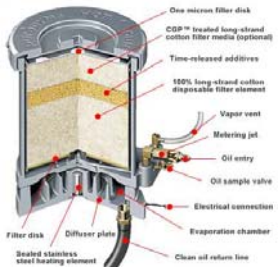
U.S. Department of Energy
Energy Efficiency and Renewable Energy

INL/EXT-05-00651

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

Oil Bypass Filter Technology Evaluation
Eleventh Quarterly Report
April–June 2005



TECHNICAL REPORT

Larry Zirker
James Francfort
Jordan Fielding

September 2005

Idaho National Laboratory
Operated by Battelle Energy Alliance

INL/EXT-05-00651

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

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Idaho National Laboratory
Transportation Technology Department
Idaho Falls, Idaho 83415

Prepared for the
U.S. Department of Energy
Assistant Secretary for Energy Efficiency and Renewable Energy
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ABSTRACT

This Oil Bypass Filter Technology Evaluation quarterly report (April–June 2005) details the ongoing fleet evaluation of engine oil bypass filter technologies being conducted by the Idaho National Laboratory (INL) for the U.S. Department of Energy's FreedomCAR & Vehicle Technologies Program. Eleven INL four-cycle diesel-engine buses and six INL Chevrolet Tahoes with gasoline engines are equipped with oil bypass filter systems. Eight of the eleven buses and the six Tahoes are equipped with oil bypass filters from the puraDYN Corporation; the remaining three buses are equipped with oil bypass filters from Refined Global Solutions. Both the puraDYN and Refined Global Solutions bypass filters have a heating chamber to remove liquid contaminates from the engine oil. One bus (73450) with a puraDYN filter had an engine failure unrelated to the Oil Bypass Filter evaluation and it did not operate this quarter.

During the April to June 2005 reporting quarter, the ten active diesel engine buses traveled 85,663 test miles. As of June 30, 2005, the eleven buses had accumulated 829,871 total test miles.

During this quarter, seven regularly scheduled 12,000-mile bus service events were performed. Bus 73449 had its oil inadvertently changed on 5/17/05 during servicing. Two buses had mechanical problems that required the oil to be changed: Bus 73446 had an injector failure, and Bus 73413 had a broken dip stick fitting on the oil pan, events introduced contaminants. Buses 73432 and 73433 began the idling phase of the INL Diesel Engine Idling Wear-Rate Evaluation Test.

Throughout the 35 months of evaluation, only six oil changes performed on INL buses resulted from degraded oil quality from normal operations. This is a 90% reduction in oil-change oil consumption (490 gallons saved) and a concurrent 90% reduction (490 gallons) in waste oil generated. In addition to the six oil changes resulting from degraded oil, six oil changes resulted from either mechanical problems or were performed inadvertently.

The six Tahoe test vehicles traveled 28,688 miles, and as of June 30, 2005, they had accumulated 260,116 total test miles.

CONTENTS

Oil Bypass Filter Technology Evaluation
Tenth Quarterly Report

INTRODUCTION AND BACKGROUND

PuraDYN oil bypass filter systems (Figure 1) are being tested on eight diesel buses and six Chevrolet Tahoes (eight-cylinder gasoline engines) in the Idaho National Laboratory (INL) fleet, and Refined Global Solutions (RGS) oil bypass filter systems (Figure 2) are being tested on three diesel buses in the INL fleet. Both manufacturers' oil bypass filters are designed to extend engine oil life by filtering solid contaminants as small as one micron out of the engine oil, and by removing harmful liquid contaminants from the engine oil.

INL personnel that manage the U.S. Department of Energy's (DOE's) Advanced Vehicle Testing Activity, along with the staff from INL Fleet Operations, are conducting the oil-bypass-filter technology evaluation. Typically, the INL buses (a total fleet of 99 buses) travel established routes, carrying workers during their morning and evening trips to and from the INL test site (over 100 miles per round trip). The Tahoes travel within the 900-square-mile INL site or between the INL site and INL facilities in Idaho Falls, Idaho, a distance of 50 miles each way.

The Oil Bypass Filter Technology Evaluation is being performed for DOE's FreedomCAR and Vehicle Technologies Program. This Oil Bypass Filter Technology Evaluation quarterly report covers the evaluation period April 2005 through June 2005.

The eleven buses are equipped with the following types of four-cycle diesel engines:

- Six buses have Series 50 Detroit diesel engines (three with RGS and three with puraDYN filters)
- Four buses have Series 60 Detroit diesel engines (all puraDYN filters)
- One bus has a Model C10 Caterpillar engine (puraDYN filter). However, this bus (73450) had an engine failure unrelated to the Oil Bypass Filter evaluation and it did not operate this quarter.

