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Issued: January 8, 2015

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These are the unapproved minutes of the 01.08.2015 Sequence VI Surveillance Panel call.

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Agenda

The Agenda is included as **Attachment 1**.

1.0) Roll Call

The attendance list is included as **Attachment 2**.

2.0) Approval of minutes

2.1) Approve the minutes from the October 20, 2014 Sequence VI Surveillance Panel.

Motion: Charlie Leverett / Dan Worcester – Accept the minutes of the October 20, 2014 Seq. VI Surveillance Panel. Approved- unanimous.

3.0) Action Item Review

3.1 OHT to report VID & VIE engine usage and expected depletion date of VID engines. – OHT

Jason Bowden reported the following remaining engine quantities in inventory:

13 each VID Engines

93 each VIE Engines

3.2 Update on supplemental service engines

Jason Bowden reported that the survey results have been received and the current estimate for service engines that will be required are 300-325 each based on the initial survey results. Jason will be scheduled a conference call within the near future between the purchasing labs and the test sponsor to address any remaining questions before we proceed with ordering this material.

3.3 Update on “Tech 1” donated runs. – Oil is available at TMC

Rich Grundza reported that the oil is available and they have not received any additional requests for the Tech 1 to date.

3.4 Labs to report on capability to control fuel temperature to the flow meter to 26C +/- 2C.

Nathan Moles commented that this issue was raised by a lab that is located in a colder climate. There was a concern that it may be difficult to reach this temperature specification. This concern appears to be addressed and all labs can meet this criteria. This issue can be considered closed.

3.5 Update on missing data in VIE reporting – TMC

Rich Grundza commented that he is missing data from one lab. Most of the data has been compiled and the data flow has now been addressed.

A question was asked as to whether this fuel temp specification is only for VIE going forward? Answer = Yes

3.6 REO 542-2 is available for VID and VID testing

Rich Grundza presented Attachment 3. He reported that 542 & 542-1 have been completely consumed. Three operationally valid tests reported. One rejected for FEO 1. All tests run on new engines.

FEI1 appears to be milder by approximately a standard deviation. FEI2 appears to be close to target. The FEI1 variability is somewhat less than the original matrix, due to it being milder. FEI2 was reported to be slightly more variable than original matrix targets.

3.7 Charlie Leverett and Dave Glaenzer revised Figure A5.6 to clarify oil temperature locations

This has been updated and needs to be forwarded to Hap Thompson. The temperature range for the fuel supply and the Horiba will all be updated in the procedure in the coming days.

3.8 SP chair and test sponsor to investigate what is needed to establish VID equivalent limits for VIE

This meeting will be set up in the future to discuss. Charlie Leverett believes that this does not need to be completed until the VID is no longer available. Nathan Moles recommended that the Panel keeps this as an ongoing Action Item in order have a plan in place. This will be an ongoing action item.

3.9 Lab survey to identify used engines available for the precision matrix
A survey was sent out to the labs and is complete. This will be a living document as we move forward. The statisticians have this information and have a couple of questions that are being addressed by the participating labs. The labs will be having a conference call to discuss these questions on

4.) Old Business

4.1 The Seq. VI Surveillance Panel approved the Test Ready Template that was reviewed during 10/20 SP meeting. Email ballot was sent out 12/17/2014 and received unanimous approval; however, there was some confusion regarding the scope of the Seq. VIE New Test Template vote; as to whether it did or did not include approval for the test to proceed to the precision matrix testing.

4.2 The negative vote at B regarding the fuel batches was withdrawn. Negative vote was withdrawn at December 2014 ASTM DO2.B.1 Meeting.

4.3 Fuel to Flow Meter temperature was changed to “critical measurement and control parameter” in the VIE draft procedure with a hard specification of $26^{\circ}\text{C} \pm 2^{\circ}\text{C}$.

This will be updated in the procedure by Hap Thompson

4.4 Updated the VIE draft procedure to list the Horiba MEXA 110 AFR analyzer along with the other listed analyzers as acceptable for use in the VID test.

This will be updated in procedure as well.

4.5 ASTM REO 542-2 is available for VID and VIE testing. There will also be a new blend 1010-1.

4.6 The PCEOCP has requested equivalent data for older test types. Work will continue on this topic as an ongoing action item.

4.7 The ASTM new test type method was reviewed. The reference oils will be Tech 1 and the new blends of 542 and 1010. The critical parts list will be updated. Labs will need to provide information for the matrix.

4.8 The engine hour correction for the VIE was reviewed.

5.) New Business

5.1 Discussion regarding Sequence VIE test ready to proceed with precision matrix. Chair to report results of vote at joint AOAP and PCEOCP meeting January 15th in Detroit.

Motion: Charlie Leverett / Andy Ritchie: The Seq. IVE is ready for precision matrix testing.

*Charlie withdrew his original motion.

