



## DILUTED BITUMEN

### **BACKGROUND ON DILUTED BITUMEN**

One of the types of crude oil derived from the Canadian oil sands is bitumen, a heavy, sour oil. Bitumen would not flow through a pipeline efficiently, so it is mixed with diluents to be readied for pipeline transportation as diluted bitumen, or ‘dilbit.’ Diluents are usually natural gas condensate, naphtha or a mix of other light hydrocarbons.

Bitumen is a mixture of heavy oil, sand, clay and water. It is separated from the sand and water in a centrifuge prior to dilution for transportation.

### **CORROSIVITY OF DILUTED BITUMEN COMPARED TO OTHER CRUDE OILS**

Diluted bitumen is no more corrosive in pipelines than other heavy crude oils. Diluted bitumen has characteristics similar to other heavy crude oils, such as those produced in Venezuela, Mexico, and California, which have been transported and refined in U.S. pipelines for decades.

The corrosivity of a crude oil type can be measured against other crude oils by the presence of sand and other sediments, sulfur, and salt. The Battelle Memorial Institute (Battelle) developed a pipeline oil comparison index (POCI) assessing seven types of diluted bitumen from Canada against heavy sour crudes from Canada, Mexico, and Colombia.

Corrosivity statistics of several types of diluted bitumen derived from the Canadian oil sands were compared against those of many other crude oils by Battelle, at the request of API. Six of the seven Canadian diluted bitumen crudes had a lower corrosivity than a blend of Western Canadian Blend, a conventional crude. All seven of the Canadian diluted bitumen crudes had a lower corrosivity than Mexican Maya crude and Colombian crude from the Rubiales Oil Field, which have been transported by U.S. pipelines for more than 40 years.

Corrosion experts support these facts and do not believe that diluted bitumen poses a unique threat to pipelines. In a recent statement, Oliver Moghissi, President of NACE International, said:

*“Corrosivity of diluted bitumen is largely similar to crude oil, which is considered to be low. In addition, the threat of corrosion from diluted bitumen can be managed by conventional engineering practice in the same way as crude oil.”*

Testing and studies conducted by Alberta Innovates, ASTM International (an internationally recognized testing and materials organization), and, most recently, Penspen (an English pipeline integrity engineering firm) all support the conclusion that diluted bitumen is not more corrosive than other crude oils.

### **PRODUCT SPECIFICATIONS FOR CRUDE OILS TRANSPORTED IN PIPELINES**

Sediments, such as sand, can contribute to corrosion in a pipeline, as can water. Like other crude oils, diluted bitumen must meet standard product quality specifications for sediment and water content in Federal Energy Regulatory Commission (FERC) tariffs. Generally, these FERC tariffs prohibit crude oil from containing more than 0.5% of sediments and water. Tariffs are agreements between pipeline operators and pipeline customers, referred to as “shippers”, and are enforceable by FERC. Product specifications in FERC tariffs and other agreements protect shippers, including refinery customers that might receive the crude oil, and pipeline operators.

To verify product quality, pipeline operators take samples of incoming batches before accepting products for shipment. Operators also take samples during transit. Pipeline operators are responsible to deliver agreed-upon batch quality to the destination refinery.

PHMSA regulations require that pipeline operators have a corrosion management program in place for their pipelines. This includes consideration of the use of corrosion inhibitors and cleaning pigs to reduce the likelihood of internal corrosion in pipelines. These measures are especially important in pipelines where there is not turbulent flow, which keeps water and sediment which are common in crude oils from settling and promoting corrosion.

### **THE SAFETY RECORD OF TRANSPORTING DILUTED BITUMEN BY PIPELINE**

Diluted bitumen has been transported safely in the U.S. for more than 40 years. PHMSA accident reports since 2002 show zero internal corrosion-related releases from pipelines carrying diluted bitumen.<sup>1</sup> Also, there are no known examples before 2002 of corrosion-caused failures on U.S. pipelines carrying diluted bitumen.

Statistics in Alberta also show no signs of additional corrosivity. The Alberta Energy Resources Conservation Board (ERCB) reported:

*“Analysis of pipeline failure statistics in Alberta has not identified any significant differences in failure frequency between pipelines handling conventional crude versus pipelines carrying crude bitumen, crude oil or synthetic crude oil.”*

The ERCB further noted that it is inappropriate to compare releases in Alberta’s data, where there is no reporting threshold, to PHMSA’s U.S. data, with a 5 barrel threshold.

### **PIPELINE PRESSURE AND DILUTED BITUMEN**

Diluted bitumen is transported at comparable pipeline pressures as other heavy crude oils. All U.S. pipelines must operate under Maximum Operating Pressure requirements administered by PHMSA. Any pipeline operator seeking to transport crude oil at a higher pressure than other operators is choosing to do so for commercial reasons, and must comply with Maximum Operating Pressure determinations made by assessing the strength of the pipe.

### **TEMPERATURE OF DILUTED BITUMEN DURING PIPELINE TRANSPORTATION**

Diluted bitumen is not heated for transportation in pipelines above the temperature of other crude oils. Any heating of the bitumen during the time it is processed into diluted bitumen terminates after the processing is complete. Diluted bitumen cools long before it is inserted into a pipeline for transportation. The range of temperatures for all crude oils from Canada is 40-135 degrees Fahrenheit. The temperature of crude can increase as it moves down a pipeline, especially just downstream of pumping stations, due to the extra energy imparted by pumps. The American Society of Mechanical Engineers (ASME) Code for *Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids* (ASME B31.4) does not consider pipeline temperatures to be elevated unless they exceed 150 degrees Fahrenheit. Much has been made about how increased temperatures in pipelines might increase the corrosivity of acids in crude, however, “[t]otal acid concentrations are a parameter that is important under refinery conditions where the product is exposed to temperatures in excess of 240C [464F]. It cannot be used to assess the likelihood of corrosion occurring in a transmission pipeline.”<sup>2</sup>

### **PIPELINE ECONOMICS SUPPORT MANAGING CORROSIVITY OF CRUDE OIL**

Pipelines are very expensive to build, and are intended to have long useful lives. It would not be logical to place any commodity in the pipeline that would put that investment at risk.

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<sup>1</sup> The review of PHMSA accident reports covers a period between 2002, when PHMSA accident reports became more comprehensive, and mid-2012.

<sup>2</sup> Penspen Integrity. *Dilbit Corrosivity*, February 2013, p. 35.