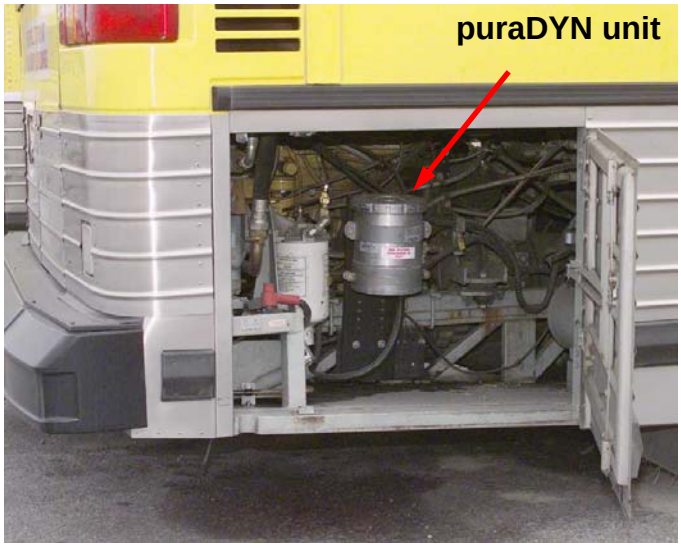

Figure 1. View of a puraDYN oil bypass filter in an INL bus. The single-canister unit contains both the oil bypass filter and liquid heating chamber.

This quarterly report includes:

- Bus mileage
- Analysis and reporting of bus engine oil conditions
- Diesel engine idling wear-rate evaluation test results
- Status of light-duty vehicle testing
- 1,000,000 mile press event.

Table 1 lists all prior quarterly reports and the major topics presented in them.

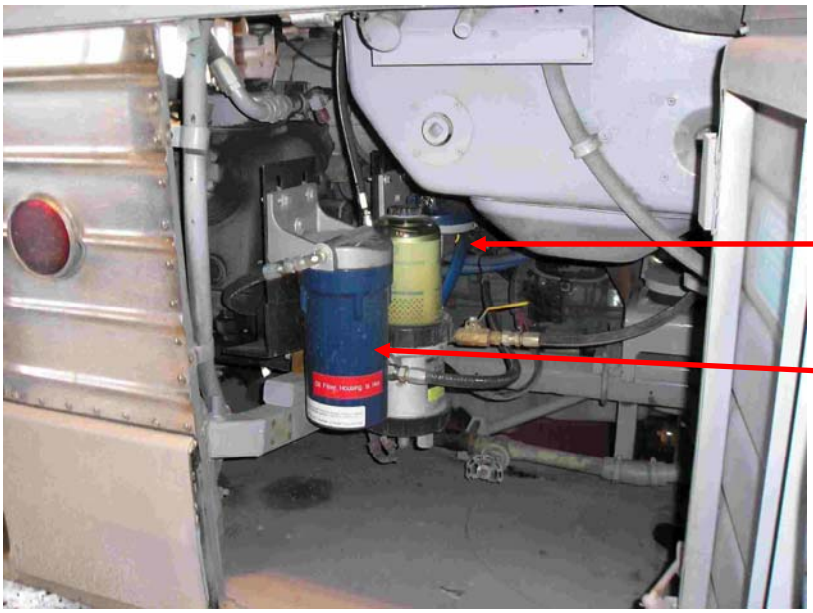

Figure 2. View of an RGS oil bypass filter and liquid heating unit in an INL bus.

Table 1. Major topics of previous quarterly reports, all of which are on line at http://avt.inl.gov/obp.

Reporting Quarter	Report Number	Major Topics
Oct 2–Dec 2 2002	INEEL/EXT-03-00129	Background on fleet operations, vehicles, filters, and oil selection Performance evaluation status Economic analysis Photographs of installed systems Bypass Filtration System Evaluation Test Plan
Jan 3–Mar 3 2003	INEEL/EXT-03-00620	Bus mileage and performance status Revised filter replacement schedule Oil-analysis sampling Light-duty vehicle test status
Apr 3–Jun 3 2003	INEEL/EXT-03-00974	Bus mileage and performance status Preliminary trends in oil analysis reports Revised economic analysis Ancillary data Light-duty vehicle test status
Jul 3–Sep 3 2003	INEEL/EXT-03-01314	Bus mileage and performance status Used engine-oil disposal costs Unscheduled oil change Light-duty vehicle test status