Discussion:

Two negative votes with comments were received and included below:

1. *“With the issue of carry-over of friction modifier from one candidate test to the subsequent BL before test, it behooves us to understand the phenomena and make efforts to eliminate or minimize it prior top matrix testing. I am unaware of and have no idea if such friction modifiers will be used in any of the matrix oils, but if they are, we could create a very messy dataset.*

Until a means of minimizing the impact of carryover by some types/styles of friction modifier are understood and/or minimized, I will have to vote

negative on the Sequence VIE test proceeding to the precision matrix phase.”

2. *“The issue of carryover of friction modifier into the baseline oils needs to be resolved prior to proceeding with the precision matrix. Lubrizol has a promising resolution in the works; however, our initial experiment was unsuccessful due to a hardware issue. We are bringing a new engine online and plan to have results for that experiment late next month. I also have concerns about the longevity of the engine, in regards to the friction modifier response at higher hours. We have very limited data on reference oils at higher engine hours, but there may be an issue with differentiating candidates at higher hours. I think it would be wise to confirm or negate this potential issue prior to running the full precision matrix.”*

There was significant discussion with regards to the two negative votes for the Seq. VIE test to be ready for matrix. Nathan Moles gave his presentation [Attachment 4](#) and there were comments and discussions during this presentation, which are captured below.

Dave Glaenzer stated that there has been work on this issue, but we have not fully explored all possible solutions. We do not completely understand this issue and he believes that additional work should be completed to fully understand the concerns of carry-over before we move into a precision matrix. Lubrizol has done work on this topic and this should continue. We may not be able to fix this issue, but we should look at it closer.

Andy Ritchie commented that there may be additives that cannot be cleaned from the flush, but I do not believe that this will have a major impact on test results if we have done everything we can to remove most of the carryover.

Robert Stockwell recommended running additional BLA cycles after each test in addition the flushes before we start a test. We run multiple flushes before we start, but would we better served running additional tests after the completion of a test (BLA1, BLA2, etc.). Nathan Moles stated their experience the BLA is not as effective as running the flush oil. Slide 10 & 11 was the focus of this discussion. More flushing was deemed unsuccessful. Reformulation of the flush with a 0W-20 version of current flush oil has been unsuccessful to date. They are currently looking at a high speed flushing condition and an alternate flush oil formulation. Dave Glaenzer had concerns that if you change the flush oil formulation there will be concerns with other additive companies whether this new formulation would work with their formulation.

Andy asked if Nathan was requesting additional time to study these changes. Nathan agrees that they would like additional time and hope to have additional information by the end of the month. There is an additive that cannot be removed from the engine with the current flushing techniques that have been in place for many years.

Andy also commented that this additive may present challenges in other flush and run industry tests. Nathan does not know what affects this additive has on other flush and run tests.

Nathan returned to the beginning of the presentation. All data in the presentation is on the VID, but they see the same effect on the VIE even with the longer flushing procedure that was implemented over a year ago. Nathan has VIE data that shows equivalency, but the data is not as clear as the VID data. Andy recommended that the VIE data be shared with the panel and we should focus on the VIE data instead of the VID data.

The presentation outlined the three reasons for Lubrizol's negative vote.

Charlie and Dave disagreed with the results on slide 7 showing higher variability of .27 for the FEI2. They both believe that the variability is much lower and that the statisticians should confirm this.

Slide 8 shows a summary of a VIE engine that was out on oil consumption and disassembled it and put it into an ultrasonic cleaner. Dave, Rich and Charlie would like to see the uncorrected data on the cleaned engines instead of using the VID hour correction factor. Jason Bowden shared concerns with a full disassembly of a test engine. Nathan stated that they are not necessarily recommending this as a fix for engine hour, but wanted to conduct a study to deal with the perceived lack of response to friction modifiers as the engine ages. They were trying to come up with a possible solution to the life of the engine.

Tim Cushing asked what level of up treat Nathan is targeting for the study referred to in Nathan's presentation. Nathan confirmed they are looking at 3 times the up-treat level for the fuel. This will be done at the fuel supplier.

Dave G. recommended increasing the oil temperature to a minimum of flush condition temperatures instead of 80°C for these ongoing study.

The group inquired as to how much time Lubrizol would need to complete the friction modifier study? Nathan believes that the first week of February 2015 would be acceptable to complete their carryover experiment. Nathan can only have the friction modifier work completed

by this date. They will not be able to address the FEI2 or engine hour concerns in this timeframe.

Charlie Leverett withdrew his original motion.

5.2 Review Lubrizol presentation regarding negative vote for matrix readiness
See 4.1 comments

5.3 Discussion to consider allowing the oil be changed at 75 hours during the break-in for Seq. VIE

This will be ongoing as we were limited on time during this call.

5.4 Questions from the statisticians in regards to the precision matrix – Jo Martinez

Labs will discuss these results in a future meeting on Wednesday 10:00 EST during a conference call.

6.) Next Meeting

Call of the chairman - Next Panel Meeting on Feb. 5th in the a.m.

7.) Meeting Adjourned

Sequence VI Surveillance Panel Conference Call Agenda January 8 @ 10:00AM EST

Call-in information is included below:

Call-in Number: 866-528-2256
Conference Code: 3744024

1.0) Roll Call

Do we have any membership changes or additions?

