



# DRA

TECHNOLOGY  
FOR HEAVY  
CRUDE



**Tim Burden, LiquidPower Specialty Products Inc., USA, highlights the reasons behind the increased adoption of heavy crude oil drag reducing agents.**

**N**early 40 years ago, the first pipeline drag reducing agent (DRA) was introduced to the pipeline industry: CDR Flow Improver. This first-generation DRA was market-changing for the pipeline industry, enabling LiquidPower Specialty Products Inc. (LSPI) to build a full portfolio of drag reducer products to treat various refined products and crude oil applications. DRA rapidly became a valuable tool to address market needs and augment pipeline capacity.

Ten years ago, LSPI introduced a breakthrough technology for the heavy crude oil market: ExtremePower® Flow Improver. Prior to LSPI's commercialisation of ExtremePower, pipeline drag reducer technology had not been available for heavy crude applications. Adoption of heavy crude DRA has been widespread since, offering producers and pipeline operators a chemical solution to optimise their production and takeaway capacity of heavy crude oils.

#### **A chemical solution for challenging pipeline operations**

Drag reducers or DRA (also referred to as flow improvers) consist of long-chain, ultra-high molecular weight polymers that fully dissolve in the hydrocarbons being transported and suppress turbulent eddies with only ppm concentrations in the hydrocarbon. The suppression of these eddies results in lower

pipeline frictional pressure loss, which allows operators to improve the operations of their pipelines in several ways:

- Flow increase – DRA allows operators to increase throughput and earn more tariff. LSPI DRA has doubled the throughput of many pipelines.
- Constraint removal – DRA effectively alleviates the constraint of a bottleneck segment, thereby allowing the flowrate down the pipeline to be increased.
- Energy management – DRA saves pumping energy. LSPI has supplied many applications where entire pump stations have been bypassed. By allowing shutdown of intermediate pump stations, energy and maintenance costs can be dramatically reduced.
- Pressure reduction – Sometimes operators need to reduce the operational pressure in a pipeline. DRA is a fast and effective tool to reduce and control pipeline pressure without compromising throughput.
- Results without large capital expenditure – Pipeline performance can often be improved without major capital investment. DRA is injected directly into pipeline products, using skid-mounted injection pumps and tanks. Installation of a DRA skid enables pipeline operators to see reliable results utilising existing infrastructure.
- Temperature management – DRA can be used to reduce the heat generated from pump energy input. Pipeline operators have used DRA to reduce the arrival temperature of heavy crude oil. DRA also have been shown to reduce



**Figure 1.** LSPI introduced the first suspension-based DRA technology (left), shown next to the company's first generation product, a gel-type DRA (CDR).



**Figure 2.** LSPI operates a world-class manufacturing campus in Bryan, Texas, USA. Strict quality standards are demonstrated through ISO 9001:2015 certification.

heat transfer to the surroundings, most notably in submerged pipelines, allowing the crude oil to stay warmer and less viscous in the pipeline.

DRA products have proven to be beneficial to pipeline operators and producers globally. DRA users are able to achieve their operational goals with the aid of LSPI's LiquidPower®, RefinedPower®, and ExtremePower Flow Improvers, which can be turned on or off as needed at concentrations tailored to the desired drag reduction performance level. In addition, LSPI's DRA products are fully mechanically degraded when encountering high shear forces inside pumps and thermally in the downstream refinery process.

### **Technology for superior performance and handling**

LSPI patented and developed the first generation of flow improvers for hydrocarbon pipelines – CDR Flow Improver, a product that was critical in the operation of the TransAlaska Pipeline in the late 1970s and 1980s. The gel technology used in CDR Flow Improver was successful but had many limitations due to the highly viscoelastic nature of the product. Handling of the product was difficult, the concentration of active ingredient was low, and the drag reduction performance was limited. Nevertheless, CDR Flow Improver paved the way for a second-generation flow improver.

In the 1990s, LSPI developed and patented LiquidPower Flow Improvers, in which polymers were incorporated as solid particles suspended in an aqueous carrier fluid. This second-generation technology of flow improvers changed the market by providing higher drag reduction performance, easier handling and improved safety. Within that technology, the first suspension DRA for refined products were also introduced by LSPI as RefinedPower Flow Improvers. LSPI Flow Improvers are used globally, treating millions of barrels of crude oil per day.

