

U.S. Department of Energy FreedomCAR & Vehicle Technologies Program

***A Pollution Prevention Success: Oil
Bypass Filter Technology Evaluation***

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Oil Bypass Filter Technology Evaluation

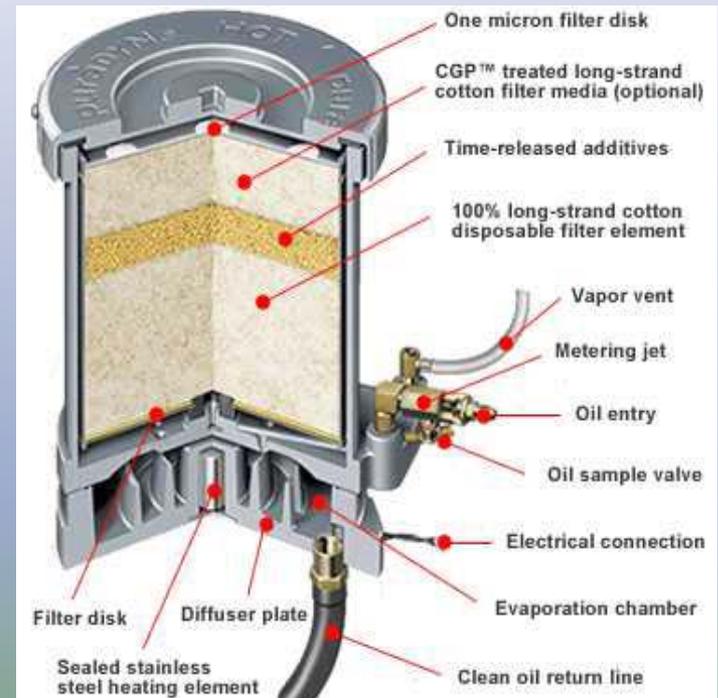
- **Funded by the FreedomCAR & Vehicle Technologies Program**
- **Performed by the Idaho National Engineering and Environmental Laboratory (INEEL)**
- **Conducted on fourteen INEEL vehicles**
- **A partnership between:**
 - **Transportation Technology & Infrastructure Department**
 - **INEEL Fleet Operations**
 - **US DOE--Headquarters**

Full Flow Filter

- **Standard to all vehicles**
- **Filters the full flow of the oil pump**
- **Standard car filters--40 to 60 micron-sized particles**
 - **What is a Micron?**
 - **One millionth of a meter**
 - **0.000039 inch is one micron**
 - **A 11-point period is about 500 microns**
 - **0.001-inch equals 25 microns**

Bypass Filter

- Secondary filter system
- Aftermarket installation
- Installed inline with the oil supply system
- Filters a partial flow of oil
- Super cleans to 0.1 micron



Oil Bypass Filter Technology Evaluation

- **Began in Oct of 2002**
- **Installed bypass filters on 8 four-cycle diesel-engine buses**
- **Expanded in Dec of 2003 to include light vehicles**
- **Six quarterly reports—on line at <http://avt.inel.gov/obp.html>**



Heavy Duty Vehicles--Buses

- **21-months of testing**
- **12,000 mile service interval—filter change and oil sample taken**
- **Buses 440,000 miles traveled and no oil changes**
- **36 oil changes avoided—317 gallons saved**
- **317 gallons of waste oil not generated**

Installed Bus Bypass System



Light Duty Vehicles

- 8-months of testing
- 6 Chevrolet Tahoe security vehicles
- 3,000 mile service interval
- 88,000 miles traveled and no oil changes
- 29 oil changes avoided—37 gallons saved
- 37 gallons of waste oil not generated



Installed Tahoe Bypass System



Why Evaluation Important

- **DOE goal: reduce foreign oil dependency**
- **Conserve oil**
- **Reduce waste oil generation**
- **Demonstrate return of investment**
- **Validate extended oil-drain intervals**
- **Determine applicability to the Complex**

Benefits of Bypass Filters

- **Extend oil drain interval >3000 miles**
- **~90% less oil use**
- **~90% less waste oil**
- **Longer engine life (5 to 20 micron range cause 60% of engine wear)**
- **Less maintenance time**
- **Return of investment: varies with vehicle**

Testing Method

- **Change filter at service interval—not oil**
- **Obtain oil analysis samples—archive and two lab samples**
- **Validate extended oil drain use via oil analysis data**
- **Track and trend data**

