

# OILFIELD TECHNOLOGY

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Scientific Drilling



## Bellasol® Antiscalants & Bellacide® Biocides Sustainable Solutions for Severe Service Conditions

BWA Water Additives is the global leader in sustainable water treatment solutions for topside or down-hole production, seawater injection or squeeze treatment.

- Bellasol scale inhibitors are environmentally friendly, high-performance antiscalant polymers.
- New Bellacide 350 – highly effective non-oxidizing biocide that improves health and safety. Widely used in hydraulic fracturing.
- BWA supports oil and gas service companies in over 80 countries.

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*Oilfield Technology* Editor, Anna Scordos, recently asked Nozi Hamidi, BWA Water Additives, USA, a few questions about the state of the speciality oilfield chemical industry.

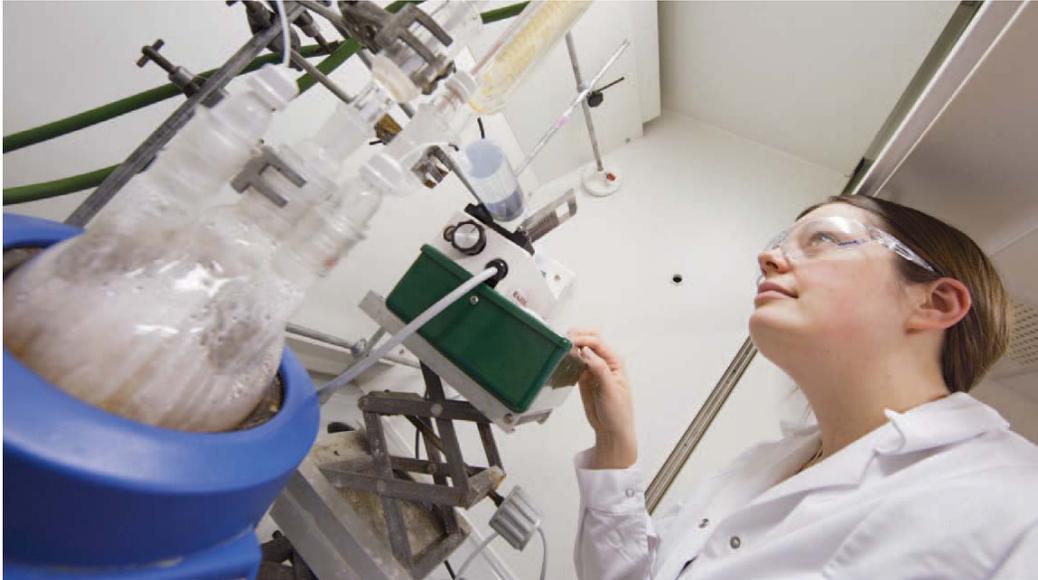
# Speciality chemical Q&A SESSION

**Q1. What areas of the industry are currently interesting for BWA?**

**A.** BWA has long provided scale control chemistries and expertise both in topside applications and downhole squeeze applications. Many years ago, the company was able to solve some of the most difficult scale issues in the Miller field of the North Sea where the combination of high total dissolved solids (TDS) and barium sulfate presented the industry with never before seen scale issues.

Several years ago, the company grew its presence in hydraulic fracturing, in particular, being well positioned to provide oilfield service providers with alternatives to the traditional biocides used to control microbial growth in fracturing waters. Bellacide 350, a newly EPA-approved non-oxidising biocide, which works well on bacteria and sulfate reducing bacteria (SRB) and presents an overall better total cost of use, was launched. Given the large volumes of water used in hydraulic fracturing - often 3 - 5 million gal. per well - and the trend to re-use this water at the frac site, there are also additional opportunities for traditional scale control chemistries.

**Figure 1.** A scientist mixing a new biodegradable antiscalant polymer.



**Figure 2.** A scientist developing an in-field monitoring test method for scale inhibitors.

Another area of the oil and gas industry of interest to the company is oilsands. The steam-assisted gravity drainage (SAGD) operations employed in oilsands require large volumes of high quality boiler feedwater. This is generated by the thermal evaporation of produced waters, which are typically contaminated with high levels of dissolved solids and hydrocarbons. Again, scale control chemistries are key to maximising the efficiency of these processes.

