

Enhancing flow for Canadian crudes

New DRA improves the movement of heavy oil through pipelines.

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The growing global demand for oil and gas and the corresponding drop in new sources of light, sweet crude from conventional reservoirs has operators ramping up their E&P efforts for heavier and harder-to-extract crude stocks. While technological gains have allowed operators to produce heavier crudes and refiners to profitably process them, problems persist in getting them from the field to the refinery.

Heavy crudes are notoriously difficult to transport via pipeline due to their low API gravity ($<20^\circ$) and high inherent viscosities (upward of 10 cu. cp at surface temperature and pressure). Solutions to this problem have included the addition of large amounts of diluent or heat to reduce the crude's viscosity and enable transportation. However, these solutions are economically prohibitive in many cases since the volume of diluent or heat generation required is quite high to sufficiently lower the viscosity and overcome frictional pressure in a pipeline. As a result, overall transmission efficiency is diminished, as is the total volume of heavy crude transported via pipeline.

Reducing drag

Drag reducing agents (DRAs) are chemical alternatives that have been used in production and pipeline applications over the past two decades. DRAs are high molecular-weight polymers that are added to the pipeline at a continuous dosage of just a few ppm and act to interrupt the frictional pressure drop, or drag, generated when the flowing crude comes into contact with the pipe wall.

While research continues into understanding the precise mechanism of drag reduction, it's understood that the polymer molecules disrupt the formation of turbulent eddies that form at the contact point between the oil and the pipe wall. Lower turbulence translates to lower drag and improved flow of heavy oil through the pipes, with lower pumping requirements.

Conventional DRA technology is not a flow-boosting solution for all crude types, particularly for those that contain precipitated asphaltenes. Canadian crudes are characterized as being asphaltenic, which lowers the drag reduction efficiency of many DRA polymers.

This limitation prompted Baker Hughes to develop its FLO ULTIMA series of DRAs, which comprise a long-chain latex polymer specifically designed to dissolve in high asphaltene-content crudes with a gravity of less than 23°API and improve the flow of heavy oil through pipelines.

The specific polymer design delivers high drag reduction in heavy crudes with less heat and lower diluent volumes, reducing corresponding HSE risks and treatment costs. The heavy crude DRA has been shown to reliably reduce frictional pressure in crudes that are restricted by viscosity or operating pressure and increase the flow rate in pipelines by more than 50%. Hydraulic engineering professionals routinely work with pipeline operators to calculate the precise amount of heavy crude DRA required to increase a given pipeline's throughput.

These specialized DRAs reduce pressure in the pipelines without coating the inner walls or adversely affecting the composition of the crude oil. This serves to enable operators to bypass pump stations

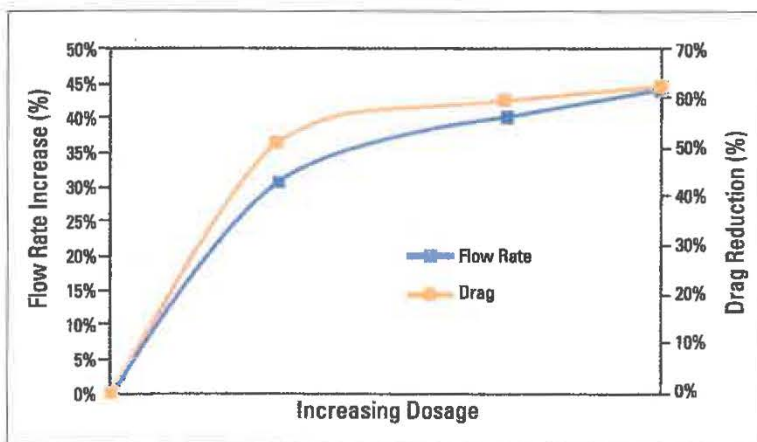


FIGURE 1. Even at a low dosage, the heavy crude DRA dramatically boosted the flow rate of Canadian crude into the refinery, with a corresponding reduction in drag in the pipeline. (Source: Baker Hughes)

and effectively optimize power usage to lower overall opex while increasing the pipeline's efficiency and throughput.

Boosting throughput

A U.S. Gulf Coast refiner required a drag reduction solution that would allow multiple crude feedstocks to be transferred through a 6.9-mile (11.1-km) pipeline delivering into the refinery. The refiner had made equipment upgrades to process a larger proportion of heavy oil and, therefore, wanted to increase the amount of heavy asphaltic Canadian crude in its feedstock.

However, the viscous nature of the crude coupled with the drag generated in the pipeline caused a significant drop in flow rate compared to lighter crude oils. This resulted in decreased throughput of the economically favorable heavy Canadian crude slate and a corresponding drop in profitability.

The refiner approached Baker Hughes to help increase its Canadian crude throughput using the new technology.

The refinery agreed to trial the new heavy oil DRA using Baker Hughes injection equipment in the transfer pipeline to the refinery.

The heavy crude DRA was injected into the pipeline at different dosage rates to optimize the flow rate of the pipeline (Figure 1). Results from the trial showed a 44% increase in the flow rate and a 62.5% reduction in drag.

As a result, the refinery was able to transport the heavy Canadian crude much more efficiently, increasing the amount of crude it could process. And, in turn, it was able to increase its profitability through a much faster speed to market using the new DRA solution.

Growing need

Boosted flow efficiency provided by the FLO ULTIMA heavy oil DRA is not limited to pipelines in and around refineries but is possible to use in the entire pipeline network between Canada's oil sands and the U.S. Gulf Coast. Much of this infrastructure has been in operation for many years or even decades and as a result has been



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pressure de-rated. The heavy oil DRA allows the pipelines to pump the same amount of crude at lower pressures, thus extending the working life of these assets.

At the same time, pipeline operators are increasing their capacity to keep up with the growing volumes of heavy oil being imported to the U.S. from Canada. For the week ending Sept. 5, 2014, oil imports from Canada to the U.S. Midwest climbed to 2.21 MMbbl/d, according to the U.S. Energy Information Administration (EIA). This marked the largest crude shipment to the Midwest from Canada since the EIA began reporting weekly data.

The January 2014 startup of TransCanada's Gulf Coast Pipeline Project, originally the southern leg of the delayed Keystone XL pipeline extending from Oklahoma through Texas, promises easier access to heavy Canadian crudes for Gulf Coast refiners. Canadian crude imports into the Gulf Coast hit an all-time high of nearly 6.2 MMbbl in June 2012, according to the EIA. As more of this heavy crude enters the U.S., technologies such as the new heavy oil DRA will be a vitally



The viscosity of Alberta's heavy oil causes issues in transportation.

important contribution to an operator's strategy to get crude to refineries across the continent as efficiently, safely and cost-effectively as possible. **E&P**



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