2015 Winter Operation's Conference
Bellaire, Michigan
October 21, 2015
Presented by Lee Schley

Innovations

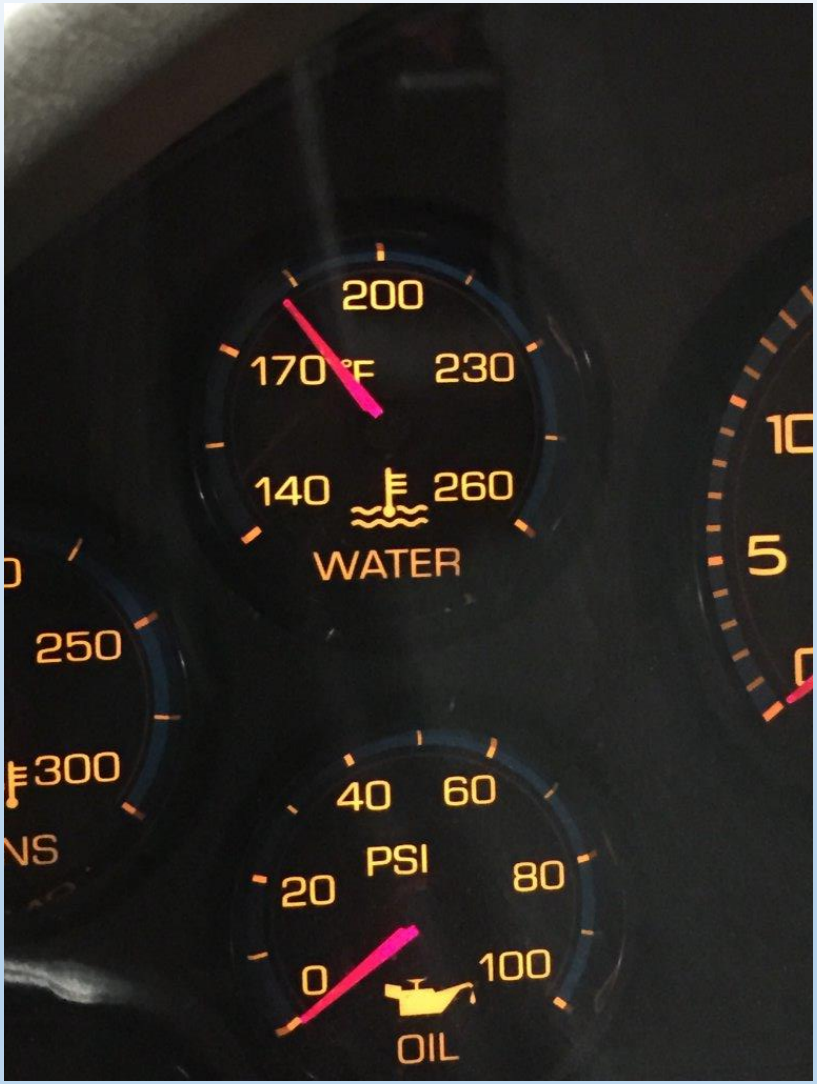
Oil Change Interval

Innovation Basis

- Current State of Michigan policy states that vehicle oil change interval is 350 hours on Winter Maintenance Trucks (04 Units).
- Oil Change Innovation at the St. Ignace Maintenance Garage recommends extending the oil change interval to 500 hours.
- Policy also states that oil is to be sampled and tested every oil change on all MDOT Winter Maintenance Trucks.
- We reviewed oil samples from the past 18 months at every oil change. The results showed that there was significant service life remaining at the recommended change interval.
- The following examples will demonstrate the potential cost savings for the State of Michigan.

Winter Maintenance Fleet Truck

- Engines used in these vehicles are either Maxx Force or Cummins Diesels



Ideal Conditions

- The Ideal engine temperature at which the oil sample is collected is around 180˚.

- In cold weather, trucks are left idling outside for 15 minutes to achieve the ideal engine temperature before collecting a sample.

SAMPLING INSTRUCTIONS AND PRECAUTIONS

1. The sample should be taken NOT MORE THAN 30 MINUTES after shutdown, and the oil should have been in service for at least 10 hours or 500 miles, before the oil can accurately reflect wear conditions.

