ENGINEERING YOUR SUCCESS.

A Parker White Paper

TwinZapp

Treating oil in water (OIW) emulsions for discharge to sea

BY PEOPLE FOR PEOPLE

Including GDF Suez E&P case study

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Table of contents

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Introduction

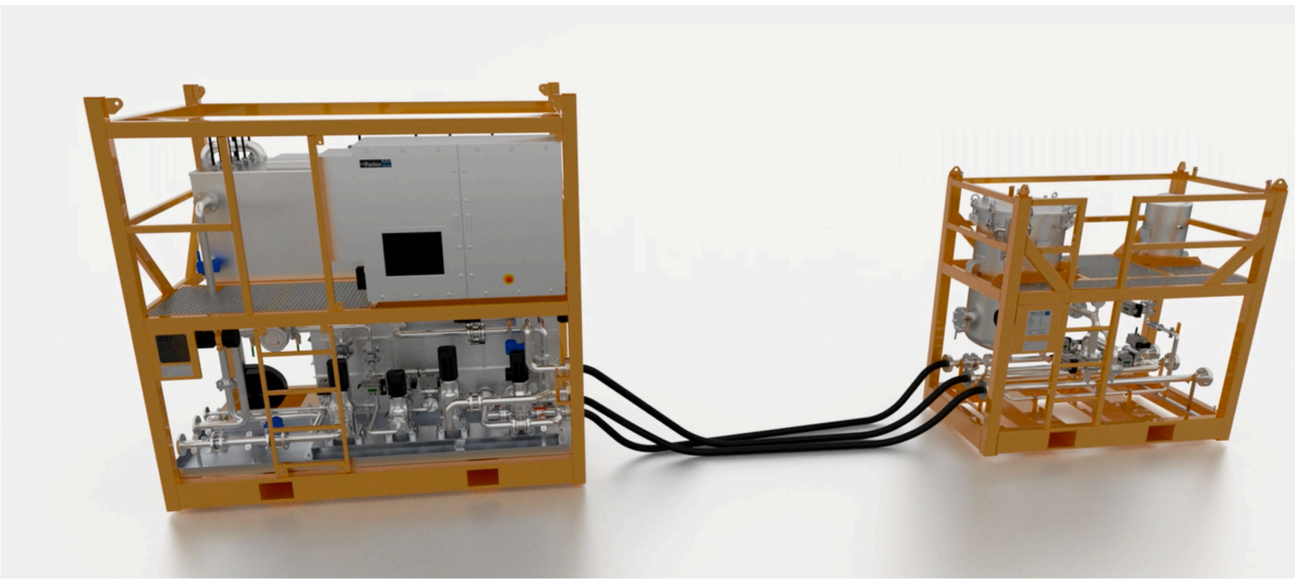
The increasing water cut in mature fields and tightening regulations are the main drivers for the growing challenge of treating oil in water emulsions. In addition, the industry is creating more emulsions in novel applications such as Fraccing, Well Deliquification and Alkali Surfactant Polymer water as used in Enhanced Oil Recovery.

Installed treatment equipment often relies on time and gravity as the main forces for separation of water and hydrocarbons (Stokes' law). For chemically stable emulsions these forces are not sufficient.

Parker Twin Filter has developed a technology based on its already extensive product line and experience in treating oilfield waste water. It uses the proven technology of electrical oxidation but uses this in a novel way to clean up water in a three step process.

The process is fitted on two mobile skids as an end-of–pipe solution. The input is water from the near atmospheric skimmer tank, the output is water which can be discharged to sea without further processing. The skids are self-sufficient, ATEX zone 2 certified, and only require electrical power and work air. It does not need regular attention from operators or specialists because the output of NTU is monitored by sensor technology.

The process is now available as a commercial product or service offering after thorough field trials in 2012 and 2013. This white paper details a case study with GDF Suez E&P in which this operator increased gas production significantly through the use of TwinZapp.



TwinZapp skid with 1st and 2nd step, 3rd step is a separate polishing skid

Technology

The technology consists of a three step process:

Step 1 Electrical Oxidation (Elox) / Electrical Coagulation:

As a consequence of the chemicals used for hydrate suppression, corrosion inhibition, well clean ups, fraccing, deliquification with foaming agents, etc, chemically stabilized OIW emulsions are formed. As a rule these types of emulsions tend to be cationic in nature and they respond well to the chemical process which is kick-started with the electrical oxidation cartridge electrodes (Elox). This step destabilizes the emulsions by reducing the polarity of the droplets in emulsion.