Reporting Quarter	Report Number	Major Topics
Oct 3–Dec 3 2003	INEEL/EXT-04-01618	Bus mileage and performance status Bus oil analysis testing and reporting Light-duty vehicle filter installations Light-duty vehicle filter installations lessons learned Light-duty vehicle filter evaluation status
Jan 4–Mar 4 2004	INEEL/EXT-04-02004	Bus mileage and performance status Bus oil analysis testing and reporting Bus engine oil particulate count analysis Light-duty vehicle mileage and performance status Light-duty vehicle filter evaluation lessons learned
Apr 4–Jun 2004	INEEL/EXT-04-02194	Bus mileage and performance status Bus oil analysis testing and reporting Lessons learned from the evaluation of heavy-vehicle filters Light-vehicle mileage and performance status Lessons learned from the evaluation of light-vehicle filters
Aug–Sept 2004	INEEL/EXT-04-02486	Bus mileage and performance status Bus oil analysis testing and reporting Oil use Lessons learned on the heavy vehicle Upcoming INEEL tests Oil bypass filter system manufactures Light-vehicle mileage and performance status Lessons learned from the evaluation of light-vehicle vehicles
Oct—Dec 2004	INL/EXT-05-00040	Bus mileage and performance status Analysis and reporting of bus engine oil Diesel engine idling wear-rate evaluation test Refined Global Solutions Filter installation Status of light-duty vehicle mileage and performance
Jan—March 2005	INL/EXT-05-00381	Bus mileage and performance status Bus oil analysis testing and reporting Diesel engine idling wear-rate evaluation test Refined Global Solutions Filter systems Light-vehicle mileage and performance status Lessons learned

HEAVY-DUTY VEHICLE TESTING

Status of Bus Mileage and Performance

During this reporting quarter, the diesel-powered buses traveled 85,663 miles. Compared to the previous quarter, this mileage is less by 13,280 miles, because the engine of one bus (Caterpillar engine) failed in January, and two other buses were taken out of service (this quarter) for the Diesel Engine Idling Wear-rate Evaluation test. Figure 3 shows the quarterly and cumulative evaluation miles. Table 2 details the total test mileage status of the eleven test buses.

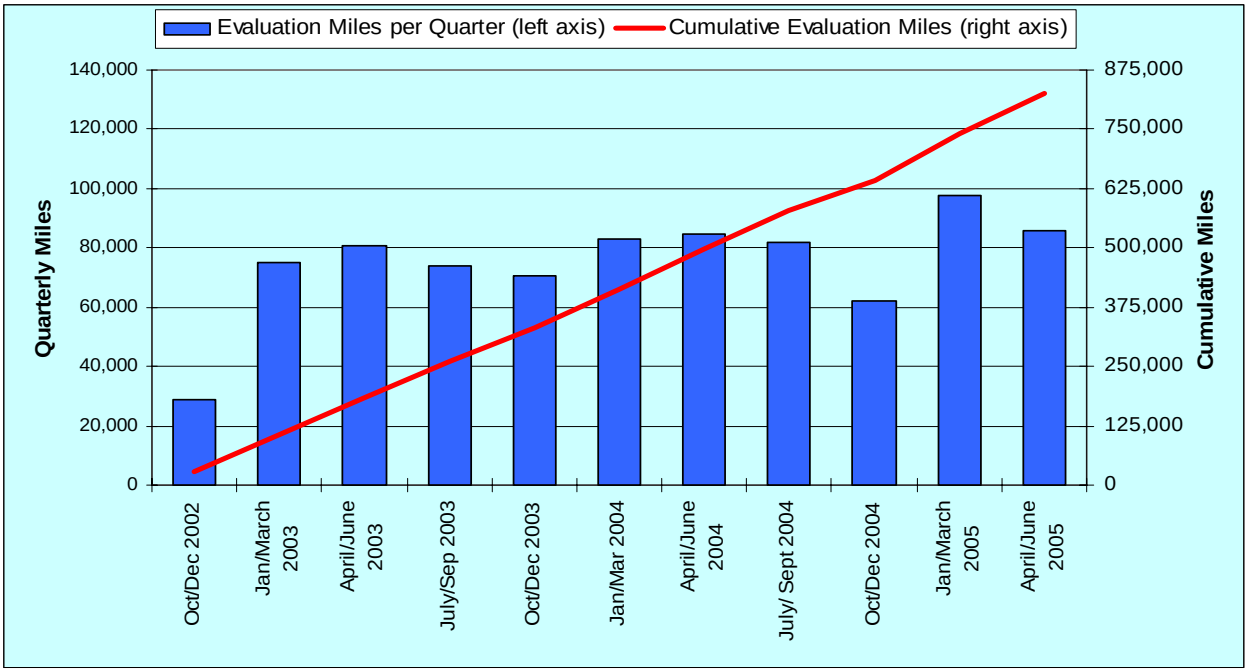

Figure 3. Quarterly and cumulative miles traveled by the test buses.

Table 2. Test buses and test miles on the bus engine oils as of June 30, 2005.

