

Press release

July 13, 2009

DNV Makes Significant Findings in Ethanol Transportation Research

Columbus, OH USA: In August of 2007, DNV began research on the safe and reliable transportation of fuel grade ethanol (FGE) and ethanol-gasoline blends through existing petroleum pipelines for the Pipeline & Hazardous Materials Safety Administration (PHMSA) and the Pipeline Research Council International (PRCI). While research is on going, there have been some significant findings.

The use of ethanol-gasoline blends for automotive fuel is rapidly increasing and existing pipelines are considered the most cost-effective method of transportation of this fuel. However, there are concerns regarding possible Stress Corrosion Cracking (SCC) of the pipelines and the compatibility of elastomeric seals and gaskets. These concerns led PRCI and PHMSA to select DNV to conduct this research study.

The first phase of this project was to determine what ethanol-gasoline blends could be transported through existing pipelines without causing SCC. DNV's research to date has found that ethanol-gasoline blends of 15 percent ethanol or less (E-15) do not cause SCC, but SCC growth does occur with higher blends (E-20 and higher). It was also determined that once crack growth occurs, it will stop if the ethanol is replaced by pure gasoline or E-10. Crack growth will resume after a short time if switched back to a higher ethanol blend or FGE. Similarly, it was also determined that a batching mode of operation, where gasoline and ethanol-gasoline blends are rotated, only slows the SCC growth rate.

DNV's research in mitigating SCC growth found that a number of inhibitors, including ammonium hydroxide appear to stop SCC completely in FGE. To verify this finding, more extensive testing is being done. Research has also been done on other commercially available inhibitor packages and a number of them also appear to be effective in preventing SCC growth.

DNV also conducted research on six different non-metallic materials (five elastomers and one thermoplastic polymer). It was found that Viton GF, Viton GFLT and Teflon offer the best hardness retention and least volumetric swelling when exposed to E-95 blends. A small amount of swelling was found for all six non-metallic materials when exposed to E-95 blends while substantial swelling was observed with Viton and Low Swell Buna N samples when switched from E-95 to neat gasoline. Tests also showed a reduction of hardness in Low Swell Buna-N and Viton samples when switching from E-95 fuel to neat gasoline along with leaching of their ingredients.

We are partnering with other laboratories to conduct a round robin testing of line pipe steel in ethanols from different production operations and feed stocks to understand the variability in SCC potency observed in different ethanols. These tests are accompanied by detailed chemical analyses of ethanol to develop correlations between ethanol chemistry and SCC potency.

Because dissolved oxygen is an important factor in causing SCC in ethanol, DNV is collaborating with vendors of dissolved oxygen monitoring probe and wireless data communication systems to develop a wireless sensor that can be used for remote monitoring of tanks and pipelines to obtain data for risk assessment from the field.

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Continued research includes extensive crack growth rate testing of different blends and inhibitor packages, dynamic seal testing of elastomers, monitoring of tanks and pipelines, development of methods to reduce dissolved oxygen concentrations in ethanol, and an assessment of the performance of other metallic materials involved in pipeline systems transporting ethanol.

“Fully establishing the reliable and safe storage and transportability of ethanol is critical to the viability of bioethanol in our renewable fuel mix. It is our hope that, from this research, we will establish guidelines, standards, and ultimately good risk management practices to achieve that goal,” explained project lead Dr. Narasi Sridhar, director of the Materials Program for DNV Research & Innovation. “DNV will continue to work with industry in addressing technical issues related to the transport of advanced biofuels, including cellulosic ethanol, biobutanol and biodiesel,” concluded Dr. Sridhar.

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