Other applications such as slop water treatment and crude oil related emulsions tend to generate anionic emulsions. With Well deliquification the preference tends to be for amfoteric foaming agents which also dictates the nature of those emulsions. More traditional Electro Coagulation is applied for these emulsions, by itself or combined with Elox, using the same ATEX equipment.

Step 2: Separation

Now that the emulsion is broken, the released oil (0.2 - 0.5 per cent of total flow) will float to the top where it is skimmed off as ‘schmoo’ and returned to the platform’s sump or atmospheric skimmer tank. Since the reject is added to the already existing waste streams it does not form another separate waste stream.

Step 3: Polishing

Further hydrocarbon removal down to typically 5 to 10 ppm is achieved in the last process step through media filtration (continuous water flow), cartridge filtration (short jobs) or UF filtration (more absolute barrier). This last step is mounted on a separate skid.

This modular approach has the advantage that media or other type filtration (cartridge / UF) filtration can quickly be changed out according to the scenario of the specific job. Different circumstances may dictate different filtration methods. A short job such as a well clean up, frac flow back or batch deliquification (foam job) may enable the use of simple cartridge filtration. On day-to-day gas production, the consumable character of the cartridges quickly becomes prohibitive and media filtration is a more efficient method.

When using a media filter, the back flush water is fed back to the Elox skid and -after settling- split into three phases. The top layer of condensate is usually fed into the platforms closed drain system. If there are any solids these are directed to the closed drain system as well. The bulk of the fluid is fed back into the TwinZapp process and retreated for discharge to sea.

If BTEX is a particular issue then absorbent cartridges can be applied as well in parallel or in series with other filtration media.

Field tests: treating emulsified water in various applications.

Through 2012 and 2013 the technology was field tested to confirm:

A. That the technology was able to function for longer intervals (>12 weeks) without specialist attention and without consumables.
B. Ability to operate on unmanned platforms (automated regulation of the processes).
C. Ability to deal with chemicals used in a normal gas production environment (methanol, corrosion inhibitor, well clean ups, frac flow back water).

Every test was executed as part of offshore operations. The system passed tests A, B and C which enables the use of the technology in a wide range of circumstances and operating parameters.

Filtration without consumables

A field test of three consecutive months with a media filter unit confirmed that the system is fully re-generable and does not require change out of the media. The media filtration uses a fully re-generable type of oleophobic media which is cleaned up in place with back flushed dirty water assisted with compressed air to quickly fluidize the media bed. The back flush cycle is controlled by dP, time or the turbidity of the output water.

Unmanned operation

The principle controlling parameter of the Elox process is the amount of energy which needs to be dosed to break the emulsion. In case of an overdose of energy, oxidation products such as FeOH3 start forming. Its particular red color is used to determine whether the system needs to adjust the amount of energy.

The resulting parameter at the end of the process is an as low as possible level of ppm free oil in the water. As an approximation, turbidity is used to determine the presence of a haze in the water. Lab and field testing has found that the relation is practically linear when below 100 ppm and a well suited approximation to control the energy dosing for the Elox process.

Application testing

A number of tests were staged during the normal operation to find out more about the operating envelope of the system. The system passed all lab and field tests without issues.