Oil Analysis Reports

- **Oil condition: viscosity, total base number, etc**
- **Contamination: water, fuel, soot, etc**
- **Engine wear metals: Copper, Iron, etc**
- **Vehicle data: miles, unit number, etc**
- **Laboratory commentary: oil evaluation statement**

Metrics for Oil Condemnation

- **Viscosity out of range—too high or too low**
- **Total base number (anti-acid)—too low**
- **Soot—too high**
- **Oxidation—too high**
- **Nitration—too high**

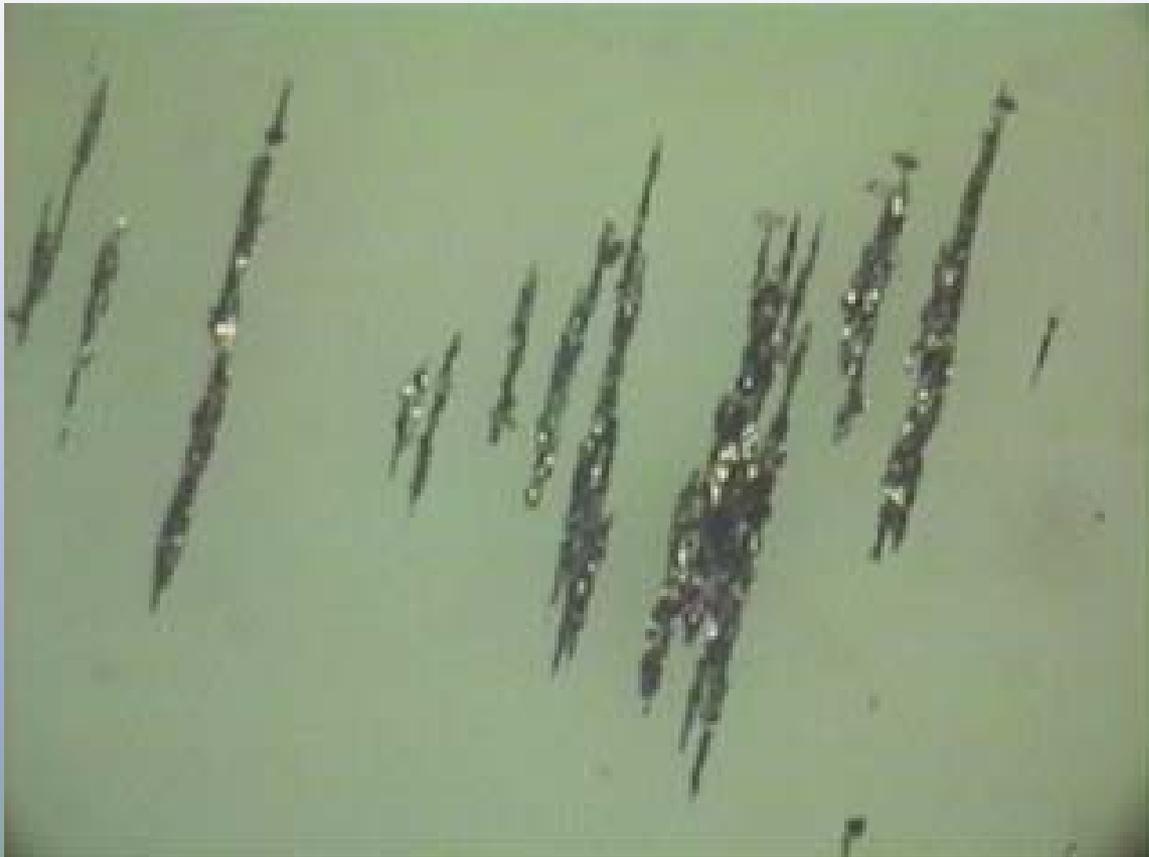
Particulate Tests Evaluate Filter Effectiveness

- **Spectrometric/elemental analysis: < 4 micron—fines**
- **Rotrode Filter Spectroscopy: 4 to 10 microns—wear trend**
- **Particle Count: 4 to 70 micron—particle binning**
- **Analytical Ferrography—traps larger debris**

Analytical Ferrography—bus 73450

- **107,000 miles on oil**
- **Wear particle types—fine iron**
- **Interpretive comments—trace amounts**
- **Ferrogram—shows photo of particles**

Ferrogram—Shows Rubbing Wear Particles at 100 X



INEEL Bypass Filter Test Status

- On going and collecting data
- Beginning of national standard
- Working on applicability to the Complex