appearance                | Clear, colorless liquid |
| Specific gravity at 20° C | 0.98                    |
| pH                        | 6.0 – 8.0               |
| Odor                      | Slight to none          |
| Boiling Point             | 100° C (212° F)         |
| Solubility                |                         |
| - Water                   | Completely miscible     |
| - Methanol                | >50%                    |
| - Isopropanol             | >50%                    |
| - Ethylene glycol         | >50%                    |

Graph 1 - Bellacide 355 versus DBNPA in Acid Producing Bacteria Test



The long lasting effect of Bellacide 355 outperforms DBNPA

- DBNPA 5% at 250 ppm
- DBNPA 20% at 250 ppm
- Bellacide 355 at 250 ppm

\*Conditions, 30K TDS, pH 8 re-inoculated vile at 24, 48 hours, 7 days

Our wide selection of biocide chemistry can be tailored for any treatment scenario.

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Table 2 - Biocide Comparison

|                              | Bellacide 355 | 20% DBNPA      |
|------------------------------|---------------|----------------|
| Dosage                       | 250 ppm       | 200 ppm        |
| Use Cost                     | 1X            | 1.1X           |
| Kill Speed                   | Fast          | Fast           |
| SRB Performance              | Excellent     | Good           |
| Biofilm Removal              | Excellent     | Poor           |
| Thermal Stability            | Very Stable   | Poor           |
| Persistency                  | >28 days      | <7 days        |
| Safe Handling                | Excellent     | Extremely Poor |
| Gel Breaker Compatibility    | Excellent     | Poor           |
| Reducing Agent Compatibility | Excellent     | Deactivates    |

## Bellacide 355: The Only Fast Acting, Long Lasting Biocide for Oil & Gas

| Features   | Benefits   |
|--|--|
| <ul style="list-style-type: none"> <li>Compatible with gel breakers</li> <li>Provides additional corrosion inhibition</li> <li>Removes biofilm</li> <li>Synergistic with halogens</li> <li>Kills algae even at low dosages</li> <li>Stable at high temperatures</li> <li>Compatible with reducing agents</li> <li>Not a skin sensitizer</li> </ul> | <ul style="list-style-type: none"> <li>Does not interfere with gelling operations</li> <li>Prevents souring during fracking</li> <li>Continues to provide protection against souring even post-frac, during production</li> <li>Prevents Microbiologically Induced Corrosion (MIC)</li> <li>Protects pipelines, pumps, valves, safety equipment</li> <li>Not affected by H<sub>2</sub>S*</li> <li>Compatible with chlorine and oxygen scavengers</li> <li>Safer to handle than traditional O&amp;G biocides</li> </ul> |

\*DBNPA is deactivated by H<sub>2</sub>S and any other reducing agent.



[www.wateradditives.com](http://www.wateradditives.com)

### Americas

1979 Lakeside Parkway,  
Suite 925  
Tucker, GA 30084, USA  
Phone +1 678 802 3050  
Or 800 600 4523  
Americas@wateradditives.com

### Asia Pacific

No. 1 Magazine Road  
#04-01, Central Mall Office Tower  
Singapore 059567  
Phone +65 9745 3227  
AsiaPacific@wateradditives.com

### Europe

2 Brightgate Way  
Stretford, Manchester M32 0TB  
United Kingdom  
Phone +44 161 864 6699  
Europe@wateradditives.com

### MENA

DMCC Dubai Branch  
Office 1802, Level 18  
Jumeirah Bay X3 Tower, Cluster X  
Jumeirah Lake Towers  
P.O. Box 263164, Dubai, UAE  
Phone +971 4 880 7336  
MiddleEast@wateradditives.com

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