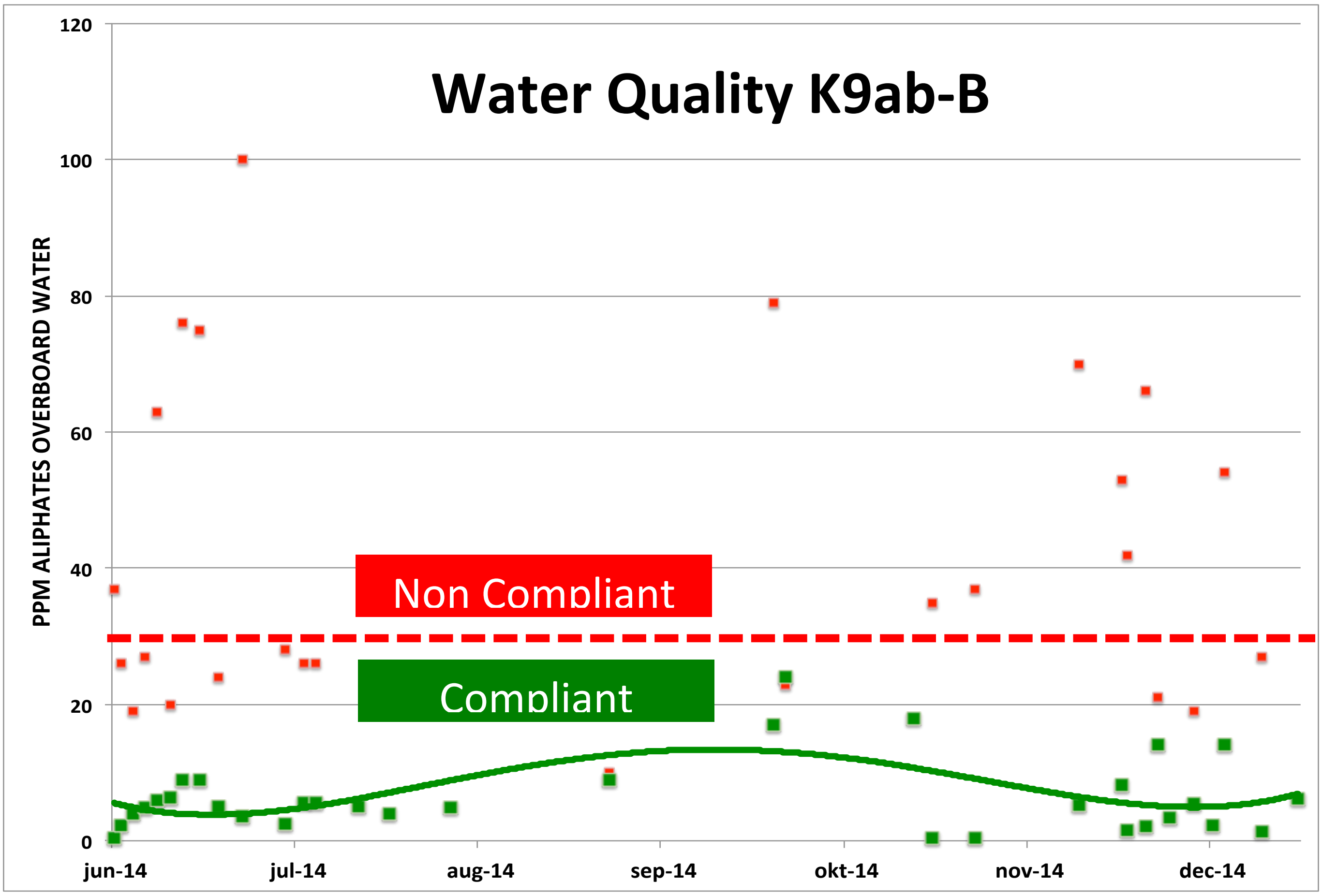
Application	Lab	Test	Field
Produced Water	X	X	X
Well clean up	X	X	X
Frac Flow Back	X	X	X
Pipe Line Pigging			X
Well Deliquification- Cationic	X	X	

The produced water flow was temporarily contaminated with methanol up to 20 per cent (as an artificial upset) and corrosion inhibitor up to 1000 ppm. These concentrations proved to have no negative effect on the effectiveness of the process, which consistently produced results between 5 – 10 ppm free oil and generally a reduction in BTEX of 40 to 50 per cent.

Case study: GDF Suez E&P : Increased gas production from previously shut-in wells