## Q2. What place do speciality chemical technologies currently occupy in the upstream oil and gas industries?

**A.** Speciality chemicals are, and will continue to be, significant to the upstream oil and gas industries. For an industry driven by yield and recovery, speciality chemicals play an important role in removing unwanted obstacles like scale and bacteria or reducing the risk of side effects like microbiologically induced corrosion (MIC). Specifically, without the use of speciality chemical biocides, there is a risk of gas souring from the introduction of bacteria, particularly SRBs. Some studies have shown that SRBs account for at least 90% of hydrogen sulfide entering

the cycle, lead to 50% of damage to underground infrastructure and that overall, the economics of biological damage can be up to 3% of the cost of the exploited metallurgical structures.

Speciality chemicals are also sometimes the only option for extremely difficult field conditions. For example, BWA has been asked to assist in developing speciality chemical solutions for the control and removal of 'exotic scale' - persistent scale species that are difficult to remove like zinc sulfide, lead sulfide or similar variations, and even uncommon species like

strontium scales. Some in the industry are even looking at speciality chemicals as a possible option for extending the value of guar, one of the key components of fracking fluid, given the recent guar shortage.

## Q3. What are some of the latest trends in speciality chemical technologies globally?

**A.** In addition to continued trends around environmental stewardship and biodegradability, there are also trends around in-field monitoring of speciality chemicals. For example, there is growing interest from oilfield service providers for a fast, simple but reliable method of measuring flowback water for the presence of specific scale inhibitors. This helps the service provider understand if the treatment has been effective or not. For example, the ability to measure high concentrations of the active component of the scale inhibitor immediately after treatment can help to identify potential downstream system upsets.

Another industry trend that is driving further development of speciality chemicals for the oil and gas industry pertains to well depth. As wells are drilled deeper, higher temperatures and higher pressures are encountered. The rate of inorganic scale formation increases greatly in high temperature high pressure (HPHT) environments. Additionally, more complicated sulfide scale issues are being reported in deeper wells compared to the usual sulfate and carbonate scale issues. HPHT environments will require deposit control programmes with even broader performance profiles than before. New scale inhibitors will be needed to provide not only sufficient thermal stability but also effective control of iron, lead and zinc sulfides.

## Q4. What is BWA doing specifically in these areas?

**A.** With respect to monitoring, the company is currently working to customise in-field monitoring technology to the suite of Bellasol products. The project to improve the company's techniques is focused on designing for simplicity and ease of use. BWA's monitoring approach is based on

monitoring the actual polymers, which is more valuable to the operator than other commercially available methods that simply monitor a tracing element and not the actual polymer. With respect to HPHT scale inhibitors, BWA has been able to identify proprietary polymer chemistry that retains effective sulfate and carbonate inhibitors even after being subjected to temperatures of up to 200 °C. The company's technology team in the UK is now engaged in the discovery of new sulfide inhibitors and is testing the performance of these new inhibitors with new, more sophisticated test methods.

## Q5. What sort of applications are oil and gas service companies requesting water treatment technologies for?

A. The typical requests are for biocides, scale control and corrosion control chemistries. These are used in downhole squeeze applications, topside applications, as well as hydraulic fracturing. Bellasol products are both threshold and crystal growth inhibitors. Other industry scale inhibitors are simply threshold inhibitors, which in practice, means that when the first evidence of scale occurs, the chemistry will drastically fail. However, with crystal growth inhibitors, when the first evidence of scale occurs, the scale inhibitor will withstand the scale and continue to perform.

In oilsands, the company is often asked for products to assist in purifying produced water so it can be recycled for the production of steam – required to power the SAGD operations typically found in the Alberta area.

But even outside of these mainstream applications, there are other applications. For example, at fracturing sites, there are many, many large tanks of water on hand. Even these tanks require some biocidal treatment for bacterial control. The trick here is to keep the application simple so that the service company can focus on the fracturing job and not the maintenance of the tanks or the treatment mechanism.

## Q6. Can you explain the issue of 'incompatibility' in the context of oilfield chemicals? What can be done to counter the problem? Do you have a case history on this issue?