2.0) Approval of minutes

2.1) Approve the minutes from the October 20, 2014 Sequence VI Surveillance Panel.

3.0) Action Item Review

3.1 OHT to report VID & VIE engine usage and expected depletion date of VID engines. – OHT

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3.9 Lab survey to identify used engines available for the precision matrix

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Two negative votes with comments were received and included below:

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2. *“The issue of carry over of friction modifier into the baseline oils needs to be resolved prior to proceeding with the precision matrix. Lubrizol has a promising resolution in the works; however, our initial experiment was unsuccessful due to a hardware issue. We are bringing a new engine online and plan to have results for that experiment late next month. I also have concerns about the longevity of the engine, in regards to the friction modifier response at higher hours. We have very limited data on reference oils at higher engine hours, but there may be an issue with differentiating candidates at higher hours. I think it would be wise to confirm or negate this potential issue prior to running the full precision matrix.”*

5.2 Review Lubrizol presentation regarding negative vote for matrix readiness (Attached)

5.3 Discussion to consider allowing the oil be changed at 75 hours during the break-in for Seq. VIE

5.4 Questions from the statisticians in regards to the precision matrix – Jo Martinez

6.) Next Meeting

Call of the chairman

7.) Meeting Adjourned

ASTM SEQUENCE VI

Name	Address	Phone/Fax/Email	Attendance
Jason Bowden Voting Member	OH Technologies, Inc. P.O. Box 5039 Mentor, OH 44061-5039	Phone: 440-354-7007 Fax: 440-354-7080 jhbowden@ohtech.com	Attended
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David Glaenzer Voting Member	Afton Research Center 500 Spring Street Richmond, VA 23218	Phone: 804-788-5214 Fax: 804-788-6358 Dave.Glaenzer@aftonchemical.com	Attended
Rich Grundza Voting Member	ASTM TMC 6555 Penn Ave. Pittsburgh, PA 15206-4489	Phone: 412-365-1034 Fax: 412-365-1047 reg@astmtmc.cmu.edu	Attended
Tracey King Voting Member	Haltermann	tking@jhaltermann.com	
Charlie Leverett Voting Member	Intertek Automotive Research 5404 Bandera Road San Antonio, TX 78238	Phone: 210-647-9422 Fax: 210-523-4607 charlie.leverett@intertek.com	Attended
Terry Kowalski Voting Member	Toyota	teri.kowalski@tema.toyota.com	
Bruce Matthews Voting Member	GM Powertrain Engine Oil Group Mail Code: 483-730-472 823 Joslyn Rd	Pontiac, MI 48340 Phone: 248-830-9197 bruce.matthews@gm.com	Attended
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Art Andrews		Exxon	Attended
Jo Martinez		Chevron	Attended
Tim Cushing		GM	Attended
Scott Stapp		GM	Attended
Cole Hudson		SWRI	Attended
Hap Thompson			Attended
Kevin OMalley		Lubrizol	Attended