Bus Number	Filter	Start Date	Bus Mileage at Start of Test	Total Test Miles
73413	RGS[2]	Dec 14, 2004	202,233	14,416
73416	RGS[2]	Dec 14, 2004	195,156	27,411
73425	puraDYN[3]	Dec 18, 2002	41,969	68,491
73426	RGS[2]	Dec 7, 2004	36,140	23,291
73432	puraDYN[3]	Feb 11, 2003	47,612	93,830
73433	puraDYN[3]	Dec 4, 2002	198,582	105,619
73446	puraDYN[3]	Oct 23, 2002	117,668	108,770
73447	puraDYN[3]	Nov 14, 2002	98,069	77,305
73448	puraDYN[3]	Nov 14, 2002	150,600	81,225
73449	puraDYN[3]	Nov 13, 2002	110,572	76,708
73450[1]	puraDYN[3]	Nov 20, 2002	113,502	152,805
			Total	829,871

1. Bus 73450 has been out of service since January 2005.
2. RGS filter systems have 65,118 total test miles.
3. PuraDYN filter systems have 764,753 total test miles.

The total miles per oil change for each bus are shown in Figure 4. The "Normal Changes" bar shows the number of oil changes that would have occurred if the engine oils were changed every 12,000 miles. (Note: Bus 73413 had an oil change on 4/13/05. Buses 73416, 73425, and 73426 have had no oil changes to date. Buses 73432 and 73433 had oil changes on 2/22/05 to begin the idling test with new oil. Bus 73446 had oil changes on 6/2/04 and 3/22/05 due to oil quality degradation and on 4/20/05 due to injector failure, but not enough miles have been accumulated for the third oil change to show on the graph. Bus 73447 had an oil change on 8/3/04. Bus 73448 had an inadvertent oil change on 9/16/03 and an oil change on 11/17/04 due to degraded oil quality. Bus 73449 had an inadvertent oil change on 5/17/05 and an oil change on 12/20/04 due to degraded oil quality. Bus 73450 had oil change on 8/3/04 due to degraded oil quality.)

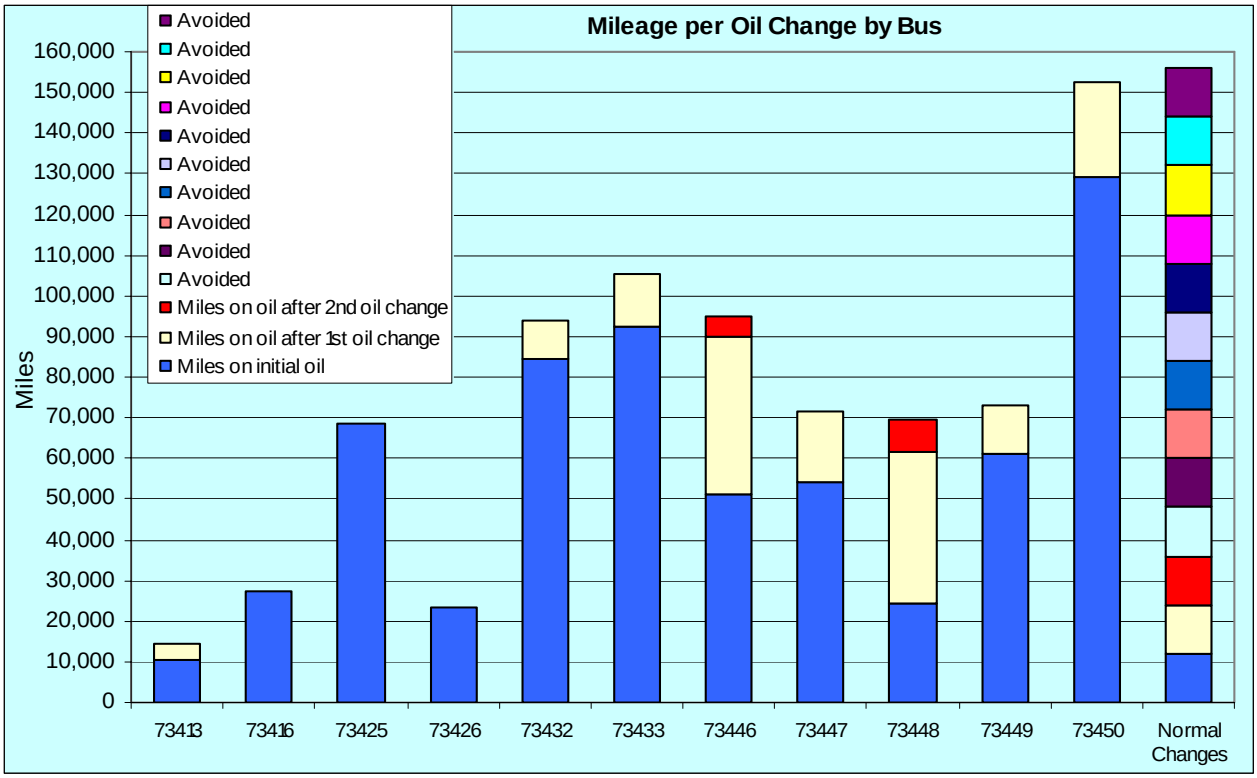

Figure 4. Total evaluation miles by bus as of June 2005.