A. 'Incompatibility' refers to how unstable an additive is under prevailing process conditions. Typically, produced brines are treated with scale inhibitors to prevent mineral scale deposition within tubular and topside equipment. So, it is a prerequisite that the inhibitor functions under the prevailing conditions of pH, TDS, temperature, calcium ion concentration, etc. regardless of where the inhibitor is applied. Identifying an effective programme where the additive is compatible with the process conditions and other additives is therefore of paramount importance to ensure functionality at not only the well sites, but also throughout oil/water gathering systems and the central treating facilities used to separate the oil, water and associated gas. The company has learned which physical polymer characteristics are important to sustain compatibility throughout these process streams and routinely addresses compatibility as part of any antiscalant programme recommendation.

To give an idea of how this knowledge translates practically, in West Africa, BWA was recently alerted of the need for an effective calcite/barite inhibitor where the antiscalant/brine incompatibility was impeding the separator and oil recovery efficiency. The incompatibility issue resulted in the performance of the existing scale control products being 'knocked out', leading to remediation work and mounting costs. Using laboratory techniques to reproduce the field conditions of the oil/water separator, the company was able to identify proprietary polymer chemistry that would be stable enough to provide calcite and barite control in returning brines. Thus, a combination of close co-operation with the local oilfield service provider, and chemical technology has helped the operator achieve smooth processing of returning oil/water mixtures and maximise oil production efficiency.

## Q7. How can biocides be applied to aid health and safety in the industry?

A. In the oil and gas industry, biocides are primarily used to kill bacteria species that, if not controlled, will produce hydrogen sulfide, which sours the gas, rendering it of much lower value. Biocides are also used to prevent biofilm and slime which, if not carefully controlled, can lead to MIC and impact the site infrastructure. One of the oldest, cheapest biocides often used in the industry is bleach, which presents significant worker safety and handling risks and can prematurely corrode in-field infrastructure. Likewise, some other traditional biocides that have been widely used are classified as skin-sensitisers, which presents risks. Often, the industry leaders have formal scorecards and evaluation systems in place to take such risks into account when selecting chemistries for biocidal applications.

## Q8. What breakthroughs have been made recently in BWA's R&D labs?

A. Firstly, there is Bellacide 350, which is a high performance and cost-effective biocide alternative to glutaraldehyde or bleach that has traditionally been used in oil and gas applications. It is one of the first biocidal actives that the EPA has approved in nearly a decade. Another recent development, is Bellasol S60, a scale control chemistry that provides superior performance against typical barium and calcium based scales as well as 'mixed' scales, that is also biodegradable. Bellasol S60 also has the advantage of not presenting the typical tradeoff of performance vs biodegradability that other biodegradable scale inhibitors present.

## Q9. How will these breakthroughs enhance industry performance globally?

A. In one recent case, great value to the industry was demonstrated by the provision of a supply of Bellacide 350 when other traditional biocides were in shortage and could not be obtained due to the timing of plant turnarounds. The advantage of Bellacide 350 though, which has been proven with several key oil and gas industry customers, is its ability to be both 'fast acting' and 'long lasting' – this means that ultimately, less biocide can be dosed compared to traditional biocides. And most

customers appreciate such a value proposition as they are under a great deal of public and regulatory scrutiny to reduce the volume of chemistry being used, not to mention improve the environmental profile of the chemistries they use.

In the past, offshore producers may have discharged production waters or wastewaters at sea. With or without regulation, many producers are now taking steps to be proactive about environmental stewardship, so there is much more interest in treatment before discharge and even specifying biodegradable chemistries from the start. That is where biodegradable scale control chemistries that meet or exceed CEFAS standards in the North Sea come in. CEFAS methodology ranks chemistries according to a hazard analysis that accounts for toxicity to aquatic organisms, bioaccumulation, and biodegradation. BWA's Bellasol

product range meets the 'Gold' standard of CEFAS, meaning they have the lowest possible hazard per CEFAS. Many European customers are interested in basing their operations on biodegradable chemistries, but interest is growing in the Americas too as they look to the North Sea as the industry model for environmental stewardship. The dilemma the industry has typically faced in the past is that the very few chemistries known to be biodegradable have not provided the necessary level of performance – the same protection against scale, particularly in severe service conditions – required by the industry. Since BWA is a supplier of biodegradable chemistries to a related market (industrial water treatment), the company has been able to leverage its know-how and expertise and overcome that hurdle for oil and gas applications. 