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Test Monitoring Center

<http://astmtmc.cmu.edu>

542-2 Review

January 8, 2015

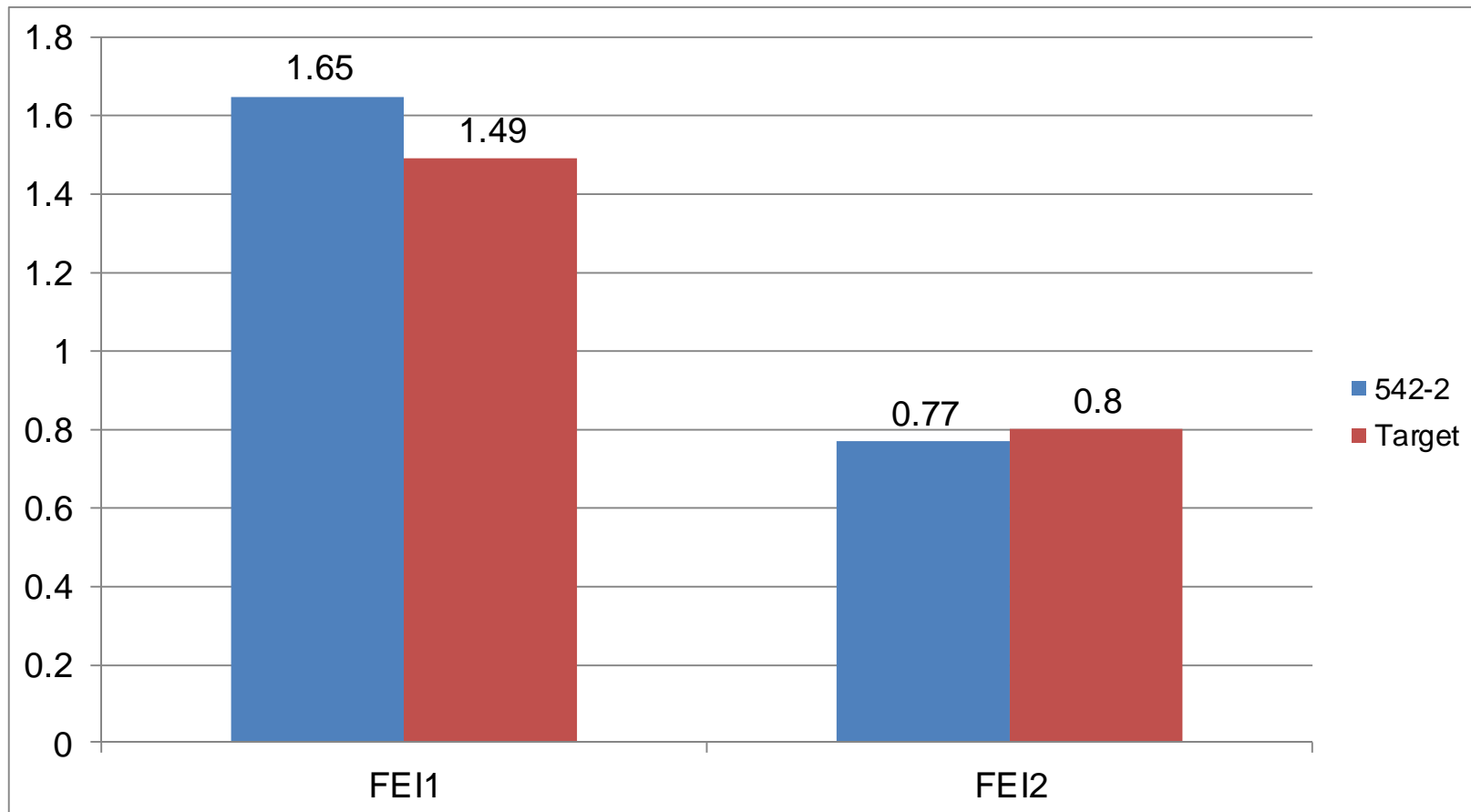
Results to Date

- “ 3 operationally valid results as of today
- “ 2 acceptable statistically
- “ 1 rejected statistically, Mild on FEI1
- “ No 542 or 542-1 remains in inventory at TMC
- “ Some labs have no 542 or 542-1 in VID or VIE inventory
- “ Results to date summarized in the following slides