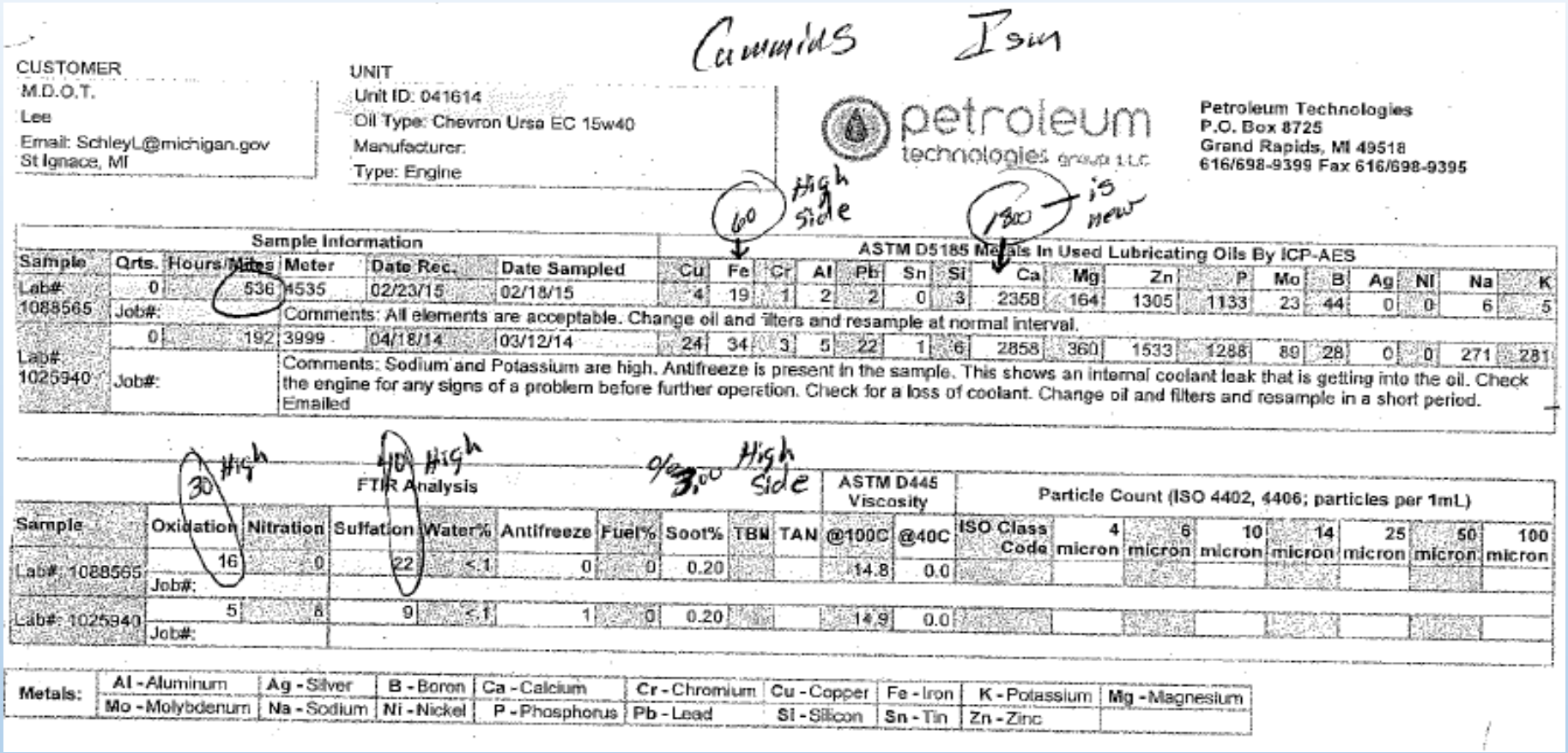
   AVOID CONTAMINATION OF SAMPLE.

2. Clean around the drain plug before draining. Remove drain plug, and when about half the oil has run out, catch the sample by inserting the bottle into the oil stream. The bottle should be at least 3/4 filled.