Analysis and Reporting of Bus Engine Oil

Seven regularly scheduled 12,000-mile bus service events were performed during the quarter. No bus engine oil was intentionally changed due to degradation of oil quality. Bus 73449 had its oil changed inadvertently on 5/17/05 during servicing due to human error. Two buses had mechanical problems that required the oil to be changed. Bus 73446 had an engine fuel injector failure that grossly contaminated the oil, so it was changed. Bus 73413 had a broken dip stick fitting on the oil pan, and it was thought that dirt and debris had entered the oil, so it was changed.

Oil Savings and Quality

There have been six intentional oil changes during the life of the test as a result of oil quality degradation. There have also been six oil changes during the life of the test as a result of either mechanical failure and attendant contamination, inadvertent changing, or intentional change when the oil quality was still acceptable. The two intentional changes when the oil quality was still acceptable occurred when buses 73432 and 73433 were removed from the Oil Bypass Evaluation and were used for the 1,000-hour Diesel Engine Idling test (new engine oil was needed at the start of the idling test). Table 3 shows the breakdown of all oil changes to date.

Table 3. Breakdown of all oil changes to date.

Bus Number	Date of Oil Change	Mileage on Oil at Change	Cause of Change
73413	4/13/05	10,259	Fitting holding tip stick on oil pan broke, contaminating oil.
73416	Ongoing	To date, 27,411	None
73425	Ongoing	To date, 68,491	None
73426	Ongoing	To date, 23,291	None
73432	2/22/05	84,601	Oil changed because of the 1000-hour idle test
73433	2/22/05	92,335	Oil changed because of the 1000-hour idle test
73446	6/2/04	51,233	Low total base number[1]
	3/22/05	38,690	High lead, nitration, and low total base number
	4/20/05	5,022	Fuel injector failure contaminated oil
73447	8/3/04	54,201	Low total base number
73448	9/16/03	24,258	Accidental change by mechanic
	11/17/04	37,582	High oxidation/nitration and low total base number
73449	12/20/04	61,312	High oxidation/nitration[2] and low total base number
	5/17/05	11,640	Accidental change by mechanic
73450	8/3/04	129,140	Low total base number

[1] Total base number or (TBN) is a measure of the acid reducing ability of the oil, and its units are in KOH/g. When the TBN decreases to 3.0 KOH/g, the bus oil is changed. Typical new oil TBN can be as high as 10.0 KOH/g.

[2] Oxidation and nitration numbers are another standard by which to measure oil quality. When the oxidation or nitration values reach 30.0 Absolute, the bus oil is changed. The oxidation/nitration values for new oil are 0.0 Absolute.

As of 6/30/05, the buses had accumulated 829,871 test miles. If this total were divided by the service interval (12,000-miles), this would equate to 62 oil change events. If the six oil changes that were performed due to degraded oil quality were subtracted from the 62 oil change events it would equate to 56 oil changes avoided. This is a 90% savings in new oil use and, conversely, a 90% savings of waste oil generated. Assuming 35 quarters of oil per servicing event, 1,960 quarts or 490 gallons of oil were saved. If the four inadvertent and two oil changes for the idling test were added to the six oil changes due to oil quality degradation, and the resulting twelve oil changes were subtracted from the 62 oil changing events, there is an 80% oil change savings—still an excellent demonstration of oil change savings. The eleven buses in this evaluation actually traveled a combined 626,532 miles without an oil change. Table 4 shows details of oil life up to the first oil change event for each bus.

Table 4. Oil life up to the first change.

Bus Number	Start Date	Date of Oil Change	Months on Oil	Mileage on First Batch of Oil	Oil Changes Avoided
73413	12/14/2004	4/13/2005	7	10,259	0
73416	12/14/2004	Ongoing	7	To date, 27,411	2
73425	12/18/2002	Ongoing	30	To date, 68,491	5
73426	12/7/2004	Ongoing	7	To date, 23,291	1
73432	2/11/ 2003	2/22/2005	24	84,601	7
73433	12/4/2002	2/22/2005	26	92,335	7
73446	10/23/2002	6/2/2004	20	51,233	4
73447	11/14/2002	8/3/2004	21	54,201	4
73448	11/14/2002	9/16/2003	22	24,258	2
73449	11/13/2002	12/20/2004	25	61,312	5
73450	11/20/2002	8/3/2004	21	129,140	10

Another measure of oil quality is viscosity. The kinematic viscosity (ASTM D-445) determined at 40ºC and/or 100ºC is a measure of the flow rate of a material's (in this case engine oil) resistance to flow in relation to time. These data are used to assign an SAE (Society of Automotive Engineers) grade to oil. The engine oil viscosity classification chart for SAE grade 40 oil has a range of: 12.5 to 16.29 cST. Viscosity is a result of the internal friction of the material's molecules. Materials with a high viscosity (for instance, honey) do not flow readily; materials with a low viscosity (for instance, water) are more fluid. The following chart (Figure 5) shows the total history of viscosity values from each oil analysis report during the initial charge of oil into the buses.