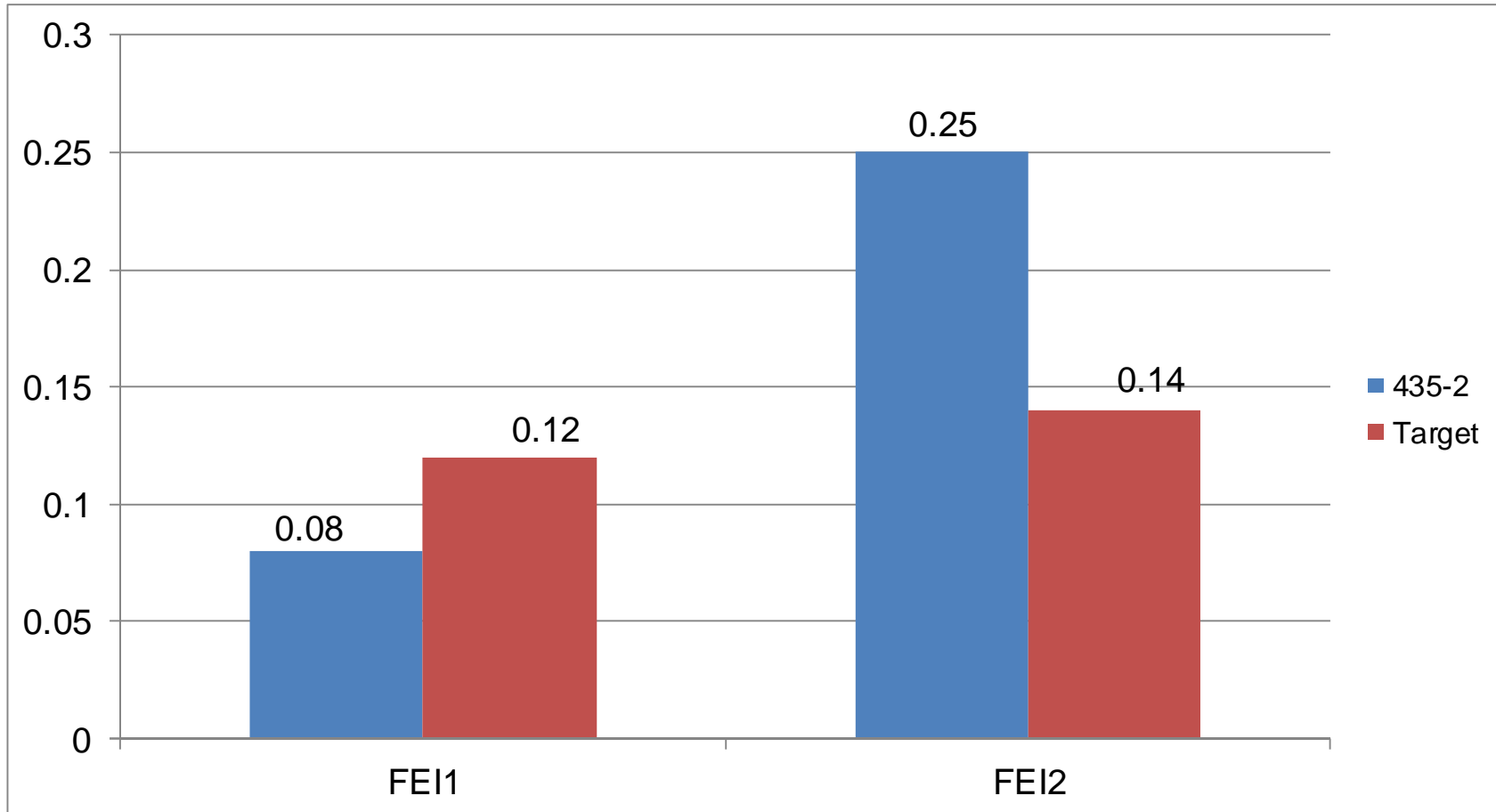
Results to Date

TESTKEY	LTMSAPP	LTMSLAB	IND	VAL	FEI1	FEI1yi	FEI2	FEI2yi
105703-VID	2	G	542-2	OC	1.74	2.0833	1.04	1.7143
105712-VID	2	B	542-2	AC	1.63	1.1667	0.7	-0.7143
105715-VID	4	A	542-2	AC	1.58	0.75	0.57	-1.6429

Comparison of 542-2 Results with 542 Targets



Comparison of 542-2 Results Standard Deviations with 542 Targets



Summary

- “ FEI1 is mild relative to the target, approximately 1 standard deviation milder, but is less variable than target, based on limited data.
- “ FEI2 is on or near target, with higher variability, again based on limited data.
- “ 542 and 542-1 inventory depleted at TMC.
- “ Results to date have been on new engines.



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Sequence VIE Ready for Matrix Unresolved Issues

Nathan Moles
January 8, 2015

Why VIE is Not Matrix Ready



1. Limited data on reference oils at higher engine hours
2. Lack of differentiation of candidates for FEI2
3. The carry-over of friction modifier from test to test

Test Ready for Matrix



SUCCESS
TOGETHER

- The test has been run at multiple labs - **Yes**
- Sufficient parts are available for matrix and subsequent testing - **Maybe**
- Discrimination has been shown – **No (FEI2)**
- Repeatability has been demonstrated - **Maybe**
- Reproducibility has been demonstrated - **Yes**