Traditional DRA, such as CDR and LiquidPower Flow Improvers, consist of ultra-high molecular weight hydrocarbon polymers which are proven to perform well in refined products and light and medium crude oils. However, this traditional technology is unable to drag reduce heavy, asphaltenic crude oils.

### **New possibilities for heavy crude**

LSPI developed and patented a revolutionary technology in the mid 2000s using a new polymerisation technique for DRA, which resulted in new methods for using ultra-high molecular weight polymers. The new chemistry resulted in a highly stable, low viscosity, aqueous dispersion flow improver that associated well with heavier, asphaltenic crudes commonly produced in South America and Canada.

Ten years ago, this technology was introduced into heavy crudes in South America as ExtremePower Flow Improver. This was the first commercial application of drag reduction of heavy crude oils, initially believed to be impossible with the previous decades of experience with first and second generation DRA products. ExtremePower Flow Improver proved that drag reduction in heavy oils was achievable with the new chemistry and new polymers developed by LSPI.

Initial commercial applications of ExtremePower Flow Improver arose when Colombian oil producers were forced to truck thousands of barrels of heavy crude oil per day over mountainous and treacherous terrain to reach their terminals. This was costly, inefficient and posed significant safety risks. After implementing ExtremePower Flow Improver in their pipeline systems, the producers and pipeline operators were able to reduce the trucking fleet and meet their production demand by utilising existing assets within their pipeline system.

### **Drag reducing agent in heavy oil applications**

#### **An economical alternative to trucking or rail transportation**

As ExtremePower Flow Improver demand in South America grew, Canadian heavy oil production also began to increase. Many refineries in the US were equipped to process heavy crude oils, and Canadian producers developed technology to upgrade bitumen to crude oil that could effectively flow in pipelines. As production increased and pipeline bottlenecks developed, pipeline operators implemented ExtremePower



**Figure 3. LSPI's manufacturing campus has achieved numerous safety achievement and merit awards.**



**Figure 4. LSPI recognises the business-critical nature of supply chain reliability. Utilising both in-house and trusted business partners, LSPI safely delivers DRA product to customers around the globe.**

Flow Improvers on feeder lines and major trunk lines in North America. Many of these pipelines are critical to the takeaway capacity of pipelines transporting crude oils that are produced in Canada and shipped to US Midwest and Gulf Coast refineries. Similar to the downsizing of trucking fleets in South America, the use of ExtremePower Flow Improvers in North America further facilitated the use of pipelines and helped reduce the need for rail car transportation.

#### **Increased flexibility for batched pipeline systems**

In both North and South America, many pipeline systems were initially designed to handle only light or medium crude oils. With the increased production of heavy crude oil, these pipeline systems evolved to handle both light/medium crude oils and heavy crude oils which are batched down the line. Utilising LSPI's engineering and predictive tools, pipeline operators are able to determine the proper locations of pump stations with LSPI injection skids for both LiquidPower Flow Improvers and ExtremePower Flow Improvers so that drag reduction benefits can be maximised for all types of hydrocarbons. As light/medium crude oils pass through a pump station, the LiquidPower Flow Improver injection skid is used to treat the batch. When a heavy crude oil batch passes through the pump station, the ExtremePower Flow Improver injection skid is turned on and the LiquidPower Flow Improver skid is turned off, thus providing optimised use of each DRA in the crude oil they were designed to function in.

#### **Opportunity to utilise DRA for temperature management**

More recently, pipeline operators have expressed concerns with managing the arrival temperature of crude oil at terminals. With long pipelines transporting crude oil from Canada to the US, numerous pump stations are continually adding thermal energy to the crude oil to move it to its destination. With increased temperature comes increased vapour pressure, causing concerns with mechanical design limitations in pipeline terminal tanks, rail cars, refineries and maritime vessels. As a result, pipeline operators need to decrease crude oil arrival temperatures at terminals. The use of ExtremePower Flow Improvers has allowed pipeline operators to shut down mainline pumps at pump stations, resulting in less thermal energy being added into the crude oil and thus lowering the crude oil temperature at the terminals and allowing safe operations within mechanical design limitations.

#### **Proven technology leadership**

After more than 40 years since its invention of the first pipeline DRA, LSPI continues to develop and improve the performance and reliability of its flow improver portfolio to assist pipeline operators and producers in meeting their needs for increased throughput, pressure reduction, energy management and thermal management. After ten years of use in an ever-changing heavy crude oil market, ExtremePower Flow Improvers have proven to be instrumental in the operations of pipelines transporting heavy crude oil to meet the growing demand for fuel. 