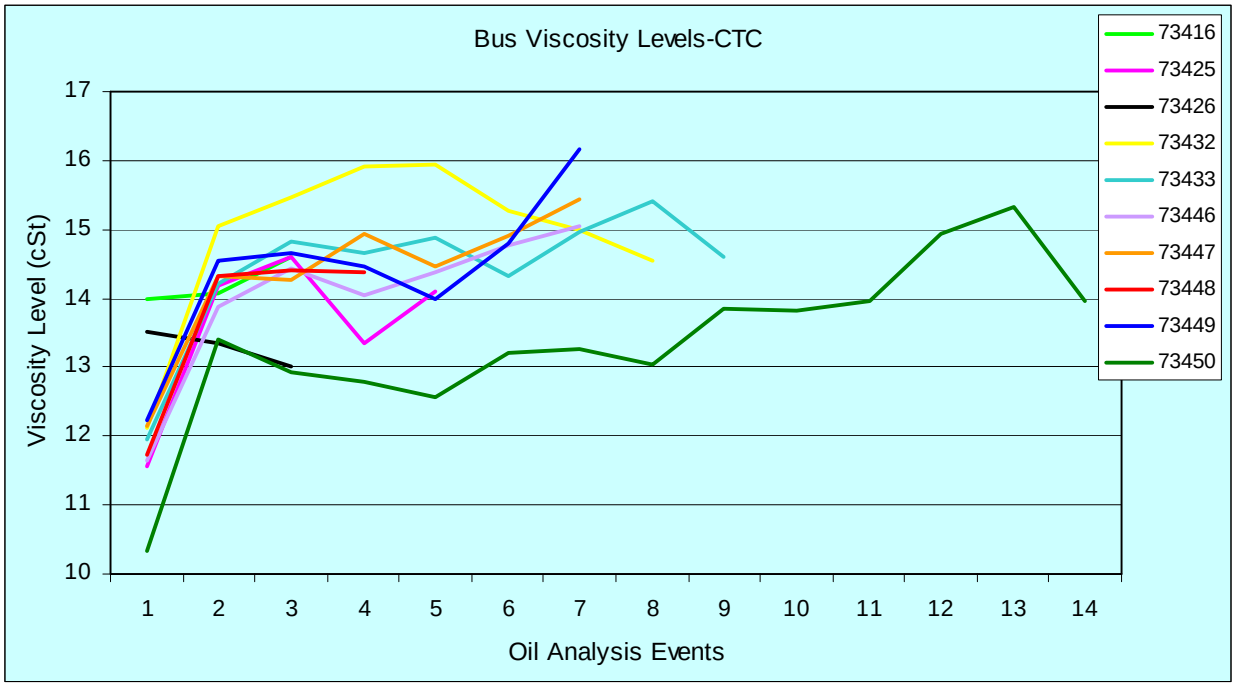

Figure 5. Viscosity values (40ºC) for the test buses during the initial oil test period.

The general trend shows that the viscosity is generally increasing (the oil is getting thicker) as it ages, because of contaminates. If an oil gets thinner (lower viscosity), it could be an indication of diesel fuel contamination. Contamination of the oil by fuel is a common problem resulting from a failed injector or fuel leaking around pistons.

Diesel Engine Idling Wear-Rate Evaluation Test

Preparation for the diesel engine idling wear-rate evaluation test began on 2/2/05 when the engine oils were changed on buses 73433 and 73432. Since both buses had traveled about 180,000 miles between them, it was decided to change the oil and run the buses a few days to clean up or flush any residual engine debris with fresh oil. The idle test began on 3/10/05, the date when the flushing oil was drained and new oil was again added to the bus engines. Both buses were then run on their respective routes for about 6,000 miles to age the test oil before the idling began. Actual engine idling started on 4/26/05 for bus 73433 and on 5/5/2005 for bus 73432.

To monitor the rates of engine wear metal, oil samples were taken each Monday and sent to two oil analysis laboratories for analysis. Also, at various intervals, the filters (one bypass and one full-flow filter) were removed and sent to National Tribology Services (NTS), Inc., of Minden, Nevada for destructive analysis. The filter test periods were (a) after the 6,000 miles of oil aging, (b) after 400 hours of engine idling, (c) after an additional 400 hours of idling (800 total hours), and (d) after 200 additional hours of idling (1,000 total hours of idling). The destructive filter analysis helped monitor the rates of engine metal wear and characterized what the filters captured, including qualitative evaluation of wear particle types (i.e., rubbing, fatigue and cutting) was captured and particle sizes. Bus 73433 finished the 1,000 hours of idling on 6/28/05; bus 73432 finished on 7/5/05. The results of this test will be reported in the near future. New West Technology is participating in the data reduction and analysis.

