NGL SERIES FOR HIGH-PRESSURE CO₂ COMPRESSORS

CO₂ EOR CASE STUDY
Problem:
In 2003, an oil company employing CO₂ in a WAG (Water Alternating Gas) enhanced oil recovery system in West Texas was experiencing problems with downstream contamination of high-pressure CO₂ compressors. The contaminant was a black tarry substance that was plugging CO₂ injection lines, filters, perforations, nozzles and the reservoir. An outside consultant was hired to find the source of the contamination. Laboratory analysis determined the contaminant consisted of iron oxides, iron sulfide, elemental sulfur, sand, scales and other solids bound together by different compounds acting as binders. These compounds were found to consist of lubricating oil, asphaltenes and paraffin. The lubricating oil was 70 - 75% of the contaminant. Lost revenue and cleaning costs were estimated at $133,000 per month.

Evaluation:
Summit Industrial Products was invited to the West Texas facility to aid in finding possible solutions to the compressor contamination issues. The outside consultant and Summit agreed, changing from petroleum-based cylinder oil to a polyglycol based (PAG) lubricant would remove a large source of the contaminant binder. Testing by Summit and an outside research laboratory confirmed Summit's NGL Series polyglycol-based cylinder oil has 1/7 the solubility of mineral oils with high-pressure CO₂. This means lubricant carry-over is reduced by 85%. The NGL Series lubricants are water soluble, so when the system is converted to water injection the water dissolves any NGL on contact. In non-WAG systems, the naturally occurring moisture in the formation dissolves any NGL carryover. Summit worked closely with the engineers responsible for the water injection side of the plant to ensure NGL would not adversely affect their operation.

Across a broad range of industrial applications, the gas compressor is a vital piece of equipment that can shut down an entire operation if it fails. Fortunately, Summit Industrial Products offers synthetic lubricants specially formulated to maximize the efficiency and reliability of gas compressors. They understand the need for a compressor lubricant that provides proper lubrication and is formulated for the upstream and downstream processes. Summit is an international leader in the development and manufacturing of quality synthetic compressor lubricants.

NGL Series for CO₂ enhanced oil recovery systems
Solution:
NGL-888, an ISO 220 polyglycol-based cylinder oil was selected to replace a mineral-based oil. PAG oils are not compatible with mineral-based oils, so the tanks and lubrication system for the cylinders and packing were cleaned with a flushing fluid. Also, acrylic air eliminators were replaced because of compatibility concerns. The frames, being a separate lubricating system, remained on mineral oil. After the changeover to NGL-888, the plant experienced heavy build-up of a contaminant at the screen filters downstream at the injection site. The screen filters had to be changed often during the first month of operation. Many people mistakenly believed this was due to the PAG-based lubricant. In fact, NGL-888 was acting as a solvent and cleaning remaining mineral oil deposits in the piping.

Conclusion:
In the three years since converting the cylinder and packing lubrication system from mineral-based oil to NGL-888 there continues to be no signs of contamination and no loss of production because of the cleaning process. No lubricant-related issues have been experienced by the team responsible for the water injection side of the operation. The number of compressors has increased from 12 to 28, while CO₂ compression capacity has quadrupled. The additional cost of NGL over mineral oils was significantly reduced by the plant being able to reduce feed rates by an estimated 50%.

The compressors used are electrically driven, low rpm reciprocating units from 2250 to 5000 horsepower installed downstream of a membrane separation system. This section of the plant consisted of 12 units compressing the CO₂ stream from 8 to 2200 psi. Flow rates were approximately 153 MMSCF.
Summit Industrial Products is recognized as an industry leader in lubricating technology. Summit is a subsidiary of Klüber Lubrication, one of the world’s leading manufacturers of specialized high performance greases, oils, pastes and coatings.