3. Do not remove the bottle cap until you are ready to take the sample, and recap the bottle immediately after filling. Take care not to confuse samples from different units.

OR

4. Remove sample with a suction pump by inserting the siphon tube down the dipstick tube or into the sump/reservoir. The siphon tube must be replaced after each sample.



Cummins Isx

CUSTOMER
M.D.O.T.
Lee
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St Ignace, MI

UNIT
Unit ID: 041614
Oil Type: Chevron Ursa EC 15w40
Manufacturer:
Type: Engine

petroleum technologies group LLC

Petroleum Technologies
P.O. Box 8725
Grand Rapids, MI 49518
616/698-9399 Fax 616/698-9395

60 High side

1300 is new

Sample Information						ASTM D5185 Metals In Used Lubricating Oils By ICP-AES															
Sample	Qrts.	Hours/Miles	Meter	Date Rec.	Date Sampled	Cu	Fe	Cr	Al	Pb	Sn	Si	Ca	Mg	Zn	P	Mo	B	Ag	Ni	Na	K
Lab#: 1088565	0	536	4535	02/23/15	02/18/15	4	19	1	2	2	0	3	2358	164	1305	1133	23	44	0	0	6	5
Job#:	Comments: All elements are acceptable. Change oil and filters and resample at normal interval.																				
Lab#: 1025940	0	192	3999	04/18/14	03/12/14	24	34	3	5	22	1	6	2858	360	1533	1288	89	28	0	0	271	281
Job#:	Comments: Sodium and Potassium are high. Antifreeze is present in the sample. This shows an internal coolant leak that is getting into the oil. Check the engine for any signs of a problem before further operation. Check for a loss of coolant. Change oil and filters and resample in a short period. Emailed																				

30 High

40 High

0/e 3.00 High side

FTIR Analysis										ASTM D445 Viscosity		Particle Count (ISO 4402, 4406; particles per 1mL)							
Sample	Oxidation	Nitration	Sulfation	Water%	Antifreeze	Fuel%	Soot%	TBN	TAN	@100C	@40C	ISO Class Code	4 micron	6 micron	10 micron	14 micron	25 micron	50 micron	100 micron
Lab#: 1088565	16	0	22	<.1	0	0	0.20			14.8	0.0								
Job#:																			
Lab#: 1025940	5	8	9	<.1	1	0	0.20			14.9	0.0								
Job#:																			

Metals:	Al - Aluminum	Ag - Silver	B - Boron	Ca - Calcium	Cr - Chromium	Cu - Copper	Fe - Iron	K - Potassium	Mg - Magnesium
	Mo - Molybdenum	Na - Sodium	Ni - Nickel	P - Phosphorus	Pb - Lead	Si - Silicon	Sn - Tin	Zn - Zinc	

- **At 536 hours of service, oil life remaining is 45%+.**

Cummins 2/2/15

CUSTOMER

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St Ignace, MI

UNIT

Unit ID: 041593
Oil Type: Chevron Ursa EC 15w40
Manufacturer:
Type: Engine

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Sample Information						ASTM D5185 Metals In Used Lubricating Oils By ICP-AES																
Sample	Qrts.	Hours/Miles	Meter	Date Rec.	Date Sampled	Cu	Fe	Cr	Al	Pb	Sn	Si	Ca	Mg	Zn	P	Mo	B	Ag	Ni	Na	K
Lab#: 1085195	0	10328	142339	02/05/15	02/02/15	3	22	1	3	2	0	5	2226	187	1290	1021	24	42	0	0	2	0
	Job#:		Comments: All elements are acceptable. The oil is reusable. If reused, please resample at normal interval. NOTE: The oil is at about 35 % used at this point. Emailed																			

	FTIR Analysis									ASTM D445 Viscosity		Particle Count (ISO 4402, 4406; particles per 1mL)							
Sample	Oxidation	Nitration	Sulfation	Water%	Antifreeze	Fuel%	Soot%	TBN	TAN	@100C	@40C	ISO Class Code	4 micron	6 micron	10 micron	14 micron	25 micron	50 micron	100 micron
Lab#: 1085195	.7	.7	18	<.1	0	0	0.22	7.8		14.9	0.0								
	Job#:																		