LIGHT-DUTY VEHICLE TESTING

Status of Light-duty Vehicle Mileage and Performance

During this reporting quarter, the light-duty Tahoe's traveled 28,688 miles, and as of June 30, 2005 they had accumulated 260,116 total test miles. The miles were lower this month because Tahoe 71333 was taken out of service last quarter. This quarter there were ten service events and three oil changes. The oil changes were due to low TBN levels.

The light-duty aspect of this assessment was actually restarted in January and February of this year. All of the vehicles were called in, and all engine oils were changed within a few days of each other. The INL Tahoes are security vehicles assigned to different locations throughout the 900-square-miles of the INL site and facilities; therefore, the actual use (in miles) varies widely between the vehicles (Table 5) and the assigned locations. The actual use can be masked somewhat, because though some may get more road-time, the others get idled more.

Table 5. Days and miles on Tahoe engine oil as well as other details.

Tahoe Number	Restart Date	Date of Oil Change	Days on Oil	Mileage on Oil	Service Interval	Oil Changes Avoided[1]
71326	2/2/2005	6/14/2005	132	7,090	3,000 miles	1.4
71391	2/1/2005	6/28/2005	146	11,858	3,000 miles	2.9
71394	2/2/2005	Ongoing	148	8,308	3,000 miles	At least 1.8
71400	2/2/2005	Ongoing	148	5,034	3,000 miles	At least 0.7
71402	1/26/2005	6/7/2005	144	9,832	3,000 miles	2.7

[1]Note: Oil changes avoided is calculated by dividing the service interval (3,000) into the miles driven and subtracting one from the quotient value.

There have been three oil changes to date, on vehicles 71326, 71391, and 71402. Eleven avoided oil changes out of 14 changes (42,122 miles ÷ 3,000 miles = 14 oil changes) equates to 80% of the oil changes have been avoided to date.

If it is assumed that vehicles 71394 and 71400 will soon have oil changes, then there were nine avoided oil changes, which equates to 64% of the oil changes avoided (9 ÷ 14 = 64%).

PRESS EVENT AT ONE MILLION MILES OF TESTING

The Oil Bypass Filter Technology Evaluation reached one million total test miles on the INL buses and Tahoes this quarter. On April 19, 2005, INL conducted a press event for the community and the media. The event was well attended by both oil bypass filter manufactures, INL employees, the general public, and both print and broadcast media.

INL media personnel produced a document for general release germane to the one million miles testing event, a copy of which is shown in Appendix A. The local media (Idaho and Utah) produced several television and newsprint releases. A brief Internet search showed some of the exposure generated by the event; a few examples are provided in Appendix B.

SUMMARY

There are eleven INL buses in the Oil Bypass Filter Evaluation. However, with two buses in the Diesel Engine Idling Test part of this reporting quarter and one bus out of service with engine failure (bus 73450), only eight buses were actively in testing the entire reporting quarter. To date, the eleven buses have accumulated 829,871 miles since testing inception (October 2002). The ten operating buses traveled 85,663 miles this quarter.

Seven regularly scheduled 12,000-mile bus service events were performed. No bus engine oil was changed this quarter due to degradation of oil quality.

Bus 73449 had its oil inadvertently changed on 5/17/05 during servicing. Two buses had mechanical problems that required the oil to be changed: Bus 73446 had an injector failure; Bus 73413 had a broken dip stick fitting on the oil pan.

The INL test buses have had 62 oil service events during the last 32 months, during which 12 oil changes were performed. Six of the 12 oil changes were related to oil quality; the other six were due to either mechanical problems (two buses), inadvertent change (two buses), or preparation for the Diesel Engine Idling test (two buses).

With six bus oil changes (due to low oil quality) over 32 months, the avoidance of using 1,960 quarts (490 gallons) of new oil has been achieved, and 1,960 quarts of waste oil was not generated. This equates to a 90% reduction in bus engine oil changes.

If the six oil changes due to oil quality were added, the six oil changes caused by accidents, mechanical problems and voluntary changes, then the reduction of oil changes is 80%.

The eleven buses in this evaluation traveled a combined 626,532 miles without an oil change.

PuraDYN filter systems have 764,753 total test miles.

RGS filter system have 65,118 total test miles.

The bus data show a trend of increasing viscosity values as the oil drain intervals are extend and the engine oils become thicker with use.

The six Tahoe test vehicles traveled 28,688 miles, and as of June 30, 2005, the Tahoes had accumulated 260,116 total test miles.

This quarter's data show that the Tahoe's avoided an average of two out of three oil changes before the oil analysis led to changing the engine oils.

The Oil Bypass Filter Technology Evaluation project reached one million total test miles this quarter, which was recognized on April 19, 2005, when INL conducted a press event for the community and the media.