Data Analysis

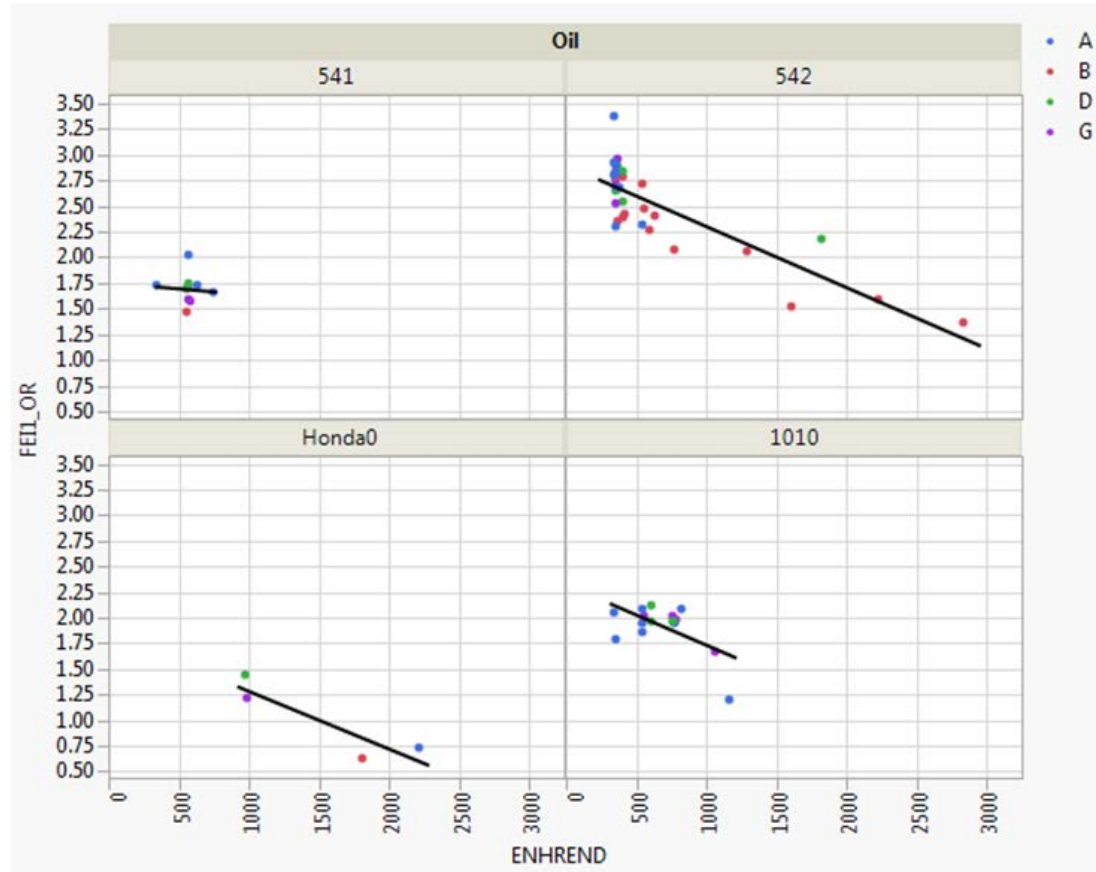


- Data were obtained from Itms.csv (1/4/13 through 12/20/14)
- 4 tests were removed from the analysis
- 92884-VIE
- 93313-VIE
- 97517-VIE
- 105711-VIE
- Two tests appear to be entered into the Itms.csv file twice (duplicate of each was removed)
- 99784-VIE
- 100491-VIE
- A total of 64 reference tests have been run across all labs
 - 7 tests completed using RO 542
 - 27 tests completed using RO 542-1
 - 10 tests completed using RO 541-1
 - 17 tests completed using RO 1010
 - Each lab ran 0W-16 oil donated by GM

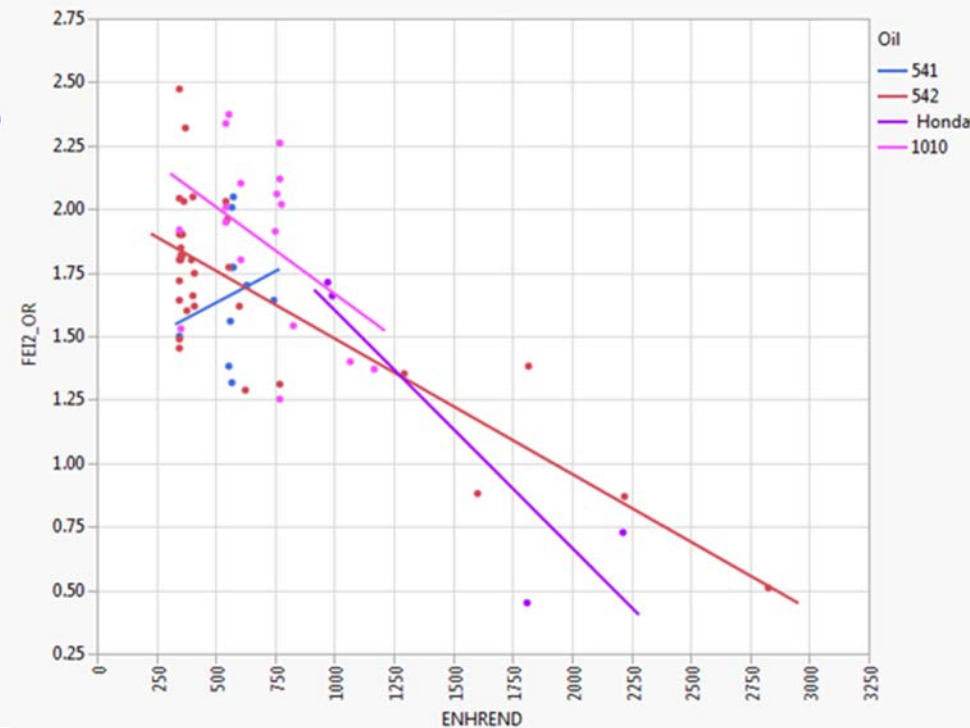
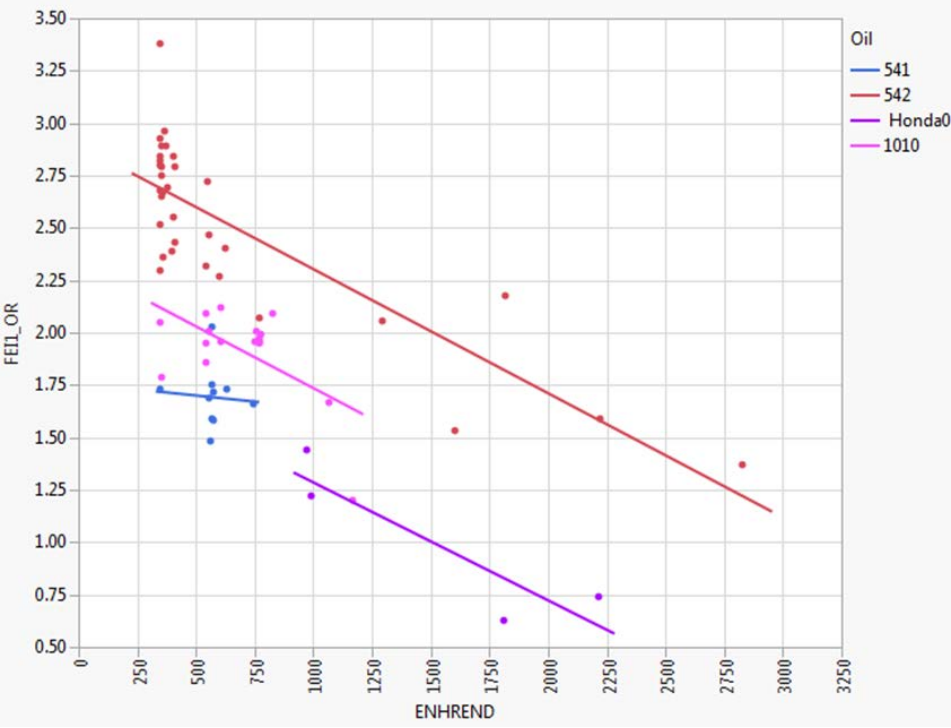
1. Data Relative to Engine Hour