Metals:									
	Al - Aluminum	Ag - Silver	B - Boron	Ca - Calcium	Cr - Chromium	Cu - Copper	Fe - Iron	K - Potassium	Mg - Magnesium
	Mo - Molybdenum	Na - Sodium	Ni - Nickel	P - Phosphorus	Pb - Lead	Si - Silicon	Sn - Tin	Zn - Zinc	

- **At 439 hours of service, oil still has 65% remaining.**

CUSTOMER
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St Ignace, MI

UNIT
Unit ID: 041643
Oil Type: 15W40
Manufacturer:
Type: Engine

Cummins

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March

Sample Information						ASTM D5185 Metals In Used Lubricating Oils By ICP-AES															
Sample	Qrts.	Hours/Miles	Meter	Date Rec.	Date Sampled	Cu	Fe	Cr	Al	Pb	Sn	Si	Ca	Mg	Zn	P	Mo	B	Ag	Ni	Na	K
Lab#: 1025938	0	358	358	04/18/14	03/10/14	1	9	1	2	0	0	5	2726	495	1556	1302	52	39	0	0	1	1
	Job#:	Comments: All elements are acceptable. The oil is reusable. If reused, please resample at normal interval.																			

High

30 40

	FTIR Analysis									ASTM D445 Viscosity		Particle Count (ISO 4402, 4406; particles per 1mL)							
Sample	Oxidation	Nitration	Sulfation	Water%	Antifreeze	Fuel%	Soot%	TBN	TAN	@100C	@40C	ISO Class Code	4 micron	6 micron	10 micron	14 micron	25 micron	50 micron	100 micron
Lab#: 1025938	7	8	8	<1	0	0	0.20			14.9	0.0								
	Job#:																		

Metals:	Al - Aluminum	Ag - Silver	B - Boron	Ca - Calcium	Cr - Chromium	Cu - Copper	Fe - Iron	K - Potassium	Mg - Magnesium
	Mo - Molybdenum	Na - Sodium	Ni - Nickel	P - Phosphorus	Pb - Lead	Si - Silicon	Sn - Tin	Zn - Zinc	

- **At 355 hours of service, only 5 hours over recommended interval, oil life is still has approximately 75%+ oil life remaining.**

Maxx Force 2/24/15

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St Ignace, MI

UNIT
Unit ID: 044021
Oil Type: Chevron Ursa EC 15w40
Manufacturer:
Type: Engine

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Sample Information						ASTM D5185 Metals In Used Lubricating Oils By ICP-AES																	
Sample	Qrts.	Hours/Miles	Meter	Date Rec.	Date Sampled	Cu	Fe	Cr	Al	Pb	Sn	Si	Ca	Mg	Zn	P	Mo	B	Ag	Ni	Na	K
Lab#: 1085089	0	31431	71267	02/04/15	02/02/15	5	131	9	94	1	1	8	2461	233	1411	1133	29	23	0	10	2	0
	Job#: 675 Hrs	Comments: Iron and Aluminum appear high. This is likely due to the break-in wear of the new engine and is normal. Suggest changing the oil and filters and resampling at a normal interval.																					

on monitor

Can be 30 — Can be 40

FTIR Analysis										ASTM D445 Viscosity		Particle Count (ISO 4402, 4406; particles per 1mL)							
Sample	Oxidation	Nitration	Sulfation	Water%	Antifreeze	Fuel%	Soot%	TBN	TAN	@100C	@40C	ISO Class Code	4 micron	6 micron	10 micron	14 micron	25 micron	50 micron	100 micron
Lab#: 1085089	24	0	36	< 1	0	0	0.70			15.0	0.0								
	Job#:																		

Metals:	Al - Aluminum	Ag - Silver	B - Boron	Ca - Calcium	Cr - Chromium	Cu - Copper	Fe - Iron	K - Potassium	Mg - Magnesium
	Mo - Molybdenum	Na - Sodium	Ni - Nickel	P - Phosphorus	Pb - Lead	Si - Silicon	Sn - Tin	Zn - Zinc	

