

## **Biobased Hydraulic Fluid Use at Brookhaven National Laboratory**

Unauthorized releases and spills of petroleum products have drastic impacts on terrestrial and aquatic environments and underground sources of drinking water. To reduce the potential impacts of these releases, Brookhaven National Laboratory (BNL) has begun switching many of its petroleum based lubricants and hydraulic fluids to biobased products. This paper is presented in three sections: historical, present and future use of on-site biobased hydraulics.

### **Historical Use**

BNL is located on Long Island in Suffolk County, New York, which is an EPA designated sole source aquifer region and very susceptible to groundwater contamination. Spills of any amount of petroleum (i.e., zero de minimus) to soils are reportable to the NYSDEC and spill remediation needs to be adequately addressed to ensure that the product does not enter the regions groundwater.

In 1998 an underground hydraulic piston of a vehicle lift at the motor pool, failed resulting in the costly clean up of the petroleum based hydraulic oil. The remediation involved saw-cutting the concrete floor; removing the leaking cylinder and excavating approximately 18 feet down to remove 50 cubic yards of contaminated soil.

Replacement of the cylinder ensued, however a precast concrete containment ring was installed under the new cylinder, which would contain future releases of petroleum product should, a failure occur again. While the system was being installed, BNL's Engineering and Environmental staffs were determined to find an alternative, environmentally appealing solution since five other vehicle lifts were of similar design.

In order to avoid future potential contamination of the water table, and dealing with an aging infrastructure, alternative design scenarios were evaluated. One option was to install all new above ground hydraulic systems. That option would have necessitated mothballing 5 (otherwise) perfectly good lifting bays and installing 6 new above ground systems. Local regulations would have required the remaining underground piping to be removed or remediated. This option was deemed economically unfeasible. A second option retrofitting all hydraulic systems to accept the biobased hydraulic oil was chosen. The retrofit involved the replacement of any older rubber seals with newer Teflon or rulon seals.

The biobased hydraulic oil chosen was canola based. The fluid is completely biodegradable, and exceeds the government criteria of being "readily biodegradable". Readily biodegradable is defined as an attribute of products that have a natural ability to biodegrade quickly and completely. Once the fluid is leaked into the ground, it is digested or consumed by naturally occurring microorganisms present in water, air and soil systems. Complete biodegradability is the conversion of a substance to carbon dioxide and water.

Based on the success of the hydraulic lifts, the BNL engineers started to evaluate what other hydraulic systems were a risk to potential spill/leaks and could be retrofitted to

accept the biobased hydraulic oil. During year 2000, BNL's engineering staff evaluated the number of spills onsite and determined that a major portion were petroleum spills from equipment such as lawnmowers, cranes, payloaders, backhoes, garbage trucks etc. resulting from failed hydraulic system components (such as ruptured hydraulic hoses). Recognizing that each spill to soil, regardless of size (i.e., a couple of drops), is reportable to the State and County regulatory agencies and that numerous spills could generate negative publicity, BNL engineers decided on a proactive approach. A program was implemented to install steel braided hoses and abrasion collars and to retrofit the system with a vegetable based hydraulic oil. The following photographs show examples of some of the hydraulic equipment in which the biobased hydraulic oil has been retrofitted.



During April of 2004, BNL sponsored a workshop on Pollution Prevention techniques for fleet managers to highlight the Lab's experiences to local businesses and governmental agencies on how to protect the environment and reduce waste disposal costs while managing large numbers of vehicles. Approximately 50 participants attended the free one-day workshop. Major highlights, and discussion generators, were the presentations on BNL's use of the bio-based hydraulic oils.

#### **Present Use.**

Presently bio-based hydraulic fluid is used in most of the equipment detailed above. Specifications for new equipment include the request for the use of bio-based hydraulics. Review of historical data indicates that these spills and the subsequent clean-up materials have decreased by over 70%. A typical example involves lawnmowers. Previously, if a hydraulic hose ruptured (while mowing), the operator normally was not aware of the spill until they noticed that the hydraulics were not responding or they saw a sheen on the grass where the oil was sprayed. The petroleum based hydraulic oil had to be cleaned up by removing the top layer of grass/soil and containerized for disposal. Regulatory requirements necessitated reporting this release (typically a gallon or less) to the NYSDEC. This incurred labor hours for digging/removal and containerizing and additional costs for disposal. Under the current scenario with the bio-based hydraulics, the material can often be left in place to biodegrade or can be disposed as routine solid waste. Regulatory reporting is only required if the material enters a regulated waterway or wetland.

#### **Future Use**

Brookhaven National Laboratory is currently constructing two new on-site buildings; the Research Support Building and the Center for Functional Nanomaterials. Both of these buildings will be pursuing LEEDs Certification. In continuing with BNL's policy of minimizing environmental impact, both building elevators have been specified to contain biobased hydraulic oil. Both LEEDs applications will be applying for Innovative Credit points due to the proactive use of the biobased hydraulics.

