Ethanol, Biofuels, and Pipeline Transportation

The use of ethanol, as a fuel additive blended with gasoline, and other biofuels has increased markedly during the last several years, due in large part to new laws and regulations. Biofuels, including ethanol, and gasoline blends (gasoline blended with biofuels, including ethanol) can be transported in liquid pipelines, but the physical and chemical properties of biofuels present operational challenges. Today, biofuels are primarily transported by other means, including rail, truck, barge, and marine transport, all of which have a more significant environmental footprint than pipeline transportation.

Pipelines are the safest, most reliable, economical and environmentally favorable way to transport liquid fuels. However, the existing liquid pipeline infrastructure generally runs from petroleum production areas to refineries and from refineries to markets. The origin points for liquid pipelines do not always line up with where biofuels are produced or available. Overcoming these challenges and expanding the capacity of pipelines to move biofuels and gasoline-biofuel blends would have great benefits for consumers, gasoline blenders, and the environment.

Water and biofuels fuel quality

Small amounts of water enter pipeline systems from fuels, terminals and tank roofs. This is generally not a problem during pipeline transportation of refined petroleum products, because the water can separate in a tank and can be drained off. Unlike petroleum products, ethanol has an affinity for water, which can be picked up as ethanol flows through the pipeline network. The water-ethanol mixture has the potential to separate from petroleum products with which it may be mixed, resulting in degraded fuel quality. This can be managed by taking steps to cover tanks and remove excess water at certain points in the supply and distribution system.

"Trailback" and jet fuel quality

Most pipelines that carry refined petroleum products carry several different products in separate "batches". For example, a products pipeline might move regular unleaded gasoline, premium unleaded gasoline, diesel fuel, jet fuel, etc. The addition of biodiesel (fatty acid methyl esters (FAME)) can cause a "trailback" of small amounts of the biodiesel into jet fuel. This leads to a concern of degraded jet fuel quality, as jet fuel standards currently do not allow for any measurable level of biodiesel. One pipeline company has begun transporting biodiesel in certain pipelines that do not carry jet fuel. However, most products pipelines carry jet fuel and are unlikely to cease doing so. More work must be done to eliminate the concerns of "trailback" by jet fuel users. Jet engine manufacturers, federal regulators and fuel producers are working to determine if it is safe to have biodiesel in jet fuel, and at what levels.

Other fuel quality issues
Some biofuels can strip lacquers and deposits from internal pipeline surfaces and carry them as impurities. These impurities can clog filters in the supply system, requiring change outs, and in vehicles, impacting vehicle drivability and requiring maintenance. This is a concern when biofuels like ethanol are first introduced into a system, but once impurities have been removed becomes a lesser issue.

Stress Corrosion Cracking
Another challenge experienced in biofuels transportation by pipeline is Stress Corrosion Cracking (SCC) associated with ethanol movement and storage in pipelines and storage tanks. Research, largely funded by pipeline companies, has made great strides in addressing this problem. Industry/government research by Pipeline Research Council International, Inc. (PRCI)[1] has found that ethanol-gasoline blends containing 15 percent or less by volume of ethanol (E-15 and below) can be transported without causing SCC in existing pipelines without any design or operational modifications. PRCI also found that higher ethanol-containing blends (E-20 and above) and fuel-grade ethanol can be transported without SCC when certain commercial inhibitors are added. The efficacy of commercial inhibitors to mitigate SCC must be assessed prior to their use.

Biofuels and Materials
Biofuels can also impact materials used in gaskets, o-rings, and seals used in fuels transportation and storage systems. Elastomers can experience swelling, shrinking and cracking when exposed to biofuels. Polymers that are often used for coatings may also be degraded by biofuels. Biofuels may also corrode certain non-ferrous metals used in gauges, meters, valves, and pumps. Any part of the supply system that will be converted to biofuels service needs to be assessed for materials compatibility and may need to be refitted with materials that are resistant to the effects of biofuels.

Dedicated biofuels pipelines
Some pipeline companies are proposing to build dedicated biofuels pipelines to connect biofuels-producing areas with large gasoline-consuming markets, with government loan guarantee assistance. Biofuels-producing areas are often far from areas that are major gasoline-consuming areas. Also, biofuels production facilities are relatively small and spread out, requiring a gathering network to aggregate sufficient throughput for a pipeline. In addition to government assistance, pipelines would need robust markets and assurances that supplies would be available over a long period of time, in order to finance such a project.

Renewable fuels regulations
On February 3, 2010, the U.S. Environmental Protection Agency (EPA) revised the National Renewable Fuels Standard, increasing annual volume standards for renewable fuels, including ethanol and biofuels. This will mean additional amounts of ethanol and biofuels will need to be transported. EPA is also considering a petition to increase the maximum amount of ethanol or biofuels allowed in gasoline from 10 percent to 15 percent. These new requirements, if they go forward, will result in the need to move ever larger volumes of biofuels from where they are produced to market. The pipeline industry is positioning itself to be able to serve that important energy need.

[1] PRCI studies are private and available only to parties that contribute to its research.