- There is limited data on limited oils beyond 1500 hours
 - Seven tests have EOT'ed after 1500 hours
 - One lab has generated over 70% of this data
- We do not know if oils are differentiated at higher hours
 - Could require Engine Hour Condemnation & shorten engines usable life



2. Reference Oil Discrimination



- Test differentiates the FEI1_OR of reference oils across the range of engine hours
- Test DOES NOT differentiate the FEI2_OR of reference oils across the range of engine hours
 - Unlike the VID

Seq VID Referencing Targets

Ref Oil	Vis Gr	FEI 1 limit	FEI 1 limit	FEI 2 limit	FEI 2 limit
RO 540	5W-20	1.55	1.09	1.31	0.77
RO 541	10W-30	1.1	0.64	0.98	0.44
RO 542	0W-20	1.72	1.26	1.07	0.53
RO 1010	5W-20	1.47	1.23	1.28	0.92



2. Variability



- VIE FEI2 appears to have much more variability than the VID

VIE Test Development Data

FEI1 OR	FEI2 OR
0.19	0.27

Estimated standard deviations based on models using ENHREND

LTMS Appendix A VID

Sequence VID Reference Oil Targets							
Oil	n	Effective Dates		FEI1		FEI2	
		From ¹	To ²	\bar{X}	s^3	\bar{X}	s^3
540 (GF5A)	11 ⁴	12-29-08	12-2-09	1.32	0.14	1.04	0.16
540 (GF5A)	11 ⁴	12-3-09	***	1.32	0.12 ⁵	1.04	0.14 ⁵
GF5B	3 ⁴	12-29-08	***	0.97	0.14	0.63	0.16
GF5C	4 ⁴	12-29-08	***	1.24	0.14	0.59	0.16
541 (GF5D)	11 ⁴	12-29-08	12-2-09	0.87	0.14	0.71	0.16
541 (GF5D)	11 ⁴	12-3-09	***	0.87	0.12 ⁵	0.71	0.14 ⁵
542 (GF5X)	11 ⁴	12-29-08	12-2-09	1.49	0.14	0.80	0.16
542 (GF5X)	11 ⁴	12-3-09	***	1.49	0.12 ⁵	0.80	0.14 ⁵
1010	5	12-01-10	9-27-11	1.31	0.12 ⁵	1.23	0.14 ⁵
1010	28	9-28-11	***	1.34	0.12 ⁵	1.10	0.18 ⁶

- Effective for all tests completed on or after this date.
- *** = currently in effect.
- Pooled s from matrix analysis.
- Matrix n-size.
- November 2009 Pooled s calculation based on additional data– reference oil n-size used= 540-36, 541-24, 542-33, GF5B-3 and GF5C-4.
- Standard deviation based on 28 operationally valid results.

Cleaning Engine



- Engine removed with 1740 hours with oil consumption 2000ml
- Ran through ultrasonic cleaner and reassembled
- LZ 0W-20 Results:
 - FEI1/FEI2/Sum = 1.81/1.21/3.02 Cleaned engine with 2039 hours
 - FEI1/FEI2/Sum = 1.79/1.48/3.27 The original run with 361 hours
 - FEI1/FEI2/Sum = 1.42/0.72/2.14 Alternate VIE engine with 2415 hours
- RO 542-1 Results:
 - FEI1/FEI2/Sum = 2.01/1.26/3.27 Cleaned engine with 2240 hours
 - FEI1/FEI2/Sum = 2.17/1.48/3.65 The original run with 558 hours
 - FEI1/FEI2/Sum = 1.68/0.96/2.64 Alternate VIE engine with 2220 hours
- Cleaning the engine brings the response back within ranges of the new engine and OC back down to 1200ml
- Next step is to run engine with up treat fuel additive to “keep clean”
 - Currently in progress

