Transmix Reduction with Rapid Sulfur Monitoring

Background

Many different types and grades of petroleum products travel through pipelines in batches. At the interface between batches some mixing occurs which results in transmix generation and product downgrading. Transmix is the portion of the of pipeline flow that is diverted to a separate tank to avoid contamination between two dissimilar product batches. Transmix generates a lot of cost to shippers and pipeline operators because it must be stored, transported, and reprocessed to decontaminate and separate the mixed products. Pipeline operators have reported transmix costs of many millions of dollars per year. Product downgrade or regrade happens when a portion of higher value but mixable product is diverted to a tank that holds a batch of lower value product such as premium gasoline being diverted to a regular gasoline tank. The higher value product batch is protected from contamination, but a portion is downgraded to the lower value product, resulting in a loss of value equal to the difference in price between the two products.

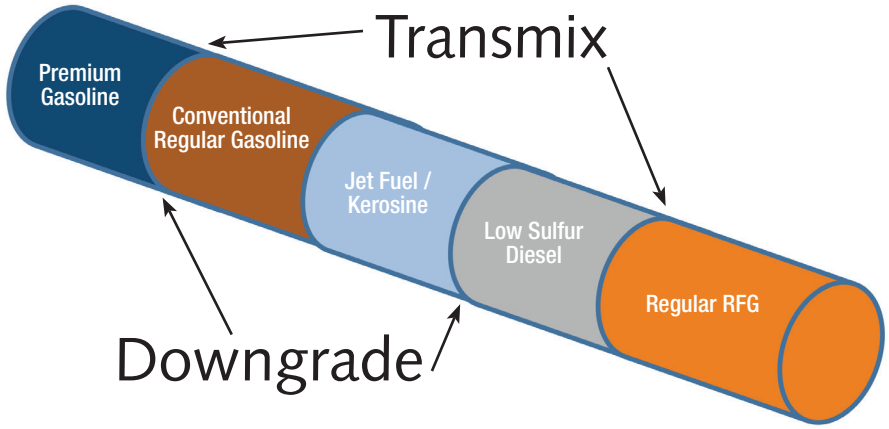

Figure 1: Transmix and product downgrading is generated at the interface between two dissimilar products in a pipeline.

To reduce the amount of transmix generated, many pipelines have invested in automating their batch cutting procedures that minimize the product sent to the transmix tank by optimizing the batch cut timing. A critical piece of the automation process is the implementation of on-line instrumentation to identify when the interface between the products has been removed to the transmix tank. Any parameter of the two products that is unique can be used to make this determination. One common on-line measurement that has been used to make this determination is specific gravity. When the products on each side of the interface have distinct densities, this cut can be made accurately and minimize the amount of transmix or downgraded product generated, saving considerable cost.

Product	Min Specific Gravity	Max Specific Gravity
Gasoline	680 g/L	740 g/L
Jet Fuel	775 g/L	840 g/L
Diesel Fule	810 g/L	960 g/L

Background

Many different products pass through pipelines and have the potential to contaminate each other. To avoid this, pipelines divert the interface to separate “transmix” tanks for reprocessing at a considerable cost. By automating the cuts between batches, optimization is possible, making cost savings of millions of dollars per year achievable.

Methodology

A Sindie® On-Line was setup to monitor sulfur levels every 10 seconds during a change from Ultra Low Sulfur Diesel to Jet Fuel with a Sulfur level of about 1,400 ppm.

Conclusion

Because the Sindie On-Line is able to update Sulfur concentration in just seconds, rapid feedback can be provided for optimized batch cuts and transmix reduction.

15 Tech Valley Drive • East Greenbush, New York 12061, USA • 518.880.1500 • www.xos.com

In situations where specific gravity overlaps between products, a better parameter to use to determine when to make a batch cut is sulfur concentration. As regulations such as Ultra Low Sulfur Diesel and Tier 3 Gasoline have set Sulfur limits at 15 and 10 ppm respectively, even a small amount of a product like jet fuel containing up to 3,000 ppm sulfur can contaminate a large batch of low sulfur product. To complicate matters, some fuels with very different sulfur content can have specific gravity specifications that overlap, making it a poor parameter for identifying the appropriate time to make a batch cut for transitions between these products.

The Sindie® On-Line is an industrial-grade process sulfur analyzer designed for continuous sulfur testing to facilitate more precise fuel interface cuts to reduce transmix and prevent tank contamination. By using a unique x-ray focusing technology, the Sindie On-line provides sulfur measurements that can be updated in seconds to provide rapid feedback for batch cut decisions. With a dynamic range starting at 0.6 ppm sulfur and stretching to 3,000 ppm, the instrument can measure Sulfur in even ultra low sulfur products.

Methodology

To demonstrate the rapid sensing capabilities of the Sindie On-Line, a stream of Ultra Low Sulfur Diesel with 13 ppm sulfur was introduced to the measurement system. The analyzer was configured to update results every 10 seconds. While the instrument continued to take measurements, the sample stream to the instrument was switched to jet fuel with 1,350 ppm sulfur content. The sulfur levels recorded by the analyzer can be seen in Figure 3 to the right.

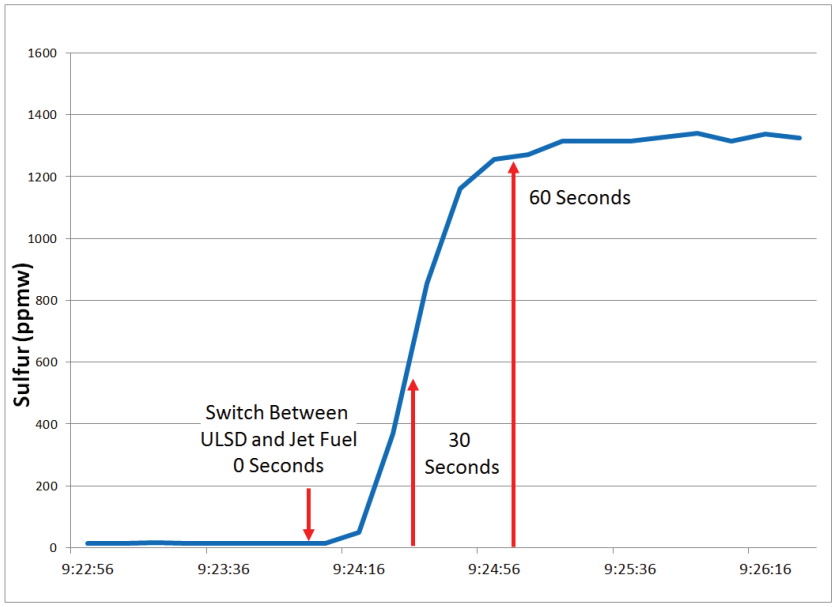

Figure 3: Continuous monitoring of Sulfur concentration during a transition from ULSD to jet fuel registers change within 10 seconds and detects new equilibrium at 60 seconds. Fast enough to allow for precision cuts of pipeline batches to reduce downgraded product and transmix generation.

Conclusion

This demonstration shows that within the 10 second measurement time, the Sindie On-Line was able to identify the changing sulfur concentration of the mixed sample stream. After 60 seconds, the mix in the sample stream had passed through the instrument and the sulfur measurements reflected the much higher sulfur content in the jet fuel. As can be seen, the Sindie On-Line is well suited to identifying important interface changes between products with similar densities but differing sulfur concentrations allowing for a significant reduction in transmix generation and product downgrade enabling pipeline operators to save millions of dollars annually.

For additional information about Sindie On-Line, please visit our website at www.xos.com or contact us at info@xos.com.