- **At 675 hours, this oil test shows 80% expiration of the oil life.**

CUSTOMER

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UNIT

Unit ID: 42
Oil Type: Chevron Ursa EC 15w40
Manufacturer:
Type: Engine

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Grand Rapids, MI 49518
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Sample Information					ASTM D5185 Metals In Used Lubricating Oils By ICP-AES																
Sample	Qrts.	Hours/Mile's	Meter	Date Rec.	Date Sampled	Cu	Fe	Cr	Al	Pb	Sn	Si	Ca	Mg	Zn	P	Mo	B	Ag	Ni	Na	K
Lab#: 1081169	42	439	7355	01/19/15	12/30/14	2	37	1	10	1	0	5	2196	173	1192	1018	22	30	0	0	1	0
	Job#:	Comments: All elements are acceptable. The oil is reusable. If reused, please resample at normal interval. NOTE: The Oxidation, Nitration and Sulfation levels are low and show only about 50% of the oil life has been used. The TBN is within limits. This shows that the oil can continue to be used at a longer drain interval.																			

FTIR Analysis										ASTM D445 Viscosity		Particle Count (ISO 4402, 4406; particles per 1mL)							
Sample	Oxidation	Nitration	Sulfation	Water%	Antifreeze	Fuel%	Soot%	TBN	TAN	@100C	@40C	ISO Class Code	4 micron	6 micron	10 micron	14 micron	25 micron	50 micron	100 micron
Lab#: 1081169	6	9	14	<.1	0	0	0.30	5.90		14.9	0.0								
	Job#:																		

Metals:	Al - Aluminum	Ag - Silver	B - Boron	Ca - Calcium	Cr - Chromium	Cu - Copper	Fe - Iron	K - Potassium	Mg - Magnesium
	Mo - Molybdenum	Na - Sodium	Ni - Nickel	P - Phosphorus	Pb - Lead	Si - Silicon	Sn - Tin	Zn - Zinc	

- **Example of an oil test result on a Maxx Force engine WMT that has been serviced at 439 hours and has still has 50% oil life remaining.**
- **As shown on this sample results, this oil is 89 hours over recommended interval.**

St. Ignace Garage Heavy and Light Fleet
Examples of Remaining Oil Service Life

Truck #	Recommended Oil change interval	Actual Hours	Oil Service Life Remaining	Engine Type
04-1614	350	536	45%	Cummins
04-1593	350	439	70%	Cummins
04-1643	350	355	83%	Cummins
04-4021	350	675	20%	Maxx Force
04-3042	350	439	50%	Maxx Force
03-4872	150	*150	Acceptable- Other parameters in play	V8- Gas; 5.4L
03-2073	150	209	80%	Powerstroke Diesel 6.0

*Note: At 150 hours, mileage on this vehicle, a Ford F-250 with a 5.4 Liter engine, was 8,656 miles.

Winter Maintenance Truck Cost Savings

350 hour vs 500 hour service	Chevron Ursa 15w40 350hrs	Chevron Ursa 15w40 500hrs
Trucks	12	12
Hours Run Per Year (Est.)	1,050	1,050
Oil Changes Per Year	3.0	2.1
Oil Capacity (Gallons)	11	11
Oil Change Labor Hours	3	3
Labor Rate	$41.83	$41.83
Oil Change Labor/Year	$5,270.58	$3,689.41
Cost of Motor Oil (Per Gallon)	$6.25	$6.25
Cost of 1 Oil Change	$68.75	$68.75
Oil Cost/ Year / Truck	$206.25	$144.38
Total Oil Cost / Year	$2,475.00	$1,732.56
Annual Total Oil Change Cost	$7,745.58	$5,421.97
Savings on entire fleet:		**$2,323.61**

Conclusion

- This innovation saves MDOT approximately $2,323.61 annually at one Maintenance Facility alone, which contains 12 Winter Maintenance Trucks.
- The cost savings potential when this innovation is applied statewide would be significant.
- The recommendation is to go to a 500 hour oil change interval for Winter Maintenance Trucks.


Thank you for
your time!