



CASE STUDY

Well intervention in the British sector of oil and gas

1. Background information

The upstream, or exploration and production sector of the oil & gas industry is a significant consumer of chemicals. Chemicals are used for example in well construction, well intervention, production stimulation, flow assurance and production stream processing applications. One of the chemicals used in oil drilling operations with a good HSE (health, safety and environment) profile is a clear brine, cesium formate.

2. Introduction

A French company that is one of the largest operators in the UK sector of the North Sea carried out remedial well interventions to replace faulty equipment prior to production start-up. This was done for seven High Pressure, High Temperature (HPHT) gas production wells. In order to perform the well intervention, a high-density fluid was required to provide well control. The well engineering team selected cesium formate brine as their preferred well control fluid for the interventions.

Cesium formate brine is a rare and high-value chemical, produced by Cabot Corporation, a US company that is a global producer of specialty chemicals and performance materials.

3. Key changes and results:

Cesium formate brine is manufactured in relatively small quantities, up to 10,000 m³ per year. With the seven wells requiring a considerable proportion of the annual world production of cesium formate brine, there were clear drivers for both user and supplier to engage in careful brine loss management and to relate payment of functionality.

The Chemical Leasing business model constitutes a key change to how these fluids are sold. The business model was chosen for all seven wells. As a consequence, the overall material flow system became more closed, as losses were reduced. This was brought about through careful management and process optimization that led to significantly lower losses than industry average.

3.1 Unit of payment applied

Before Chemical Leasing:	US\$ per volume of fluid
After Chemical Leasing:	US\$ per day of fluid volume use on rig + US\$ per volume of fluid lost

3.2 Technical measures tested and implemented

Historically this type of HPHT workover applications could only have been performed with the other heavy brine, zinc bromide, which is a HSE hazard for people and environment. Zinc bromide is not available for lease, but has to be purchased. Technically, the new well intervention fluid was used in the same way and for the same purposes as the fluid option it displaced.

Cabot engineers started by doing a thorough audit of the platforms' fluids handling and transfer system in order to identify possible operations or equipment that could lead to either brine contamination or fluid losses. Following the rig audit, a detailed Fluids Management Manual was

prepared and distributed to all personnel responsible for handling the fluid, both onshore and offshore.

The well interventions were successful, and the required repairs were carried out without any major fluid losses. During the seven year period a total volume of 4,000 m³ brine was handled on the rig, which is about 40% of the yearly production. Only 10% (400 m³) of this volume was lost during the repairs. This is considerably less than the industry average using other fluids and business models. The rest of the fluid used was recycled by Cabot at their Aberdeen plant, and made available for reuse in the next Total well and other future wells. By using a Chemical

Leasing business model, the focus of both parties were on reducing both losses and brine contamination.

Losing less fluid to the environment or to the formation reduced the environmental impacts at site and conserved the mineral resource for reuse at high value. Less losses and less waste also had positive economic benefits for both the operator and the supplier.

After these successful early cases, Cabot has supplied cesium formate brines based on a Chemical Leasing business model to serve as well completion and workover fluids in over 200 wells across the globe.

3.3 Results achieved

Before Chemical Leasing	After Chemical Leasing (2010 onwards)
<ul style="list-style-type: none"> • Alternative fluids cannot be discharged, and entailed hazardous waste management approaches as well as transport cost and constituted a risk to the environment in case of spills • The use of the more toxic alternative, zinc bromide, led to extended rig time of up to 1 week due to additional clean-up work required • The use of zinc bromide could lead to severe chemical burns when splashed on skin 	<p>Environmental benefits:</p> <ul style="list-style-type: none"> • The formate fluid has a much less harmful environmental profile, it is a lesser risk to the environment in case of accidental discharges, and it does not require treatment as hazardous waste <p>Economic benefits:</p> <ul style="list-style-type: none"> • The team efforts of user and supplier created a basis for a long-term relationship • The use of the formate fluid removed the need for certain technical procedures, such as clean-up prior to production, thereby saving time and money • The use of the rare and expensive fluid was only possible using Chemical Leasing <p>Social benefits:</p> <ul style="list-style-type: none"> • Creation of jobs (in laboratories) • Risk reduction and better working conditions