APPENDIX A

Press Release: One Million Test Miles

DOE News Release
FOR IMMEDIATE RELEASE
June 17, 2005

NEWS MEDIA CONTACTS:
Reuel Smith, (208) 526-3733, Reuel.Smith@inl.gov

DOE completes one million oil-bypass-filter test miles on Idaho National Laboratory buses and light-duty vehicles

The U.S. Department of Energy, through its Advanced Vehicle Testing Activity, has accumulated one million oil-bypass-filter-test miles on 11 Idaho National Laboratory (INL) buses and six light-duty Chevrolet Tahoes. Oil bypass filters are used to extend engine oil life by cleaning solid contaminants as small as one micron out of the engine oil, as well as removing harmful liquid and gaseous contaminants from engine oil.

Bypass filters from puraDYN Inc. and Refined Global Solutions Inc. are being used to evaluate the feasibility of reducing engine oil use and minimizing waste oil generation at INL as well as throughout the DOE complex. INL personnel that manage DOE's Advanced Vehicle Testing Activity, along with the staff from INL Fleet Operations, are conducting the oil-bypass-filter technology evaluation. Fourteen oil-bypass-filter systems from puraDYN are being used on eight INL buses and six INL Tahoes, while oil-bypass-filter systems from Refined Global Solutions are being used on three INL buses.

During the 1 million test miles, the oil bypass filters have been used to avoid 80 percent of the oil changes in the test buses, avoiding the use and waste generation of 1,680 quarts (420 gallons) of bus engine oil. The Tahoes have demonstrated a 75 percent reduction in engine oil changes, avoiding the use and waste generation of more than 130 quarts (33 gallons) of engine oil.

Based on the results of the INL testing, analysis has shown that annual engine oil savings of up to 32,000 gallons could be achieved if oil bypass filters were used in the entire DOE fleet nationwide and up to 1.7 million gallons could be saved annually if oil bypass filters were used by all federal fleets.

In addition to supporting DOE's goal of ensuring energy security for the United States, this demonstration provides the environmental benefit of reducing the generation of waste oil products.

To validate the extended oil-drain intervals, an oil-analysis regime evaluates the fitness of the oil for continued service by monitoring the presence of 30 variables, including: necessary oil additives, undesirable contaminants, engine- and component-wear metals, and oxidation and nitration levels. The testing also includes counting the number and size of particulates suspended in the oil of the test buses and Tahoes to validate the effectiveness of the filters. In addition, heightened wear-metal levels can be used to identify potential engine and component failures.

Nine quarterly reports documenting the Oil Bypass Filter Evaluation results can be found at http://avt.inl.gov/obp.html. The evaluation test plans can also be found at this address.

These elements of the Advanced Vehicle Testing Activity are managed for the DOE Office of Energy Efficiency and Renewable Energy from the Idaho National Laboratory in Idaho Falls, Idaho.

DOE, through its Advanced Vehicle Testing Activity, conducts Accelerated Reliability and Fleet testing on hybrid, neighborhood and urban electric vehicles, as well as hydrogen-powered internal combustion vehicles. (The Advanced Vehicle Testing Activity is a DOE activity within the FreedomCAR and Vehicle Technology Program.) The Advanced Vehicle Testing Activity performs unbiased baseline performance testing to provide benchmark data for technology modeling and research and development programs, as well as to help fleet managers and other vehicle purchasers make informed purchase and operations decisions.

For more information on the Advanced Vehicle Testing Activity and its testing methods and activities, visit the Advanced Vehicle Testing Activity Web page http://avt.inl.gov, or contact James Francfort at James.Francfort@inl.gov, (208) 526-6787.

Note: Reference to any specific manufacturer or products is not an endorsement by the federal government nor the INL.

— INL —

05-020

APPENDIX B

PRESS EVENT COVERAGE

KSL News: Device Could Make Frequent Oil Changes Obsolete
The "oil bypass filter" is an old idea that's never become standard in the industry. ... Tuesday, the Idaho National Laboratory will announce favorable test **...**

KIDK 3 - Idaho Falls, Pocatello, Blackfoot
Idaho Falls Mayor Announces Major Greenbelt Expansion ... Oil Bypass Filter. The INL is testing oil bypass filters that could reduce the dependency on **...**
www2.kidktv.com/x18258.xml?ParentPageID=x3750& ContentID=x5331&Layout=kidk.xsl&AdGroupID=x3776... - 215k -

INEEL - News Desk - DOE completes one million oil-bypass-filter ...
The US Department of Energy, through its Advanced Vehicle Testing Activity, has accumulated one million oil-bypass-filter-test miles on 11 Idaho National **...**
newsdesk.inel.gov/contextnews.cfm?ID=601 - 7k -

[PDF] DOE News Release
File Format: PDF/Adobe Acrobat - View as HTML
-After one million miles, US Department of Energy/Idaho National ... Oil bypass filters are used in concert with standard internal combustion (“full flow”) **...**

[PDF] Science
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oil bypass filters in Idaho National Labo- ... accumulated one million oil-bypass-filter-test miles on 11 Idaho National Laboratory **...**
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