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Military base finds success with biobased hydraulic fluid

U.S. Army employees at Fort Leonard Wood in the Missouri Ozarks conducted a one-year field demonstration using canola-based hydraulic fluid in construction equipment. The demonstration, which ended in 2006, indicates biobased fluid performs as well as conventional, petroleum-based fluid.

The demonstration was a collaborative effort involving two agencies within the U. S. Department of Agriculture and the U.S. Army Tank Automotive Research Development and Engineering Center (TARDEC). The shared objective was to introduce environmentally acceptable hydraulic fluids into military hydraulic systems.

The USDA agencies were the Cooperative State Research, Education and Extension Service (CSREES) and the Office of Energy Policy and New Uses. Their mission includes research on biobased products, which are made from renewable agricultural resources. TARDEC is the military's laboratory for advanced automotive technology.

“The field demonstration was a huge success,” said Carmela Bailey, USDA-CSREES national program leader for its agricultural materials division. “It proves that biobased hydraulic fluids can be used for military construction equipment on all military bases.”

Employees at Fort Leonard Wood were somewhat skeptical but wanted to participate in the field demonstration, Bailey added. But as the test continued over many months, they became were satisfied with biobased hydraulic fluids and have no reservations on using them again, she said.

Fort Leonard Wood's terrain submitted the fluid to the ultimate test. The military base is known as “little Korea” due to its rolling hills and extremes in temperature. The 3rd Training Brigade there trains 16,000 soldiers on an annual basis.

The military construction equipment used in the field test consisted of two bulldozers, two scrapers, two graders, two cranes, one loader and one excavator. The existing petroleum-based hydraulic fluids were removed from the equipment and replaced by biobased hydraulic fluids from the following companies: Cognis, Cargill, Hydro Safe Oil Division Inc. and Terra-solve Inc.



Fort Leonard employee drains fluid during a field demonstration.



The base's grader operates with biobased hydraulic fluid.

Biobased hydraulic fluids have numerous performance benefits, including:

- High biodegradability. The biobased hydraulic fluids exceed the government criteria for being readily biodegradable. Over 90 percent of biobased hydraulic fluids biodegrade in 120 days.
- Low volatility. Volatility is the rate at which fluids vaporize. High volatility can lead to fluid loss and potential equipment damage.
- Minimal viscosity changes. Viscosity is the property in hydraulic fluids that provides the lubrication of a hydraulic system's moving parts. With temperature changes, less viscosity is better for the equipment.
- Compatible with existing petroleum-based fluids.
- No equipment failure. Biobased hydraulic fluids produce no oil leaks or operational problems.

The fluids also have cost benefits because they're environmentally safe, eliminating the clean-up costs related to spills. In addition, no respiratory protection is needed for workers.

Currently, biobased hydraulic fluids are made from rapeseed, sunflower, corn, soybean and canola. In 2005, hydraulic fluids comprised 75 percent of the biobased lubricant market; however, this represents only 2 percent of total hydraulic fluid sales.

All federal government agencies, including the Army, are seriously considering the conversion to biobased hydraulic fluids on a permanent basis, according to Bailey. A valuable tool for evaluating the long-term benefits of biobased products is the BEES (Building for Environmental and Economic Sustainability) analysis developed by the National Institute of Standards and Technology, she said. For more information on BEES, see http://www.bfrl.nist.gov/oae/software/bees/please/bees_please.html

Bailey hopes the Fort Leonard Wood demonstration serves as a model for demonstrations of other biobased products that can meet the military's training and environmental stewardship requirements. For additional information, contact her at cbailey@csrees.usda.

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