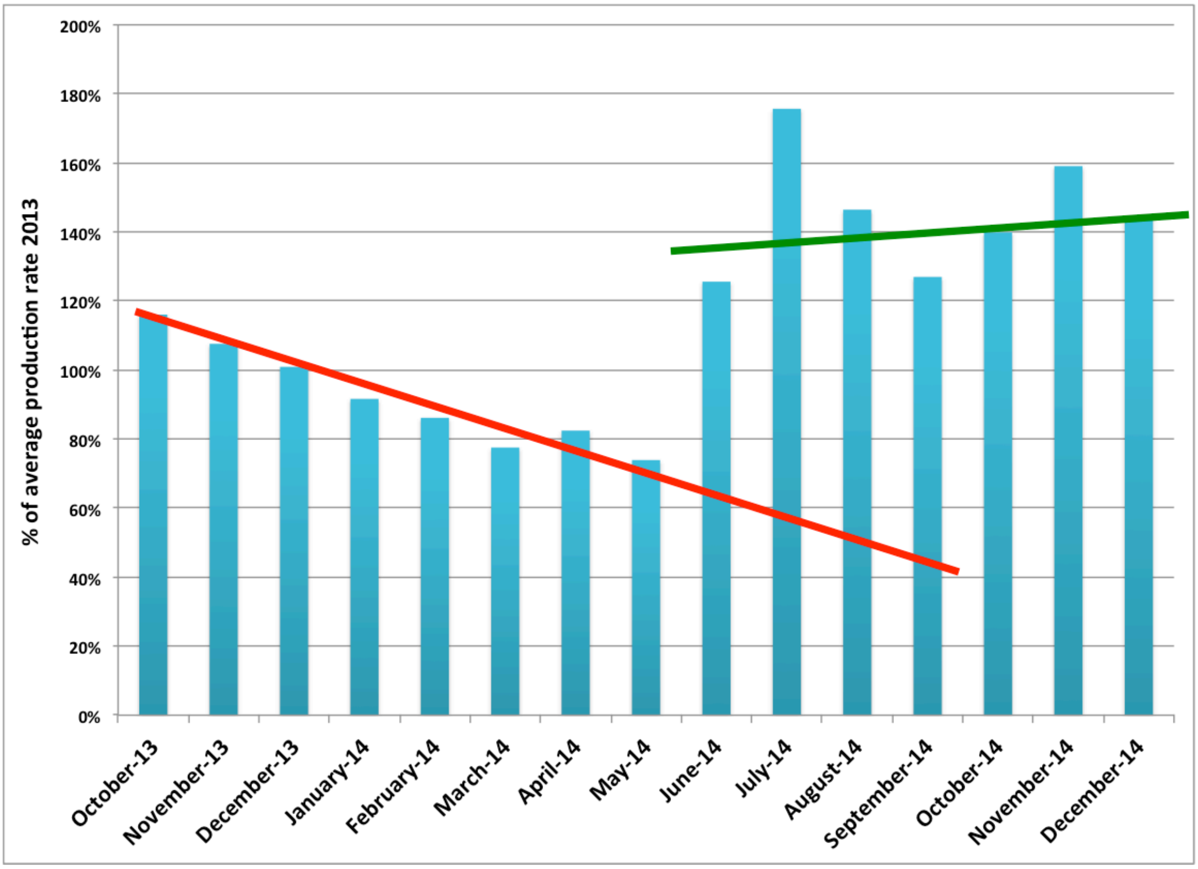
A unit was installed on platform K9-B on the Dutch Continental Shelf. The installation proved that the system was easily regulated and controlled to suit the existing conditions.

After several weeks of uninterrupted production GDF Suez decided to open up wells which were previously shut-in due to the poor water quality which could not be treated to specifications suitable for overboard discharge. The previous treatment solution used depth filtration followed by oil absorption which could not process the 'tight' emulsion.



Water inlet condition to Twinzapp and outlet quality over a 6 month operating period

This programme has boosted gas production of this particular installation by upwards of 50 percent and has added several millions of Euro's to the bottomline in just this period. After a regular maintenance shutdown of 10 days, the system was started up again without a requirement for specialist attention.



Gas production data before and after TwinZapp installation in May 2014

Conclusion

The TwinZapp process has the potential to add value to offshore operations in various ways:

- The operator achieves compliance with overboard water regulations with a comfortable margin. This applies also when treating chemically emulsified water and treating out chemical upsets such as spikes in corrosion inhibitor concentration.
- Wells which were previously shut in due to untreatable water quality can now add to total hydrocarbon production.
- Application of TwinZapp on well test and fraccing campaigns can mean earlier release of a rig or frac vessel. The returns from the wells can now be treated with TwinZapp rather then stored for transport to shore.

References

Reference 1: Chemically Emulsified Water Treatment Frac Water, a Parker Market Application Publication; Chemically Emulsified Produced Water a Parker Market Application Publication