Improve FEI2 Discrimination



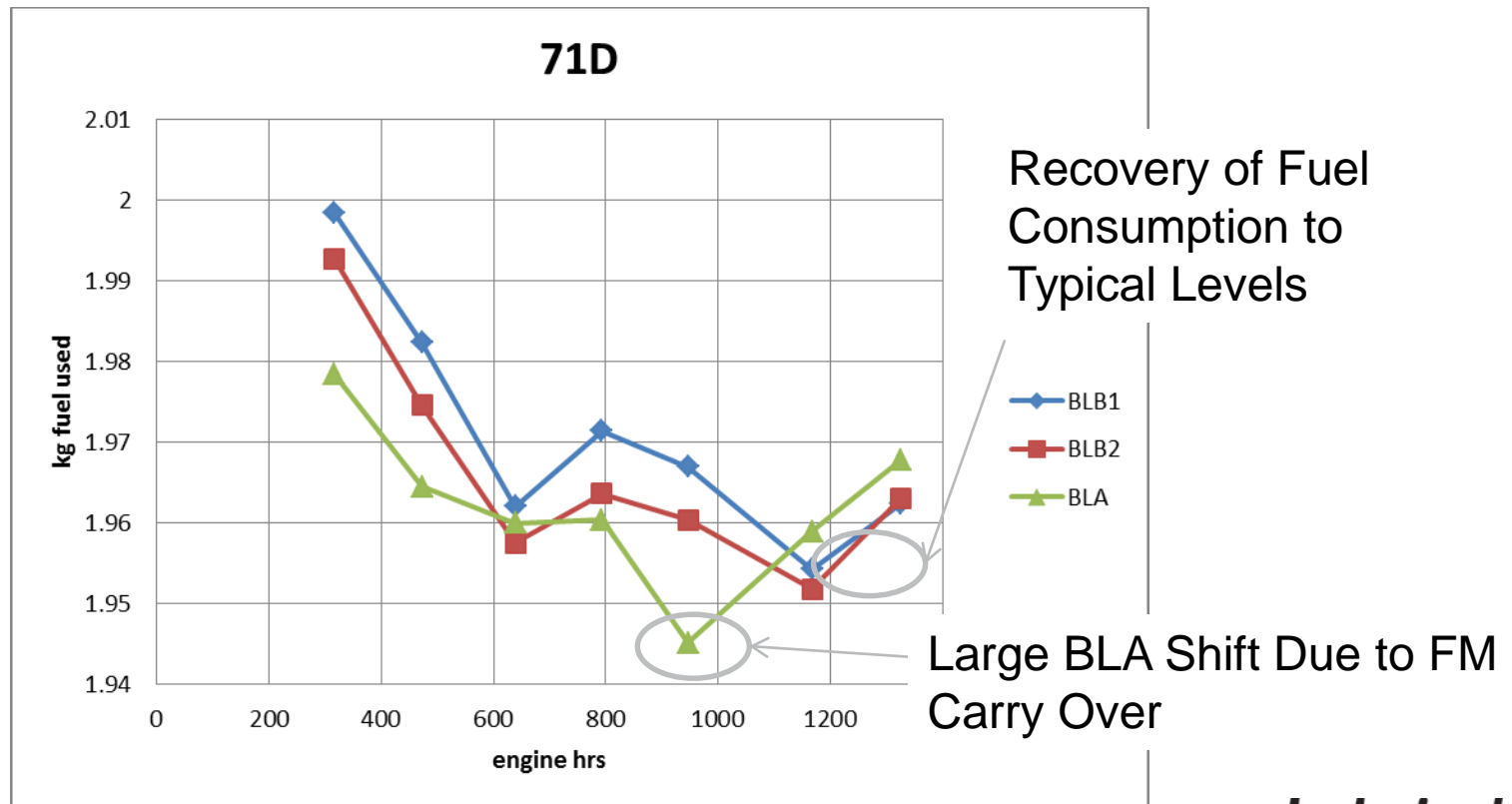
- **Relatively new observation**
- Keeping the engine clean (up treat fuel additive)?
- Shorten aging length from 125 hours to 100 hours?
 - Is the friction modifier being depleted?
- Need different/better reference oils with improved friction modifier?

3. FM Carry Over Summary



SUCCESS
TOGETHER

- Large BLA shifts on the order of 0.70% have been observed. Test is actually penalizing stronger/more durable FM formulations
- Lingering effects can impact BLB fuel consumption of subsequent tests and ultimately FEI results



3. FM Carry Over Resolutions



- We continue to investigate if there are substantial FM carryover effects in the VIE – If there are, several options for addressing it come to mind:
 - More flushing (**unsuccessful on VID**)
 - Flush oil and double BL flushes performed twice following completion of VID test with minimal impact on high BLA shift
 - Reformulation of the flush (**unsuccessful to date on VID**)
 - 0W-20 version of current flush oil was ran 12 and 24hrs with minimal impact on high BLA shift
 - High Speed Flushing Condition (**TBD**)
 - Use 3500rpm break-in condition to increase oil flow and cycles/minute
 - Alternate Flush Oil Formulation (**TBD**)
 - Use different detergent formulation